The Impact of School-Level Autonomy on Expenditure Allocations Within a School

Jessica Merkle*†

May 3, 2018

Abstract

Decentralized decision-making in public schools has been touted as a reform that may improve student achievement by allowing school-level agents to influence key decisions. This paper examines the impact of school-level budgetary autonomy on resource allocation across functional categories. The Empowerment Schools Program, which was implemented in New York City Public Schools in the 2004-2005 school year, provides a unique opportunity to study the impact of school-level budgetary autonomy without conflating its effects with changes to student funding formulas, school choice, or other district-wide policies. I employ a fixed effects method to identify the impact of the program on expenditure categories, relying on the variation in the timing of schools' take-up of autonomy. I show that principals in the program decreased total per-student expenditures by $488. I also find that principals do not increase expenditures in any functional category, but rather decrease expenditures in categories for which the program may create more significant autonomy. I also find some evidence that experienced and inexperienced principals differ in their assignment of expenditures. The combined results suggest that it is important to consider the interaction of autonomy with other constraints, such as the budgeting of full-time equivalent positions rather than lump-sum monies, and the ability of principals.

Keywords: Budgetary autonomy; Decentralized decision-making; Per-student expenditures; Public school budgets
JEL Codes: I22; H75

*Assistant Professor, Auburn University, Department of Economics, jsh0036@auburn.edu.

†I would like to thank Richard Romano, Lawrence Kenny, and Damon Clark for their comments and encouragement. I would also like to thank David Figlio for comments on an early draft of this paper. I am also grateful to New York City Public Schools for data assistance and Jonah Rockoff for sharing data on principals' experience. All remaining errors are my own.

Decades of research has found only small educational returns to allocating more resources to the public school sector (Hanushek (2003)). It is often claimed that this is the result of misaligned incentives within the public school system. One possible way to move resources toward a more efficient use is by allowing school-level knowledge to inform their allocation. This can, some believe, explain why private schools (Evans and Schwab (1977); Rouse (1998)) and charter schools (Hoxby and Rockoff (2004); Hoxby and Murarka (2009)) have been found to perform better than public schools.

Since school administrators are key agents in the daily operation of schools and one of the critical functions they perform is the management of a school's budget, they may be uniquely suited to understand and implement school-level information. Prior research has shown that time spent managing the budget significantly impacts student achievement (Horng et al. (2009)). This paper analyzes the resource allocations that result from a budgetary autonomy program implemented in New York City Public Schools (NYCPS) in 2004. The program was called the Autonomy Zone, and later the Empowerment Schools Network, and at its peak included 38% of elementary and middle schools in NYCPS. The program increased a principal's budgetary autonomy by shifting control of centralized expenditures to the school-level, increasing procurement caps, and relaxing the requirement to purchase some services from district-contracted vendors. In addition, the increased autonomy was coupled with greater accountability for student outcomes. In many ways, the program's set-up follows best practices for an autonomy program, particularly by coupling strong accountability with the program (Loeb and Strunk (2007)).

The results of this paper suggest that budgetary autonomy interacts with many existing constraints within the school system which impinge the free assignment of funds. I show that autonomous schools' generally reduce per-student expenditures within a school, decreasing it in all categories over which the program could create genuine autonomy. The reduction on total per-student expenditures is 4.8%. Looking across types of expenditures, I find similar reductions in per-student expenditures in half of the functional categories. Interestingly, I find no categories with a statistically significant increase in per-student expenditures.

The overall reduction comes from reducing non-teacher classroom expenditures, support services, and other direct service expenditures. These are areas where we might expect the principal to have some latitude to reassign funds because at least of portion of these monies are given as lump sums rather than allocated as full time equivalent positions. Support services and other direct services are categories that contribute to the overall functioning of the school. Support services accounts for services provided directly to students that supplement the classroom environment, this includes counseling, outreach, evaluation for special programs , and other forms of support for student's individualized needs. Other direct services contains food services, transportation, school safety, computer system support, and other costs that relate to the physical functioning of a school. These results may show that principals improve the "efficiency" of their school by focusing only on cost reductions. This behavior may stem from being unable to improve test scores due to the use of proficiency tests or because principal's lack the requisite knowledge to make such decisions.

Since the success of any autonomy program depends on the knowledge and ability of the decision-maker, in this case, the school principal, I examine the role of principal experience in the assignment of funds in autonomous schools. I find some evidence that more experienced principals use autonomy differently than less experienced principals. More experienced principals decrease their school's support services expenditures more than inexperienced principals. Also, more experienced principals do not decrease per-student expenditures in other direct services, but inexperienced principals do. Even examining principals by experience, I do not find any increases in per-student expenditures that follow from autonomy.

1 Literature Review

Starting with the Coleman Report and Hanushek (1986), there has been significant academic work trying to answer the question, "Does Money Matter?" in the provision of education. Hanushek's insight is not that the absolute level of money doesn't matter, but rather that incentives within the educational system may distort the assignment of funds away from categories that improve student

output. As such many subsequent analyses focus on identifying the changes to student outcomes that occur when decision-making structures change within the educational system. For instance, charter schools can greatly change such structures because they devolve many key decisions, ranging from curriculum choice to hiring and firing of teachers, to the school-level. Many studies focus on the impact of such changes on outcomes, but to examine why the heterogeneity in outcomes that the literature finds it is important to assess the underlying reallocation of resources. In this vein, I examine how allocation decisions may differ when schools are given greater control of their budgets.

The relevant literatures that support this analysis come broadly from three areas: 1) the literature on school-level autonomy and school based budgeting and 2) the literature on charter schools, and 3) the literature analyzing the role of school principals. This second strand of literature is, of course, quite large and therefore in this paper I try to highlight examples that provide foundation for the type of program I study.

As a starting point, the model by Bishop and Woessman (2004) provides a simple theoretical model that addresses the importance of institutions in the production of education quality. They aptly direct attention to the fact that, 'it is the institutions of the education system that allocate the rights of decision-making in the system and determine the incentives faced by the actors.'[1] They assume a priori that autonomy has two effects: 1) it increases the informational content of decisions and, as a result, improves the efficiency of resource allocations and 2) it increases the latitude for an educational agent to divert funds from quality producing uses. Bishop and Woessman (2004) suggest that school-level autonomy on standard setting and testing would lead to the inefficient diversion effect dominating the efficiency achieving information effect. Increased control of process and personnel decisions, however, would lead to the opposite. The empirical analysis developed in this paper builds on these insights.

Pritchett and Filmer (1999) make a similar point about the importance of explicitly examining the interests of educational agents. They focus particularly on the preferences of teachers who

[1] Bishop and Woessman (2004), p. 18.

care directly about inputs that influence their salaries and work environment. Pritchett and Filmer (1999) suggest that school-level autonomy may decrease the influence of teachers' preferences on the assignment of funds within a district by raising the influence of parents. In the analysis in this paper, I think explicitly about the role of the school principal and how school-level autonomy, at least as implemented in NYCPS, increases the influence of her preferences on the allocation of funds.

To apply these theoretical insights to studying real-world autonomy programs, it is useful to have an understanding of the forms these programs take. The implementation of autonomy programs varies widely across school districts. Some programs allow principals control of budgetary allocation, personnel decisions, or even curricular decisions. Charter schools, therefore, can be characterized as autonomous schools with autonomy across many types of decisions. There are many programs that have been classified as autonomous or decentralized decision-making, but it is important to make a distinction between the program studied here and programs that devolve decision-making to a level above the school or implement school-based management.

Programs that grant an educational body above the school-level as the decision-maker do not provide the same level of access to local knowledge or the ability to independently evaluate and incentivize school units (Ouchi (2006)). For example, in 1969 the New York City Schools' Chancellor reorganized the district's elementary and middle schools into 32 community school districts (CSDs).[2] Also, school based-management programs which often required a committee of parents, teachers, and administrators to discuss decisions within the school is quite different because the committees role was often advisory rather than decisive.

Even given these exceptions, autonomy programs have been implemented in many U.S. locations, including Cincinnati, Milwaukee, Houston, Seattle, Oakland, Boston, Chicago, Portland, Minneapolis, St. Paul, Prince Williams County (Virginia), Okaloosa (Florida), and state-wide in Hawaii. The majority of programs implemented in public schools are patterned, at least to some extent, off of a school-level autonomy program implemented in Edmonton, Canada in 1976. This

[2]The history of this reform is discussed briefly in Stiefel et al. (2003), p. 407. High schools remained under centralized control.

program maintained district control of standard setting, but allowed the individual principals to make operating system decisions (Ouchi (2006)). Ouchi (2006) notes that the Edmonton program coupled autonomy with weighted student funding formulas and school choice. Therefore, it is difficult to know if the success of this and other similarly modeled programs is caused by autonomy, such as Houston and Seattle. The program studied here allows the effect of budgetary autonomy with performance incentives to be evaluated.

There are two studies, Stiefel et al. (2003) and Loeb and Strunk (2007), which focus explicitly on the implementation of school-level budgetary autonomy. Stiefel et al. (2003) examines a prior school-based budgeting program in New York City schools that increased budgetary autonomy. The program was introduced in 1996 under the name Performance Driven Budgeting (PDB). PDB combined budgetary autonomy with performance incentives. Schools that expressed interest and were approved by their CSD superintendent joined the program. Stiefel et al. (2003) employ a difference-in-difference strategy that compares the student test scores in PDB schools to those in non-PDB schools. They find that the program increased school-level math and English scores in Grade 4 by approximately 0.056 and 0.059 of a standard deviation, respectively. A similar result holds for Grade 5 English scores (0.057). The impact on Grade 5 math scores is not statistically significant. They also examine underlying expenditure changes to total per-student expenditures, reimbursable expenditures, and expenditures on classroom teachers, but find little evidence of any sizable changes. This paper takes a different approach by analyzing functional categories of expenditures in addition to expenditures on teachers.

Loeb and Strunk (2007) examine the impact of autonomy on National Assessment of Educational Progress (NAEP) test scores at the state level, in particular on the percent passing at the Basic Level and the percent passing at the Proficient Level. Their paper does not focus on a particular initiative, but instead traces a general decentralization trend occurring between 1993 and 2000. They use principal's self-reported level of autonomy on the NCES Schools and Staffing Survey. Loeb and Strunk look specifically at the interaction between accountability and a principal's level of budgetary control. They present evidence that principal autonomy is more successful un-

der systems of stronger accountability. Principal control of spending has a statistically significant and negative impact on both percent passing at the Basic and Proficient levels. When principal autonomy, however, is interacted with accountability, the impact is positive and significant.

Similar to Loeb and Strunk (2007), Hanushek et al. (2013) examines the impact of school-level autonomy as reported by school principals, but they provide evidence from a cross-country, panel analysis. He finds that autonomy improves student achievement in developed countries, but may decrease it in developing countries. He shows that this negative impact is likely to follow from autonomy over content decisions, rather than budgetary or personnel-decision making forms. The measurement of autonomy comes from principal surveys collected by PISA. Principals' were asked to report "In your school, who has the main responsibility for" a particular set of decisions. A school is characterized as autonomous if an individual within the school has the main responsibility "as opposed to [it] not being the responsibility of the school." The percentage of schools who report budgetary autonomy by this metric is 90.2% and 81.1% in 2000 and 2009, respectively. It is possible that schools even without the freedom to assign budgetary funds would report that the principal is responsible for the management of the budget. In the United States, the percentage of schools reporting budgetary autonomy is 98.7% and 85.8% in 2000 and 2009, respectively. My paper differs by measuring budgetary autonomy as participation in a program that decreased strictures on the use of funds. Hanushek et al. (2013) also comments "that prior empirical work has ...attempted to estimate the reduced form relationship that indicates the overall impact of decentralization on educational outcomes." Therefore, in this paper I examine the first order question of whether budgetary autonomy, as implemented in NYCPS, changed the underlying allocation of funds.

Since autonomous public schools are intermediate between traditional public schools and charter schools, studies analyzing the impact of charter school attendance provide evidence of the impacts broader autonomy may present. There is now some convincing evidence that charter schools can improve educational outcomes (Hoxby and Rockoff (2004); Hoxby and Murarka (2009); Abdulkadiroglu et al. (2011). These studies identify the impact of charter school attendance on student

test scores by using lotteries in oversubscribed schools. These schools are oversubscribed because parents' demand for them is high. The reduced sample that results, therefore, does not tell us the implications of charter schools for the wider population. This sample identifies effects for students entering better charter schools, i.e. the charter schools most strongly demanded by parents. Clark (2009) uses a regression discontinuity design that does not hinge on lotteries to identify the impact of grant-maintained schools in the UK, a program equivalent to U.S. charter schools, on students' test scores. He finds that grant-maintained schools produce relatively large improvements in student achievement.

Since charter schools have sometimes been found to improve test scores, research in that area has turned to examine the key attributes of a successful charter. There is some evidence that changes to the schools' culture, such as "No Excuses" policies, are part of this success. There are few studies, however, that directly examine the role of budgetary autonomy in chartersAngrist et al. (2013). Carpenter (2013) contributes to the research on how charter schools work by comparing expenditure patterns of charter schools to those of traditional public schools in Texas. He finds that charter schools' allocations patterns are both statistically and practically distinct in three categories: instructional services, support services, and other costs. The instructional services category contains expenditures on teachers and other classroom inputs, such as textbooks, paraprofessionals, and instructional supplies. Other costs is a catch-all category containing expenditures on transportations, custodial services, food services, and many other non-instructional types of expenditures. Support services includes expenditures for counseling, special education, attendance tracking, and other services required by individualized education plans. Carpenter finds that charters decrease expenditures on instructional service and support services and increase expenditures on other costs.

Beyond studies that address the impact of autonomous decision making in public schools, there is a growing body of research that analyzes the role of the principal in the production of education (see e.g. Blank (1987); Horng et al. (2009); Branch et al. (2012)). While it is difficult to draw general results from this literature, some studies have found that principals that spend time on

"organizational management" are associated with better school outcomes (Horng et al. (2009)). Since organizational management is a category that includes managing the school budget, this provides some support for pursuing a better understanding of the effects of budgetary autonomy.

2 Program specifics

The program used to motivate the model of autonomy and conduct the subsequent empirical evaluation is the Autonomy Zone/Empowerment Schools Program implemented in New York City public schools (NYCPS). Although the practice of increasing autonomy for schools is neither new nor solely practiced in NYCPS, focusing the empirical specification on these schools provides a sufficient number of observations, a clearly defined program, and intra-district variation in decision-making authority[3]

The Autonomy Zone program began in 2004-2005 school year as a pilot with 29 schools . The initial funding for the program came from The Fund for Public Schools, a non-profit group that channels private donations to New York City public school initiatives.[4] The Fund contributed $1.3 billion, approximately $43 dollars per student, to cover initial costs. The pilot program lasted for two years, with 19 additional schools entering the program in the second year.

The Autonomy Zone program was "designed to give principals a greater degree of autonomy and flexibility in decision-making in exchange for greater accountability regarding student achievement."[5] By the district's assessment the program was successful and, as a result, the program was expanded under the Empowerment Schools Program (Empowerment Network).[6] In 2006-2007 and 2007-2008, an additional 216[7] and 246[8] schools , respectively, joined the program.

[3]The majority of U.S. districts implementing autonomy pursue a district-wide approach that increases the autonomy of all schools. Houston, Seattle, Chicago, Portland, Minneapolis, Prince William County, Okaloosa, and Hawaii have all increased autonomy district-wide.

[4]The Fund for Public Schools Annual Report 2005

[5]Ibid., 17

[6]Empowerment Schools Brochure.

[7]The NYCDOE website officially reports 332 schools participated in the first year of the Empowerment Schools program. My count is less than this because I do not include charter schools in the data set. Charter schools joined the program to collaborate with public schools about program choices.

[8]In 2008, 30 schools joined the program and 11 participating schools returned to district control.

Throughout the evolution of this program, the key component has been increased budgetary and decision-making autonomy for the principals who participate. The principal alone has the ability to apply to join the program. Once the principal decides to apply, he/she submits a contract including performance goals to the district. Following these submissions, the district must approve the participation of the school. Between 2004 and 2007, 22 schools that wished to participate were turned down. I cannot identify these schools and do not know the reason NYCPS decided to block their participation. The program could potentially affect school-level decision making through three channels: 1) increasing the total budget, 2) increasing control of the budget (including the vendors the school can contract with), and 3) performance incentives.

The total budget increased due to the district reallocating monies from the district budget to the school and awarding performance incentives in the form of budgetary increases. Schools gained greater control of their budgets because these new funds as well as previously restricted funds were now discretionary.

Schools on average gained control of approximately $250,000 more in discretionary funds; or approximately $326 per student.[9] 60% was in the form of additional funds and 40% was newly unrestricted funds that were previously restricted portions of the school's budget. As a percentage of a school's total budget , this increased control of the budget by 2.5%. Schools, of course, allocated these funds in diverse ways. The following shows how two schools chose to use their funds. In School A, with 384 students and $122,000 in additional discretionary spending, they

> implemented new [e]xtra [c]urricular [a]ctivities, including Yearbook and Choir, [p]artially [f]unded two coaches to provide professional development to teachers to increase instruction quality, and allocated money toward parent outreach programs.

In School B, with 1,383 students and $228,000 in additional discretionary spending, they

> hired: 1 new teacher and 1 new paraprofessional, started a drama program, and focused on professional development for math teachers to increase the quality of math

[9]The per student increase was determined by dividing $250,000 by the average number of students in a school (766).

instruction received by students.

While the increase in per student funding and the school's unrestricted budget is moderate, the greatest expansion in a principal's budgetary autonomy followed from an increased procurement cap and the ability to purchase inputs from non-contracted vendors. The program doubled the procurement cap for expenditures without district approval from $2,500 to $5,000. Schools gained the ability to buy services from vendors not contracted with the district for up to $25,000.

The budgetary reward was tied to improvement in student achievement. "Schools that receive an A on their progress reports and +(well-developed) or π (proficient) on their quality review will be eligible for rewards and recognitions, including extra funding."[10] The grade a school receives on their Progress Report Card is determined in part by an increase in student achievement above the previous year. All schools in the district receive a Progress Report Card, but only autonomous schools are eligible for a budgetary reward as a result. The budgetary reward is received in the year following the school's performance. This characteristic of the program, therefore, not only increased the level of discretionary funds, but also attempted to strengthen the alignment between the principal's incentives and student achievement.

For a school to earn an A on their Progress Report, the raw score they are assigned must increase by a specified amount over last year's raw score. The size of this required improvement is dependent on the current percentile rank of the school in terms of student achievement and the composition of the student body. In this way, the district is attempting to not unduly penalize schools that, for instance, already have a high percentile rank and are not likely to make large gains, as well as schools with more difficult to educate student populations. These required gains are aligned with the conditions required to achieve Adequate Yearly Progress . A school's score on the Progress Report Card is comprised of ratings of the school environment (15%), student performance on standardized exams (25%), and "student progress" (60%). For middle schools and elementary schools, which is the focus of this study, student progress is measured by average student improvement from the prior year to the current year on English/Language Arts and math

[10] Autonomy Zone FAQ.

exams.

Finally, principals also agreed to sharper personal incentives tied to the school's performance on the Progress Report. Principals who failed to meet the expected gains in scores faced consequences as a result. The possible consequences ranged from district interventions to leadership changes and school closure. "The accountability agreements lay out sanctions – including removal – that can be levied against principals who fail to perform."[11] The district meted out punishments particularly for schools in the program that receive a grade of D or F on their progress report or a grade of C in three consecutive years. The consequences of poor performance may also be in the form of decreased professional status leading to less desirable career advancement. Conversely, meeting the expected gains may allow principals to signal their ability and result in more rapid promotion.[12]

3 Data

The data used in this analysis comes from 3 main sources: New York City Department of Education's School Based Expenditure Reports (SBERs), the Accountability and Overview Reports (AORs), and a dataset containing principal employment history.[13] The primary dataset is the SBERs for the 2002-2003 to 2006-2007 school years. These reports contain detailed expenditures made by a school, including both those made at the school's discretion and those mandated by the district. This dataset is combined with student and teacher demographic data, as well as information on principal experience, to form a rich, unbalanced panel composed of 901 schools in New York City[14]. Charter schools are excluded from the dataset.

In the SBERs, the expenditures are categorized by the student type served and their function. The recorded expenditures represent expenditures from all funds, so they contain expenditures from both categorical and general funds. Principal's do not have latitude over categorical funds because they are required to spend them on the purpose for which they are intended. General

[11] "Let Principals Lead," New York Times, July 14, 2006, accessed through Lexis Nexis.
[12] See Cullen and Mazzeo (2007) for an analysis of internal principal labor markets.
[13] The combined dataset contains complete data for 89% of autonomous schools.
[14] The panel is necessarily unbalanced. From 2002 to 2006 NYCPS opened 178 new schools.

funds, however, have less strictures. Examining money from all funds enables better capture of the true allocations of funds. Since money is fungible and categorical funds may crowd-out the use of general funds within a category, I examine total expenditures.

Within a school, there are at two student types: 1) general education students and 2) full-time special education students. I confine the analysis to the funds spent on general education students. Since this analysis is linked with understanding how autonomous schools altered their behaviors, focusing on changes in allocations directed at the students who make up the largest portion of the Progress Report Card index should capture any significant change in resource allocations[15]

The SBERs catalogue expenditures within 5 major functional categories. The largest of these categories is Direct Services to Schools. These expenditures account for all spending that takes place at the school site and directly contributes to student education. Included in this category are expenditures on text books, teachers, administrative staff, school support staff, and instructional materials. On average, Direct Services spending is $12638.38 per student[16], which accounts for approximately 89% of total expenditures within a school.

To capture changes in important resource allocations, I aggregate expenditures into seven mutually exclusive categories. Five of these categories fall under Direct Services: teachers, other classroom expenditures, leadership (net of principal's salary), support services, and other direct services. The first two direct services categories directly impact the classroom environment. The teachers category contains expenditures on teachers who provide full-time, part-time or per-diem instruction in the classroom. Other classroom expenditures contains expenditures on paraprofessionals who are not mandated by an Individualized Education Plan (IEP), textbooks, librarians and library books, instructional supplies, professional development, and curriculum development by staff. Leadership contains expenditures on assistant principals, supervisors, secretaries, school aids, audio-visual technicians, and administrative office supplies, materials, and equipment. The remaining two categories, support services and other direct services, pertain to the overall function-

[15]The reports also contain enrollment by student type. This allows me to construct per student expenditures by student type.

[16]All expenditures have been converted into 2007 dollars using the CPI-U tables.

ing of the school. Support services contains expenditures on counseling, attendance/community outreach programs, assessment, special education, and remedial activities. Other direct services includes food services, transportation, school safety, computer system support, custodial services, and building maintenance.

I also aggregate expenditures to the central office or a central service and expenditures on capital services. These two categories of expenditures do not have associated unrestricted funds that can be assigned in response to school-level needs or autonomous control. I, however, include central office expenditures as a category because an express intention of the autonomy program is to reduce expenditure outlays for centralized services for schools that join. I also check for any effects of the autonomy program on capital services, with the expectation that there will be no effect. If there were effects of the autonomy program it may suggest some underlying difference between the autonomous and non-autonomous schools.

These seven categories on average account for approximately 96 percent of total expenditures in a school. This strategy accounts for about 95% and 97% of total expenditures for autonomous and non-autonomous schools, respectively. Table A1 contains an explanation of the types of expenditures that fall under particular expenditure categories. Since this analysis is designed to analyze a principal's reallocation of funds given greater budgetary autonomy, leadership expenditures do not include the principal's salary. The 2% difference (95% versus 97%) in the percentage of total funds accounted for with the 7 categories is the result of the difference in the percentage of expenditures allocated to a principal's salary in autonomous schools versus non-autonomous schools. In non-autonomous schools, the average per student expenditure on the principal is $294.32. In autonomous schools, the average per student expenditure on principal services is nearly double this amount, $557.39. The difference in per student expenditures in part reflects the fact that autonomous schools tend to be smaller than non-autonomous schools.

Table 2 compares the per-student and percentage of expenditure allocations across the seven previously discussed functional categories for autonomous and non-autonomous schools separately. It is, of course, not clear from the comparison of means whether the allocation differ-

ences are the result of underlying differences in students, physical environments, sets of teachers, or other unobserved differences rather than generated by autonomous decision-making. Table 2 shows that total per-student expenditures are statistically different with autonomous schools on average spending $1663.76 more per-student. Autonomous schools appear to spend more in all functional categories. Further, the percentage of funding is statistically different across autonomous and non-autonomous schools for 6 of the 7 expenditure categories. The percentage differences are of small magnitude, ranging from 6.65% of the mean allocation percentage for other direct services to 12.3% for support services.

Of the seven categories, the largest is expenditures on teachers. On average, schools spend 41% or $5194.50 per-student of their budgets on teachers' services. This accounts for approximately 42% and 39% of total expenditures in non-autonomous and autonomous schools, respectively. Although autonomous schools devote 7% less to of their total budget to teachers, they spend $314.42 more per-student than non-autonomous schools due to their larger average budget. Looking at the standard deviations for teacher expenditures, however, one can see that there is substantial overlap in budget sizes. Teachers are, of course, an important resources in the production of student learning.

The next largest category, which is less than half the size of teachers, is other direct services. This type of expenditure accounts for 14.73% of total expenditures in the average school. Autonomous schools on average allocate 0.98 percentage points or $106.56 more to this category. The next largest category is other classroom expenditures. In all schools, the average level of other classroom expenditures is $1382.76. The level of these expenditures is on average greater in autonomous schools, with autonomous schools spending $178.47 more per-student than non-autonomous campuses. The two types of schools, however, do not significantly differ in their proportion of budget they allocate on average. Autonomous schools on average allocate 1.07 percentage points more to support services. The magnitude of this unconditional percentage difference is larger than the differences for all other categories. It shows that on average autonomous schools spend 12.3% more on support services. Support services includes expenditures on special student

populations, such as English Language Learners (ELL) or low socioeconomic status students. It is, of course, not clear from these comparisons whether this is the result of underlying differences in student populations or the decisions of the school.

The standard deviations of 4 of the per-student expenditure categories are statstically different for autonomous versus non-autonomous schools. Autonomous schools appear to have more variable expenditures levels on teachers and leadership than non-autnomous schools, but less variable expenditures levels on capital and centralized services. When looking at the percentage of expenditures allocated to a particular category, however, the standard deviations are largely the same. Only expenditures on capital are differentially variable between these types of schools, with autonomous schools having less variable expenditures in this category. Therefore, autonomous schools do not appear to follow more variable expenditures patterns than non-autonomous schools, although the absolute levels differ a bit more. These comparisons of variability, however, may mask true variability due to schools, student, and teacher characteristics.

The student and teacher demographic data obtained from the AORs includes information such as the number of students enrolled in a school, class size, the racial makeup of the school, the number of students receiving free or reduced school lunches, the number of uncertified teachers, and the average age of a teacher. These data also contain important indicators of behavioral problems, such as the number of suspensions and the annual attendance rate. These covariates will help to control for differential expenditure needs that are the result of students and the existing stock of teachers. Finally, this data is supplemented with information from principal's employment histories to capture the experience of the principal in both administration and teaching. One of the key discussions in the autonomy literature is whether the success of such programs turns on the ability of the decision-maker (see. e.g. Hanushek et al. (2013)). Table 1 reports the summary statistics for these variables.

4 Empirical Methodology

I utilize a simple fixed effects specification to identify the whether resource allocations are systematically altered under the Autonomy Zone/Empowerment Schools Organization. I estimate the following equation for the outcome of total per-student expenditures, where β_1 is the coefficient of interest,

$$y_{it} = \alpha_0 + \beta_1 auto_{it} + \alpha_1 x_{it} + c_i + \delta_t + u_{it}. \quad (1)$$

$auto_{it}$ is a dummy equal to 1 for schools that are participating in autonomy and 0 otherwise, δ_t are a full set of time dummies, c_i are individual fixed effects, and u_{it} are the idiosyncratic errors. The dependent variable y_{it} is specified as total per student expenditures. This model uses the non-autonomous schools as the control group for the autonomous schools. The critical assumption is that the trends in expenditures are the same for these two types of schools.

c_i accounts for attributes of the school that are time-invariant, such as the age the school was built and its geographic location. It also accounts for the relationship of enrollment to capacity in 2002, which is the year NYCPS presented a 5-year capital expenditure plan.

Since the expenditures include funds from state, federal and local sources, as well as funds that are earmarked for particular functions, it is important to appropriately control for time-varying factors that are often part of these funding algorithms. These formulas are for the most part driven by the composition of students within a school and prior performance of these students. For instance, Title I funding is higher for schools with a higher proportion of low socioeconomic status students. Schools with different characteristics will also have different costs of attaining some level of education outcomes. For instance, there may be economies of scale in operating a school of a sufficient size. To account for the possibility that such factors may be correlated with the decision to become autonomous, I include a vector of time-varying controls x_{it}. I control for characteristics of students and teachers within a school that may alter the level and/or most efficient use of funds.

Student characteristics include contemporaneous characteristics such as the proportion eligible for free or reduced lunch, the proportion classified as English Language Learners (ELL), and total

enrollment; as well as lagged covariates including the number of students suspended, the average number of absences for students in school i, the proportion of students repeating a grade, and class size. These variables are lagged one year because expenditures in the current year are likely to influence these outcomes.

The included teacher covariates are all lagged one year to account for the stock of teachers that are in place in the prior year and that would inform teacher allocation decisions regardless of autonomy in the subsequent year. The lagged teacher covariates are mean teacher age and the proportion of uncertified teachers. Mean teacher age is included to proxy for the average level of experience of teachers within a school. The mean age of teachers could either increase or decrease the level of per-student expenditures. More senior teachers will draw higher salaries because seniority is a key part of the salary schedule. A more senior set of teachers, however, may also mean a higher probability of teacher retirements or movements to other schools. If this effect dominates, then a more senior teacher force may mean lower expenditures in subsequent years when they are replaced by less senior teachers.

The proportion of unlicensed teachers controls for the impact of teachers with very little training. Teachers with little training may require the school to spend more funds on teacher training or replace them with certified teachers in subsequent years. Teacher characteristics in the previous year act as a constraint on the type of resource allocations that will be possible and effective. I do not control for characteristics in the current year because I am interested in whether autonomous principals decide to change allocation patterns by hiring more experienced teachers or reducing class sizes.

I also include a measure of principal's ability, specifically a dummy equal to 1 if a principal has more than 4 years of administrative experience. This specification follows an investigation of returns to principal charateristics by Clark et al. (2009). They find that returns to principal experience level off around this cutoff.

Schools participating in the autonomy program may express differential expenditure priorities

than were required by the district control. I capture this possibility by estimating equations such as

$$y_{ijt} = \alpha_0 + \beta_1 auto_{it} + \alpha_1 x_{it} + c_i + \delta_t + u_{it} \forall j = 1, .., 6 \tag{2}$$

where y_{ijt} is specified either as the per-student funding or the percentage of funds assigned to one of the 6 mutually exclusive funding categories. The categories are expenditures on teachers, leadership, other classroom services, support services, other direct services, and centralized services.[17] The included covariates are the same as those specified in equation (1). If autonomous schools seem to be shifting resources in similar patterns, this may point to underlying inefficiencies in centralized allocations.

I also examine the allocation of teacher resources particularly. To the extent possible, I investigate whether autonomy causes principals to select more experienced teachers, measured as certified or older teachers, or change class sizes. I estimate the equation(3) with dependent variables that capture teacher quality and quantity decisions. I use the proportion of uncertified teachers and the average age of teachers in the current year as a measure of teacher quality. I also check if principals change the quantity of teachers hired by estimating a specification of equation (3) with class size as the dependent variable.

Finally, principal experience may be an important prerequisite for the functioning of autonomy. Therefore, I compare the behavior of experienced and inexperienced autonomous principals using specifications such as

$$y_{ijt} = \alpha_0 + \beta_1 auto_{it} + \beta_2 auto_{it} * experience + \alpha_1 x_{it} + c_i + \delta_t + u_{it} \forall j = 1, .., 6 \tag{3}$$

where $auto_{it} * experience$ is the interaction of a principal having more than four years of leadership experience and participating in autonomy.

[17] Capital expenditures are excluded from the main evaluation, but will be examined for spurious effects.

5 Results

Table 3 contains results from the estimation of equation (1). Column (1) is a baseline DID model without the time-varying covariates. The specification includes both school and year dummies. The results in column (1) suggest that schools participating in the autonomy program spend $524 less per student than schools that are not enrolled in the program. This accounts for 4% of the average schools total expenditures. The magnitude of the impact is small. In column (2), I include the time-varying covariates discussed in the previous section. This reduces the impact of autonomy slightly. Column (2) suggests that becoming autonomous causes schools to spend $488 less or 3.8% less for schools with average per-student expenditures. The estimated impacts, however, are not statistically different.

Even though the magnitude of the impact is small compared to mean per-student expenditures, it is still possible that a $488 decrease per student could impact the learning environment. In an average-sized school, this would decrease school expenditures by $369,416 ($488*757). To gain some understanding of what could be purchased by a school with these funds, it would allow schools to hire 2.7 more teachers earning average teacher salaries.

To further investigate how this reduction in per-student expenditures translates to resource allocations within a school, I estimate equations (3) to show the impact of joining the autonomy program on assignment of funds to a specific functional category. Table 4 and 5 report these results. Table 4 contains information on the impact on the three direct services categories that serve students most directly, specifically, leadership, teachers, and other classroom inputs. Table 5 contains results for categories that impact the overall school environment. These capture expenditures on centralized, support, and other direct services.

Column (1) and (2) of Table 4 shows that becoming autonomous does not change expenditures on leadership services or teachers for the average school. Teachers are a particularly fundamental input to the production of school services. The fact that there is no effect, however, may be an indicator of the lack of latitude a principal has to make make decisions about increasing the quantity or quality of teachers in their school. Teachers labor markets in NYCPS are likely dictated more

by the interaction of the districts and a particularly strong teachers union. Rubinstein et al. (2007) point out that most school receive teacher position allocations, rather than a lump sum to spend on teachers. This type of allocation pattern would not be affected by budgetary autonomy and could explain why I find null results for this category. They also point out that these allocations are determined mostly by the level of enrollment and class size requirements. The statistical significance and sign of the coefficient on lagged class size in column (2) are consistent with this insight.

Column (3) reports the impact on other classroom services. This category declines by approximately $126 per-student. This decreases expenditures in this category by 9.1% for the average school.

Autonomy has the expected impact on centralized services. Table 5 column (1) reports this impact. Participating in autonomy is estimated to decrease per-student expenditures on centralized services by $139.70. The program was designed to shift centralized expenditures to direct services. This decreases centralized expenditures by 15%. This effect has the largest magnitude of all the expenditure impacts.

Column (2) also shows that participating in autonomy causes a decline in per-student spending for other direct services of $95.28. Per-student spending for support services declines by 5% for the average school.

As a falsification test, I check whether autonomy has an impact on capital outlays. The results are reported in Table A2 in the Appendix. Since capital outlays should not be influenced either by participation in autonomy or any of the contemporaneous or lagged variables, I use this category to check for unobserved differences between autonomous and non-autonomous schools. Capital outlays follow from long-run decisions to build a new school or alter a school building and are governed by different constraints than categorical funds. The procurement cap increase and small funding changes that follow from autonomy are not likely to impact these expenditures due to the size of an expenditure item in this category. Further, contemporaneous and one-year lagged values of student and teacher characteristics are not likely to be the main determinants of these types of decisions. The age of the school building, continued overcrowding, and policy changes that impact

the organization of schools may be important factors. All of these would be captured by the school and year fixed effects included in the model. The magnitude of all the coefficients in the capital model are extremely small. For instance, the impact of the autonomy program reduces per student expenditures by $0.000005. The p-value on this variable is greater than the cutoff for marginal significance (p-value=12.4). Column (2) shows that there is a small, but statistically significant increase in the percentage of expenditures attributed to this category in autonomous schools. This is likely an artifact of being able to decrease expenditures in the categories examined in Tables 4 and 5 and not decrease capital outlays. The statistical and practical insignificance of these results confirms that becoming autonomous does not have an impact on capital outlays.

It is of note that joining the autonomy program decreases total per-student expenditures and all coefficients in the expenditure category specifications are also negative. Even with reduced expenditures, autonomous schools may show different priorities by allocating a smaller or larger share of their budget to a particular category. Tables 6 and 7 present the results of this investigation. The results generally show very little change in the priorities of autonomous schools. Table 6 column (2) shows that the percentage of expenditures allocated to teachers increases by 1.16 percentage points. The magnitude of this change is very small (approximately 3% of the mean percentage of expenditures allocated to teachers). Autonomous schools also appear to increase leadership expenditures by 0.267 percentage points, or 3.5% of the average percentage attributed to this category. In contrast, the percentage of funds allocated to other classroom inputs declines by 5.2% in a school with the average percentage of expenditures in this category (-0.5596/10.768). Table 7 column (1) confirms that the autonomy program does decrease the role of centralized expenditures. Participating in autonomy decreases these expenditures by 0.782 percentage points or 10.43% of the mean percentage of expenditures allocated to this category. Column (2) shows that the importance of support services declines in autonomous schools. The percentage of funds allocated to support services declines by 0.412 percentage points, or 4.73% of the mean percentage.

Although per-student expenditures on teachers do not change, autonomous principals may be making different decisions about how to tradeoff the quantity and quality of teachers. Table 8 ex-

amines the impact of autonomy on the quality and quantity of teachers in a school. Column (1) and (2) examine potential quality indicators, i.e. the average age of teachers in a school and the proportion of uncertified teachers. Neither measure shows any significant impact of autonomy on the quality of teachers. Similarly the impact on class size is not statistically significant at conventional levels. These results seem consistent with the fact that personnel decisions are contingent on the assignment of full time equivalent positions to a school rather than lump sum monies.

Since more able principals may be better equipped to benefit from autonomy, I investigate the possibility that there is heterogeneity in allocation decisions that results from the ability of the principal. Prior research by Clark et al. (2009) finds that few characteristics of principals appear to matter for student outcomes. They do, however, show that principal experience improves students' math scores and attendance. Further, they show that experience beyond 4 years has little additional impact on these outcomes. Since principal tenure in NYCPS is given after 3 full years of service as a principal, it is also possible that the change in returns to experience around this cutoff are the result of the tenure process or at least include its impact. Table 9 and 10 report the differential impact of autonomy by experience on per-student expenditures. Table 10 shows that a principal having more than 4 years of experience has statistically distinct allocations patterns from a less experienced principal in other direct services and support services. Column (2) shows that experienced principals decrease expenditures in support services and that inexperienced principals do not. Column (3) shows that more experienced principal's decrease other direct services by less than inexperienced principals. It is interesting to note that both the experienced and less experienced principals do not use autonomy to increase expenditures in any category in measurable ways.

6 Conclusion

In theory, budgetary autonomy could allow decision-makers with local knowledge to improve student outcomes by re-assigning funds to their most productive use. In contrast, the preferences of

a principal to allocate the monies in ways that do not improve student test scores is also possible. The results of this paper consistently show a reduction in per-student expenditures in critical functional areas and very small magnitude changes in the proportion of expenditures allocated to a particular category. Autonomous principals reduce total per-student expenditures by $488 or 4.8% on average. The reductions in per-student expenditures come from reductions in other classroom services ($126) and support services ($95.28).

These results are consistent with the idea that educational agents may not understand how to improve student test scores (Fryer (2011)). [18] Related to this idea is the often suggested view that educational agents may misapprehend efficiency by focusing only on costs. Another possibility is that school principals appropriately apprehend the incentives in the system and are responding to test score ceilings (Koedel and Betts (2010)). Proficiency based tests are more likely to evince ceiling effects. In 2010, directly following the period of my study, NYCPS changed their testing instruments because of evidence that tests often repeated the same questions from year to year and that requirements to receive a score of level 3 or 4 were minimal.[19] In this case, a principal may be incentivized to reduce his budget because test score increases are difficult to attain.

I also find that more experienced principals allocate expenditures for support services and other direct services differently than inexperienced principals. Inexperienced principals reduce other direct services while showing no statistically significant increase in support services. In contrast, experienced principals decrease support services expenditures and do not decrease other direct services.

The results, generally, suggest that this autonomy program did not create significant reassignment of funds within a school. Future budgetary autonomy programs may generate greater redistribution toward productive expenditures categories by allowing more autonomy over personnel decisions and considering the ability and knowledge of the educational agent.

[18] Fryer has provided considerable evidence that for students input based incentives outperform output based incentives.

[19] See e.g. Medina, Jennifer. "Standards Raised, More Students Fail Tests" *The New York Times*, July 28, 2010.

References

Abdulkadiroglu, A., J. Angrist, S. Dynarski, T. Kane, and P. Parthak (2011). Accountability and Flexibility in Public Schools: Evidence from Boston Charters and Pilots . *Quarterly Journal of Economics, 126(2): 699-748.*.

Angrist, J., P. Parthak, and C. Walters (2013). Explaining Charter School Effectiveness. *American Economic Journal: Applied Economics, 5(4):1-27*.

Bishop, J. and L. Woessman (2004). Institutional Effects in a Simple Model of Educational Production. *Education Economics, 12(1): 18-39*.

Blank, R. (1987). The Role of Principal as Leader: Analysis of Variation in Leadership of Urban High Schools . *The Journal of Educational Research 81(2): 69-80.*.

Branch, G., E. Hanushek, and S. Rivkin (2012). Estimating the Effect of Leaders on Public Sector Productitivity: The Case of School Principals. *National Bureau of Economic Research Working Paper No. 17803*.

Carpenter, D. (2013). Where Does the Money Go? Budget Expenditure Allocation in Charter Schools. *Journal of Education Finance, 38(4): 304-319.*.

Clark, D., P. Martorell, and J. Rockoff (2009). School Principals and School Performance. *Center for Analysis of Longitudinal Data in Education Research (CALDER), Working Paper No. 38, Urban Institute*.

Evans, W. and R. M. Schwab (1977). Finishing High School and Starting College: Do Catholic Schools Make a Difference. *The Quarterly Journal of Economics, 110(3):941-971*.

Fryer, R. (2011). Financial Incentives and Student Achievement: Evidence from Randomized Trials. *Quarterly Journal of Economics, 126(4): 1709-1753*.

Hanushek, E. . (2003). The Failure of Input-Based Schooling Policies. *Economic Journal, 113(485): F64-F98.*.

Hanushek, E. (1986). The Economics of Schooling: Production and Efficiency in Public Schools. *Journal of Economics Literature, 24(3): 1141-1177*.

Hanushek, E., S. Link, and L. Woessman (2013). Does School Autonomy Make Sense Everywhere? Panel estimates from PISA. *Public Choice, 24:71-92*.

Horng, E., D. Klasik, and S. Loeb (2009). Principal Time-Use and School Effectiveness. *National Center for Longitudinal Data in Education, Working Paper No. 34*.

Hoxby, C. and S. Murarka (2009). Charter Schools in New York City: Who Enrolls and How They Affect Their Student's Achievement . *National Bureau of Economic Research Working Papers No. 14852*.

Hoxby, C. and J. Rockoff (2004). The Impact of Charter Schools on Student Achievement. *Harvard University and Columbia Business School, Unpublished manuscript*.

Koedel, C. and J. Betts (2010). Value Added to What? How a Ceiling in the Testing Instrument Influences Value-Added Estimation. *Journal of Education Finance and Policy, 5(1): 54-81*.

Loeb, S. and K. Strunk (2007). Accountability and Local Control: Reponse to Incentives With and Without Authority Over Resource Generation and Allocation. *Education Finance and Policy, 2(1): 10-39*.

Ouchi, W. (2006). Power to the principals: Decentralization in three large school districts. *Organization Science, 17(2): 298-307.*.

Pritchett, L. and D. Filmer (1999). What education production functions really show: a positive theory of education expenditures. *Economics of Education Review, 18: 223-239.*.

Rouse, C. (1998). Private School Vouchers and Student Achievement: An Evaluation of the Milwaukee Parental Choice Program. *The Quarterly Journal of Economics, 113(2):553-602.*.

Rubinstein, R., A. Schwartz, L. Stiefel, and H. Amor (2007). From districts to schools: The distribution of resources across schools in big city school districts. *Economics of Education Review, 26:532-545.*.

Stiefel, L., A. Schwartz, C. Portas, and D. Y. Kim (2003). School Budgeting and School Performance: The Impact of New York City's Performance Driven Budgeting Initiative. *Journal of Education Finance, 28: 403-424.*.

Description of Data Sources

The data used in this analysis comes from New York City Department of Education's (NYCDOE) School Based Expenditure Reports (SBERs), the Accountability and Overview Reports (AORs), principal employment history, and a dataset containing program participation. The primary dataset is the SBERs for the 2002-2003 to 2006-2007 school years. The SBER dataset is available for download from the NYCDOE website. These reports contain detailed expenditures made by a school, including both those made at the school's discretion and those mandated by the district. Data on expenditures was summed to the functional levels described in the paper using the codes provided in the SBERS which identify each function.

The AORs contain student and teacher demographic data. These data sets can also be downloaded from the NYCDOE website. In addition to these two publicly available data sets, I used a dataset containing autonomous school entry and exit dates created by NYCDOE data department. This data can be shared upon request. Data on principal's leadership experience was shared by another researcher with the permission of NYCDOE. Similar permission would be required for this data.

Table 1:
Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum
Expenditures				
Total	12638.38	2506.737	6963.092	44324.59
Per-Student Expenditures by Category				
Capital	754.364	268.545	322.022	1129.63
Central	925.763	169.427	553.973	1867.584
Leadership	967.369	408.466	44.614	4158.403
Other Classroom	1382.76	588.159	212.145	7155.596
Other Direct Services	1852.057	552.399	488.338	10443.39
Support Services	1115.976	456.444	94.475	5926.808
Teachers	5194.501	967.755	2013.124	19157.37
Percentage of Expenditures by Category				
Capital	5.966	1.935	0.944	12.871
Central	7.502	1.294	2.551	13.141
Leadership	7.600	2.577	0.410	26.072
Other Classroom	10.768	3.424	2.362	34.130
Other Direct Services	14.727	3.345	2.839	35.122
Support Services	8.708	2.582	0.924	24.085
Teachers	41.541	5.170	16.179	64.419
School-level covariates				
Participating in Autonomy Program	0.040	0.196	0	1
Mean age of teachers	41.053	3.877	25	58.143
Proportion of teachers uncertified	0.109	0.078	0	1
Class size	25.398	7.232	1	96
Proportion of students eligible for free or reduced meals	0.697	0.277	0.029	1
Proportion of English Language Learners	0.108	0.100	0	1
Proportion of students repeating a grade	0.028	0.042	0	1
Absences per student	12.295	3.783	0	40
Suspensions per student	0.041	0.069	0	0.818
Fall enrollment	757.404	585.588	7	4477
Principal's leadership experience (years)	8.534	6.012	0	53.038
Principal's teaching experience (years)	11.493	8.434	0	61.041

The above summary statistics come from expenditure data for 1345 schools in New York City Public Schools from 2002-2003 to 2006-2007. Data on student demographics, particularly the proportion of students receiving free or reduced meals, the proportion of English Language Learner students, and the proportion of students repeating a grade, are available for 895 schools.

Table 2:
Expenditures for Autonomous and Non-Autonomous Schools

	(1) Non-Autonomous		(2) Autonomous		(3) Difference
	Mean	Standard Deviation	Mean	Standard Deviation	
Per-student expenditures by category					
Total	12558.81	2484.48	14222.57	2424.96	-1663.76***
					(-11.27)
Capital	746.30	272.06	914.97	85.23	-168.67***
					(-27.12)
Central	922.69	171.92	984.30	94.18	-61.61***
					(-10.17)
Leadership	957.68	400.76	1160.19	502.82	-202.51***
					(-6.68)
Other classroom services	1374.22	586.29	1552.70	600.57	-178.47***
					(-4.89)
Other direct services	1846.96	548.52	1953.52	617.07	-106.56**
					(-2.85)
Support	1102.25	449.45	1390.39	506.76	-288.14***
					(-9.37)
Teachers	5179.46	951.94	5493.89	1204.98	-314.42***
					(-4.33)
Percentage of expenditures					
Capital	5.94	1.96	6.58	1.13	-0.65***
					(-9.03)
Central	7.52	1.30	7.07	1.11	0.46***
					(6.69)
Leadership	7.57	2.55	8.13	3.02	-0.55**
					(-3.03)
Other classroom services	10.77	3.43	10.80	3.30	-0.03
					(-0.17)
Other direct services	14.77	3.32	13.79	3.72	-0.98***
					(4.36)
Support	8.66	2.55	9.73	2.96	-1.07***
					(-5.99)
Teachers	41.68	5.12	38.76	5.40	2.92***
					(8.91)
Number of Schools	1111		234		1345

The above summary statistics come from expenditure data for 1345 schools in New York City Public Schools from 2002-2003 to 2006-2007. Schools are classified as autonomous if they are participating in the program in a particular year. There are 234 autonomous schools in the data set. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. T-statistics are reported in parentheses in column (3).

Table 3:
The Impact of Autonomy on Total Per-Student Expenditures

	(1)	(2)
Participating in Autonomy Program	−532.4096***	−488.4873***
	(97.4100)	(101.3774)
Principal's leadership experience (years)		−0.4222
		(3.2726)
Mean age of teachers last year		−19.6159*
		(11.6342)
Proportion of teachers uncertified last year		903.5921*
		(491.5330)
Class size last year		0.1544
		(0.5602)
Proportion of students eligible for free or reduced meals		83.3018
		(70.5091)
Proportion of English Language Learners		759.3454
		(566.7726)
Proportion of students repeating a grade last year		964.5141
		(957.6771)
Absences per student last year		−10.3651
		(14.0999)
Suspensions per student last year		−405.5799
		(333.3400)
Fall enrollment		−11.2743***
		(1.1368)
Fall enrollment squared		0.0033***
		(0.0006)
Constant	14474.9624***	20758.4824***
	(34.2517)	(660.9248)
School dummies	Yes	Yes
Year dummies	Yes	Yes
Observations	5938	3124
Number of schools	1345	894

The outcome variable is total per-student expenditures. The unit of observation is a school-academic year. Results are obtained from estimating equation (1). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 4:
The Impact of Autonomy on Per-Student Expenditures by Category

	(1) Leadership	(2) Teachers	(3) Other Classroom
Participating in Autonomy Program	−1.9153	−44.3743	−126.5868***
	(20.0562)	(60.1623)	(30.7873)
Principal's leadership experience (years)	0.0178	−3.2497	0.2144
	(0.8115)	(2.2201)	(1.2787)
Mean age of teachers last year	1.9417	−5.4419	1.0847
	(2.6764)	(7.1660)	(4.3109)
Proportion of teachers uncertified last year	218.8843*	581.9641**	49.8518
	(128.5706)	(276.1585)	(182.3198)
Class size last year	−0.2773	0.7687*	−0.2231
	(0.2165)	(0.4362)	(0.1700)
Proportion of students eligible for free or reduced meals	−16.9916	60.4344	17.8549
	(15.4012)	(43.0278)	(28.1733)
Proportion of English Language Learners	−53.1272	1079.9679***	260.8130
	(124.1816)	(372.0223)	(221.9374)
Proportion of students repeating a grade last year	672.7750***	513.0595	169.5071
	(246.6219)	(625.6004)	(423.1543)
Absences per student last year	1.8012	−7.9367	1.3971
	(3.8620)	(9.0743)	(5.4946)
Suspensions per student last year	−102.5586	−359.4897*	90.9263
	(86.7930)	(204.5200)	(167.0432)
Fall enrollment	−1.2052***	−4.4541***	−1.9333***
	(0.1188)	(0.6105)	(0.2744)
Fall enrollment squared	0.0003***	0.0013***	0.0006***
	(0.0000)	(0.0003)	(0.0001)
Constant	1606.8644***	8158.2271***	2445.8655***
	(137.0874)	(400.4822)	(230.0986)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3124	3124	3124
Number of schools	895	895	895

The outcomes variables are per-student expenditures in 3 mutually exclusive, functional categories. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equation (2). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 5:
The Impact of Autonomy on Per-Student Expenditures by Category

	(1) Central	(2) Support	(3) Other Direct Services
Participating in Autonomy Program	−139.7026***	−95.2770***	−47.1804
	(10.6256)	(30.0124)	(41.7527)
Principal's leadership experience (years)	−0.6324	1.3533	−0.1906
	(0.4451)	(0.9929)	(1.0451)
Mean age of teachers last year	−0.8993	−10.7993***	−5.4559
	(1.5279)	(3.9436)	(4.3735)
Proportion of teachers uncertified last year	−45.8424	124.4159	−20.5550
	(57.8041)	(152.2650)	(200.9639)
Class size last year	0.0602	−0.2510	−0.0622
	(0.0877)	(0.2197)	(0.1917)
Proportion of students eligible for free or reduced meals	9.7578	44.7655**	−14.1340
	(9.5905)	(21.0012)	(28.4969)
Proportion of English Language Learners	132.1892*	−95.6779	−301.9910
	(74.6457)	(174.4594)	(223.4546)
Proportion of students repeating a grade last year	−111.4844	12.7021	−22.0375
	(120.7499)	(262.6700)	(360.9851)
Absences per student last year	−0.7336	−0.0014	−4.0851
	(1.7662)	(4.6084)	(5.7778)
Suspensions per student last year	0.2537	21.3812	−92.6753
	(41.4893)	(107.7076)	(161.0565)
Fall enrollment	−0.1284**	−1.5726***	−1.3304***
	(0.0580)	(0.1925)	(0.2091)
Fall enrollment squared	0.0000	0.0005***	0.0004***
	(0.0000)	(0.0001)	(0.0001)
Constant	1260.8938***	2492.9612***	3158.2444***
	(75.9448)	(190.0459)	(241.5254)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3078	3122	3124
Number of schools	894	893	894

The outcomes variables are per-student expenditures in 3 mutually exclusive, functional categories. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equation (2). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 6:
The Impact of Autonomy on Percentage of Expenditures by Category

	(1) Leadership	(2) Teachers	(3) Other Classroom Inputs
Participating in Autonomy Program	0.2674*	1.1576***	−0.5596**
	(0.1507)	(0.3418)	(0.2186)
Principal's leadership experience (years)	−0.0001	−0.0254**	0.0078
	(0.0060)	(0.0127)	(0.0091)
Mean age of teachers last year	0.0256	0.0320	0.0311
	(0.0187)	(0.0453)	(0.0305)
Proportion of teachers uncertified last year	1.2013	1.4199	−0.5736
	(0.9720)	(1.8347)	(1.2914)
Class size last year	−0.0033	0.0068*	−0.0019
	(0.0023)	(0.0038)	(0.0014)
Proportion of students eligible for free or reduced meals	−0.1400	0.0381	0.2195
	(0.1126)	(0.2622)	(0.2066)
Proportion of English Language Learners	−0.4771	5.5858***	−0.5104
	(0.8573)	(2.1385)	(1.5818)
Proportion of students repeating a grade last year	3.9468**	1.7835	−0.5011
	(1.5512)	(3.5357)	(2.7665)
Absences per student last year	0.0156	−0.0381	0.0340
	(0.0268)	(0.0627)	(0.0401)
Suspensions per student last year	−0.2093	−2.0021	1.0575
	(0.6294)	(1.4125)	(1.1043)
Fall enrollment	−0.0023***	−0.0007	−0.0026**
	(0.0009)	(0.0021)	(0.0013)
Fall enrollment squared	0.0000	0.0000	0.0000*
	(0.0000)	(0.0000)	(0.0000)
Constant	7.6336***	38.7405***	10.4345***
	(1.0092)	(2.2853)	(1.4976)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3124	3124	3124
Number of schools	895	895	895

The outcomes variables are percentage of expenditures allocated to 3 mutually exclusive, functional categories. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equation (2). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 7:
The Impact of Autonomy on Percentage of Expenditures by Category

	(1) Central	(2) Support	(3) Other Direct Services
Participating in Autonomy Program	−0.7822***	−0.4118*	0.2439
	(0.0963)	(0.2266)	(0.2440)
Principal's leadership experience (years)	−0.0034	0.0079	0.0007
	(0.0041)	(0.0072)	(0.0072)
Mean age of teachers last year	0.0003	−0.0828***	−0.0188
	(0.0141)	(0.0271)	(0.0292)
Proportion of teachers uncertified last year	−0.8751	−0.0383	−0.6947
	(0.5339)	(1.0102)	(1.3277)
Class size last year	0.0008	−0.0027	−0.0005
	(0.0008)	(0.0017)	(0.0017)
Proportion of students eligible for free or reduced meals	0.0452	0.3466**	−0.3036
	(0.0852)	(0.1444)	(0.1875)
Proportion of English Language Learners	0.2711	−0.6631	−2.6338*
	(0.6031)	(1.1491)	(1.3845)
Proportion of students repeating a grade last year	−2.0807**	−1.0121	−1.2907
	(1.0233)	(1.7224)	(2.3640)
Absences per student last year	0.0000	−0.0071	−0.0158
	(0.0154)	(0.0302)	(0.0367)
Suspensions per student last year	0.2046	0.5711	−0.0306
	(0.3847)	(0.7782)	(1.0999)
Fall enrollment	0.0053***	−0.0034***	0.0018
	(0.0006)	(0.0010)	(0.0013)
Fall enrollment squared	−0.0000***	0.0000**	−0.0000*
	(0.0000)	(0.0000)	(0.0000)
Constant	5.5002***	14.1265***	15.8974***
	(0.6615)	(1.2703)	(1.6202)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3078	3122	3124
School dummies	894	895	895

The outcomes variables are percentage of expenditures allocated to 3 mutually exclusive, functional categories. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equations (2). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 8:
The Impact of Autonomy on the Allocation of Teachers

	(1) Age of Teachers	(2) Uncertified Teachers	(3) Class Size
Participating in Autonomy Program	−0.2596	−0.0052	−9.6138
	(0.1906)	(0.0050)	(6.3402)
Principal's leadership experience (years)	−0.0012	0.0001	0.1548*
	(0.0066)	(0.0002)	(0.0914)
Mean age of teachers last year	−0.1899***	−0.0003	0.0833
	(0.0301)	(0.0005)	(0.4185)
Proportion of teachers uncertified last year	0.6839	−0.2351***	9.5554
	(0.9002)	(0.0328)	(22.2515)
Class size last year	−0.0004	0.0000	0.0330
	(0.0014)	(0.0000)	(0.1860)
Proportion of students eligible for free or reduced meals	0.0320	0.0021	−0.2260
	(0.1369)	(0.0033)	(1.8394)
Proportion of English Language Learners	−2.3706**	0.0341	22.5674*
	(1.1585)	(0.0337)	(12.8704)
Proportion of students repeating a grade last year	0.3050	0.0616	−3.3540
	(1.8891)	(0.0442)	(19.0542)
Absences per student last year	−0.0108	0.0009	0.1370
	(0.0267)	(0.0007)	(0.6193)
Suspensions per student last year	−0.2372	−0.0347*	14.6434
	(0.6291)	(0.0179)	(16.7720)
Fall enrollment	−0.0036***	−0.0000	0.0165
	(0.0009)	(0.0000)	(0.0159)
Fall enrollment squared	0.0000	0.0000*	−0.0000
	(0.0000)	(0.0000)	(0.0000)
Constant	51.4071***	0.1076***	5.5200
	(1.3220)	(0.0248)	(21.1517)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3096	3096	3124
Number of schools	894	894	895

The outcomes variables are indicators of the quality and quantity of teachers in a school. The unit of observation is a school-academic year. Results are obtained from estimating equation (2). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 9:
Heterogeneous Impacts of Autonomy by Principal Experience

	(1) Leadership	(2) Teachers	(3) Other Classroom Inputs
Participating in Autonomy Program	−86.3194	−81.3654	−108.7778
	(105.0245)	(317.4352)	(105.5514)
Autonomy*Tenured Principal	89.7199	33.1081	−19.2017
	(105.5921)	(319.9873)	(108.2669)
Tenured Principal	3.5774	−32.9061	13.4955
	(9.0368)	(26.6471)	(14.2483)
Mean age of teachers last year	1.8856	−5.5762	1.1186
	(2.6805)	(7.1680)	(4.3069)
Proportion of teachers uncertified last year	209.7531	587.1359**	44.1878
	(128.0456)	(273.8220)	(183.0058)
Class size last year	−0.2914	0.7630*	−0.2241
	(0.2160)	(0.4473)	(0.1713)
Proportion of students eligible for free or reduced meals	−17.2779	61.1784	16.7668
	(15.4145)	(43.0743)	(28.1856)
Proportion of English Language Learners	−53.2233	1098.5926***	265.8929
	(123.6441)	(369.2592)	(221.5540)
Proportion of students repeating a grade last year	672.2051***	517.7316	163.5668
	(246.7326)	(625.1543)	(422.7826)
Absences per student last year	1.7970	−7.8815	1.3676
	(3.8512)	(9.0958)	(5.4979)
Suspensions per student last year	−101.4185	−362.1977*	90.7852
	(86.8595)	(204.1983)	(166.9312)
Fall enrollment	−1.2086***	−4.4539***	−1.9323***
	(0.1191)	(0.6108)	(0.2736)
Fall enrollment squared	0.0003***	0.0013***	0.0006***
	(0.0000)	(0.0003)	(0.0001)
Constant	1609.2605***	8152.3861***	2436.3390***
	(137.2125)	(399.8339)	(229.7990)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3124	3124	3124
Number of schools	895	895	895

The outcomes variables are per-student expenditures allocated to 3 mutually exclusive, functional categories. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equation (3). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. An experience principal is defined as a principal with 4 or more years of experience. Prior research from Clark et al. (2009) found this break point to be significant for principal's impact on student outcomes.

Table 10:
Heterogeneous Impacts of Autonomy by Principal Experience

	(1) Central	(2) Support	(3) Other Direct Services
Participating in Autonomy Program	−70.8686	114.0851	−232.1617**
	(74.2667)	(120.8420)	(93.6313)
Autonomy*Experienced principal	−74.6760	−220.4283*	196.1102*
	(76.6647)	(121.5155)	(101.1115)
Experienced principal	−4.5018	15.4034	6.8581
	(4.9068)	(11.1986)	(12.6811)
Mean age of teachers last year	−0.8737	−10.6016***	−5.5848
	(1.5087)	(3.9388)	(4.3577)
Proportion of teachers uncertified last year	−39.3084	137.5821	−40.7666
	(56.4440)	(151.9808)	(200.1614)
Class size last year	0.0707	−0.2194	−0.0934
	(0.0982)	(0.1925)	(0.1896)
Proportion of students eligible for free or reduced meals	9.6884	44.2356**	−14.8324
	(9.5872)	(21.0328)	(28.4358)
Proportion of English Language Learners	139.0593*	−98.4407	−300.1196
	(74.3244)	(174.0003)	(225.5519)
Proportion of students repeating a grade last year	−113.4606	7.4508	−23.6348
	(120.5006)	(262.6099)	(361.0758)
Absences per student last year	−0.7285	−0.0366	−4.0935
	(1.7637)	(4.5995)	(5.7787)
Suspensions per student last year	−1.2831	19.8366	−90.4168
	(41.2220)	(107.2503)	(161.2512)
Fall enrollment	−0.1246**	−1.5644***	−1.3378***
	(0.0572)	(0.1915)	(0.2095)
Fall enrollment squared	0.0000	0.0005***	0.0004***
	(0.0000)	(0.0001)	(0.0001)
Constant	1253.6699***	2482.4459***	3161.8592***
	(75.2418)	(190.0661)	(241.7443)
School dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	3078	3122	3124
Number of schools	895	894	895

The outcomes variables are per-student expenditures allocated to 3 mutually exclusive, functional categories. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equations (3). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. An experienced principal is defined as a principal with 4 or more years of experience as a principal. Prior research from Clark et al. (2009) found this break point to be significant for principal's impact on student outcomes.

Table A1:
Definition of Expenditure Categories

Function	Description of function
I. Direct Services to Schools	Services provided directly to public school students and staff, and which take place primarily in the school building during the school day, during the school year.
A. Classroom Instruction	School-based direct instructional services provided primarily in classrooms.
i. Teachers	All teachers who provide direct instruction on full-time, part-time or per-diem basis or during their preparation periods.
ii. Other Classroom	Includes spending on paraprofessionals, other classroom staff, textbooks, library books, instructional supplies and equipment, professional development, contracted instruction, and summer and evening services.
B. Support Services	Direct services to students that supplement the basic classroom instructional program. This includes counseling services, attendance and outreach services, drug prevention, referral and evaluation services, support for after school and student activities, and support for parental involvement.
C. Leadership	Includes salaries of full-time and per diem assistant principals, salaries of deans and program coordinators, secretaries, school aides, and the supplies and materials to maintain administrative offices. This category is net of principal's salary since the principal cannot set his/her own salary.
D. Other Direct Services	Includes food services, transportation, school safety, computer system support, custodial services, building maintenance, leases, and energy costs.
II. Central	Includes sabbaticals/leaves, instructional support and administration paid to the district office, instructional support paid to the central office, operational offices (e.g. Office of the Chief Financial Officer), central leadership (e.g. school board/Chancellor's office), and funds spent for retiree health and welfare.
III. Capital	Payment for long-term debt in support of school construction.

These categories are mutually exclusive.

Table A2:
The Impact of Autonomy on Capital Expenditures

	(1) Per-student	(2) Percentage
Participating in Autonomy Program	0.000005	0.1810***
	(0.000004)	(0.0494)
Principal's leadership experience (years)	−0.00000001	−0.0012
	(0.0000001)	(0.0017)
Mean age of teachers last year	0.0000002	0.0109*
	(0.0000005)	(0.0060)
Proportion of teachers uncertified last year	0.00003	−0.2817
	(0.00002)	(0.2436)
Class size last year	0.00000003	−0.0002
	(0.00000003)	(0.0005)
Proportion of students eligible for free or reduced meals	−0.00002	0.0178
	(0.00002)	(0.0360)
Proportion of English Language Learners	−0.00003	−0.6399**
	(0.00002)	(0.2531)
Proportion of students repeating a grade last year	−0.00003	−0.4112
	(0.00004)	(0.4699)
Absences per student last year	0.000001	0.0090
	(0.0000006)	(0.0068)
Suspensions per student last year	−0.000003	0.1996
	(0.00002)	(0.1664)
Fall enrollment	0.00000002	0.0051***
	(0.00000002)	(0.0005)
Fall enrollment squared	0.000000000001	−0.0000***
	(0.000000000007)	(0.0000)
Constant	902.7183***	3.4425***
	(0.0000)	(0.3197)
Observations	3124	3124
Number of schools	895	895
School dummies	Yes	Yes
Year dummies	Yes	Yes

The outcomes variables are percentage of expenditures and per-student expenditures on capital. For definitions of the outcomes, see Table A1 in the appendix. The unit of observation is a school-academic year. Results are obtained from estimating equation (2). Standard errors are presented in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.