Which Schools Matter?
Disentangling the Impact of Zoned Schools
and Choice Schools on House Prices in New York City

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Abstract

This paper examines the impact of investments in individual public schools on neighborhood economic development as measured by property values. Specifically, we investigate which specific characteristics of schools are most critical in driving house prices and whether those characteristics matter even for schools which do not use student residence as the sole determinant of admission, which we call 'choice schools', and measure the impact of school openings and closings on property values. To study these questions, we use rich data on New York City public elementary schools geocoded and matched to data on property sales for a fifteen-year period beginning in 1988.

Our results suggest that the quality of locally zoned schools, as measured by education outcomes such as performance on reading tests and school inputs such as teacher-pupil ratio and teachers' experience, is valuable to the public and therefore, investments or reforms that increase that quality may spur neighborhood economic development. We also find that the presence of choice schools has a large positive impact on neighborhood property values, although the link between property values and the quality of nearby choice schools is less evident in our data. The results of our analysis of school openings and closings suggest that investments in new schools might not be conducive to neighborhood revitalization if those schools have weak performance.

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Which Schools Matter? Disentangling the Impact of Zoned Schools and Choice Schools on House Prices in New York City

1. Introduction

While a growing literature examines the relationship between public schools and house prices, much of this work has focused almost exclusively on the extent to which the price of a house reflects the quality and characteristics of the local public school and, more specifically, the school that children would be able to attend based upon their location in the school's 'catchment area' or 'attendance zone' (hereafter 'zoned school'). In contrast, relatively little attention has been paid to the impact of schools that admit students based upon other (not exclusively geographic) criteria – including magnet schools, alternative schools, and charter schools, for example. Yet, the number and type of these 'unzoned' or 'choice' schools is increasing in urban America, spurred, in part, by increasing interest in 'small schools' and school choice. At the same time improving public schools is clearly one of the critical components of efforts to attract and retain middle class families in urban neighborhoods, and such efforts could make critical contributions to the long-term economic health and viability of the country's central cities. This paper investigates the impact of investments in individual public schools on neighborhood economic development as measured by property values.

In a significant improvement over the existing literature, we investigate the possibility that not only the characteristics of the locally zoned elementary schools but also other school choices available to the community may be capitalized in the value of the house. In addition, we investigate which particular characteristics of schools (e.g., test score outcomes, schooling inputs, student demographics) are most critical in driving house prices, and also explore how property values respond when schools close or new ones open.

Our study uses unusually rich data on New York City public elementary schools geocoded and matched to data on property sales for a fifteen-year period beginning in 1988. The research design controls for differences in characteristics of the neighborhoods in order to isolate the effect of real differences in school attributes.

To preview the results, we find that the locally zoned schools' inputs such as teacher-pupil ratio and teachers' experience, and outcomes such as performance on reading tests have positive effects on property values. The positive effect of teacher-pupil ratio on house prices is particularly strong.

The proximity of alternative school choices appears to be highly valued by homeowners, although the presence of a large number of schools may not necessarily be beneficial. The link between property values and the test scores of nearby choice schools is less evident in our data. School openings and closings are found to have mixed impacts on property values, depending on whether the school is zoned or choice, however more research is needed to better understand the underlying mechanisms through which these effects may occur. Finally, we find that student demographics of both zoned and choice schools are relevant to property values. English language proficiency, economic status, and racial mix all matter, however, with few exceptions, their

property value impacts are small.

The paper is organized as follows. Section 2 reviews the literature on the relationship between property values and public schools. Section 3 describes the models and empirical strategy. Section 4 describes the data used for the study and provides some summary statistics. Section 5 discusses the results. A final section presents conclusions and outlines next steps in this research.

2. Background and Literature Review

Much evidence suggests that concerns about public school quality are critical to family decisions about residential choices (Jordan *et. al.*, 1998; Nechyba, 2000; and Epple and Romano, 1998). There is growing concern in some U.S. cities that the number of school-age children is dropping, perhaps as a result of families leaving in search of better schools (Egan, 2005; Leff, 2005; Abdo, 2000; Sawhill, 1999).

Although many studies have examined the relationship between property values and the quality of local schools, some studies are particularly relevant to our research.

In his seminal study of the relationship between schools and house prices, Oates (1969) found that both school expenditures and tax rates had large effects on property values in a sample of New Jersey towns. Subsequent research has investigated a broader range of measures aimed at capturing the characteristics of schools that matter to homeowners and that might influence house prices. These include alternative measures of inputs (e.g., school expenditures, student/teacher ratios) and outcomes (e.g., test scores). In principle, expenditures may be the most comprehensive measure of inputs, if differences in input prices can be accounted for, and, to the extent that inputs determine the quality of schools, school expenditures serve as a good proxy for school quality (for which no single comprehensive measure exists). Unfortunately, there is no consensus regarding the relationship between school expenditures (or other measures of inputs) and any of the partial quality measures such as test scores.

In reviewing the more relevant recent literature, we begin with studies that examine the effect of school inputs on house prices. Hayes and Taylor (1996), using data on 288 house sales in Dallas, found that test score gains increased home prices, whereas school expenditures were not statistically significant determinants of house prices. In contrast, Bradbury, Mayer, and Case (1997), using aggregate data on Massachusetts towns and controlling for unobserved town characteristics, found a positive relationship between school spending and appreciation in the price of housing. Downes and Zabel (2002) report similar findings to Hayes and Taylor (1996), using a geocoded version of the American Housing Survey for the Chicago metropolitan area. Most recently, Haurin and Brasington (2006) found that variations in purchased school inputs (teacher-pupil ratio, teacher education, the dropout rate, the attendance rate and expenditures per pupil) and peer effects have little effect on house prices while parental inputs, including parents' education, economic status, race, stability in the community and housing tenure, are highly valued in the housing market.

Turning to the recent research examining school outcomes and housing prices, Haurin and Brasington (1996) examined house sales in a cross-section of 140 school districts in Ohio and

found that higher test scores raised house prices. In a significant methodological advance, Black (1999) investigated the relationship between school quality and property values, limiting her sample to homes near a school attendance boundary. Her estimates were based on a comparison of neighboring homes, which, she argued, should have similar housing and neighborhood characteristics but were located in different school catchment areas. More recent applications of this methodology include Davidoff and Leigh (2006), Figlio and Lucas (2004), Kane *et. al.* (2003), Downes and Zabel (2002), and Weimer and Wolkoff (2001).[1] All these studies found a positive relationship between school test scores and house prices.

Although the debate about the relationship between school inputs and test scores is far from resolved, a consensus seems to be emerging that the characteristics of local schools matter to housing prices. It is, however, unclear which school characteristics are most important, and, critically, whether it is only the characteristics of the local zoned school that matter. The existing studies of the relationship between school attributes and housing that have used school level data have usually concentrated on the impacts of locally zoned schools, with little attention paid to the impacts of schools without designated attendance zones (i.e., magnet or charter schools). Thus we consider the impact of the characteristics of a property's officially zoned school on the value of the property, but also the attributes of other schools that are within close proximity.

To be clear, house prices may reflect the characteristics of zoned schools because residential address determines which school a student will be assigned to by the school district. Although changes in zones are possible – due, perhaps, to changes in the population of school children – they are, in practice, infrequent, and home buyers regard their house purchase as including the right to attend the local zoned school. Home buyers may also consider the proximity of other schools– including private schools as well as other public schools that their children may be able to attend or may want to attend. Thus, the characteristics of the alternatives may be important to house prices. Of course, it is not necessary that resident children do attend these schools. Prices may well reflect the option value only and diversity of choices may be valued in and of itself. Or, it may be that school characteristics are valued because they signal the quality of other characteristics, say, of the community, the local public sector or the neighborhood. And, in a different vein, it may be that the "competition" provided by choice schools leads to improvements in the zoned schools, in ways uncaptured by the usual measures. Notice that it is not clear *a priori* whether the presence of a greater number of schools in a neighborhood would increase house prices. If choice schools can be attended by students outside of the neighborhood, more schools might mean that 'undesirable' kids would be in the neighborhood or even just more kids and their presence may outweigh any utility gains from having a larger array of school choices. In addition, having many schools to choose from may actually make it more difficult and time consuming for parents to select one. Or, increasing the number of schools may increase school segregation, which home buyers might not like. In the end, this is an empirical question.

Finally, while previous research largely treats schools as static, schools do, indeed, change over time. Existing schools are phased out and closed down, and new schools open, driven by changes in demographics, economic conditions, school finances, among myriad other causes. Notice that

[1] For example, Weimer and Wolkoff (2001) used the imperfect overlap of the boundaries of school districts and enrollment areas with the boundaries of towns providing other public services in Monroe County (in the state of New York) to identify the effect of elementary school output on property values.

the closing of an existing school may have both positive and negative effects on surrounding property values. Bad schools may be more likely to close and the closing of a bad school may have a positive influence on property values, akin to that of a dissamenity removal. Alternatively, closing a school may put additional strain on the resources of remaining schools (unless public funds can be re-directed to support them), driving down their performance or desirability and, eventually, property values. Likewise, the opening of a new school may have different effects on neighboring house values – positive if the school is good or if it helps reduce crowding in existing schools and negative if the school is bad. In the end, determining whether the impact of school openings and closings have a positive or negative impact on property values is, like the other questions we ask, an empirical matter, to which we turn below.

3. Methodology

To investigate the impact of local schools on communities, we estimate a series of hedonic regression models that explain the sales price of a property as a function of its structural characteristics, its neighborhood surroundings and amenities, and the characteristics of the local zoned school and other nearby schools. Here we build on models used in Schwartz, Susin, and Voicu (2003), though we improve on them significantly by using the characteristics of locally zoned schools and other nearby schools, rather than the characteristics of a school district, as independent variables.

Our simplest model explores the effects of the average attributes and number of all nearby schools, whether zoned or choice, on house values, controlling for student demographics, presence of subsidized housing and other neighborhood characteristics. This model can be represented as follows:

$$\ln P_{izdt} = \alpha + \beta X_{it} + \varphi S_{zt-1} + \lambda N_{zt-1} + \theta R_{it} + \delta_z W_z + \rho_{dt} V_{dt} + \varepsilon_{it} \quad (1)$$

where $\ln P_{izdt}$ is the log of the sales price per unit of property i in school zone z, in community school district d, and in year t; X_{it} is a vector of property-related characteristics (e.g., age, building class, structural characteristics); S is a vector of average attributes of the local schools (one-year lagged) including educational outcomes such as performance on standardized reading and math tests, educational inputs such as teacher-pupil ratio and indicators of a teacher's education and experience, and socio-economic characteristics of the students; N_{zt-1} denotes the number of local schools (including both the locally zoned school(s) and nearby choice school(s)), and accounts for the possibility that the number of available schools may, too, be capitalized in the value of the house; R_{it} are vectors of ring variables (described below) that capture the impact of proximity to various types of subsidized housing; W_z are a series of school zone fixed effects, which help control for unobserved, time-invariant features of different micro-neighborhoods and schools;[2] and V_{dt} are a series of dummy variables indicating the quarter and neighborhood (as measured by community school district) of the sale, which allow for distinct time trends for each

[2] In some cases, two or more school zones may partially overlap. In these cases, we include separate dummies for the overlapping and non-overlapping portions of the zones. For example, two zones that partially overlap are represented by three dummies – one for the overlapping portion and two for the areas that are part of only one zone.

community school district used in the analysis.[3] We use lagged rather than contemporaneous values of school characteristics to allow for the possibility that changes in school quality are not immediately captured in property values**.** The coefficients to be estimated are α, β, φ, λ, γ, θ, δ and ρ, and ε is an error term.

One may be concerned that other activities, unrelated to schools, may have been taking place in the city's neighborhoods, during our study period, and if so, the change in property values that we interpret as the schooling impact may be due, at least in part, to these other activities. Our community school district-quarter fixed effects should capture, to a large extent, the impacts of other investments. But to further minimize the possibility that other neighborhood changes may be causing any property value impacts we attribute to the schools, we have extended our analysis to address one of the changes most likely to have occurred in neighborhoods across the city. During our study period, New York City's own capital program, the Ten Year Plan for Housing, funded the construction or rehabilitation of over 200,000 units of affordable housing (see Schill, et al. 2002 for a detailed description of the Ten Year Plan programs). Additionally, about 75,000 housing units were created or rehabilitated with federal subsidies (see Ellen et al. 2007 for a detailed description of the federal programs).

To capture the impact of these subsidized housing investments on property values, we compare the prices of properties that are within 1,000 feet of subsidized housing sites to prices of comparable properties that are outside this 1,000-foot ring, but still located in the same neighborhood. Then we compare the magnitude of this difference before and after the project completion.[4] This 'difference-in-difference' in property values is our measure of the impact of subsidized housing. Vectors R_{it} help us perform the difference-in-difference estimation. They include an InRing dummy variable that indicates whether the property sold is within 1000 feet of any existing or future subsidized housing project; a PostRing dummy variable that indicates whether the property sold is within 1000 feet of any *completed* subsidized units; a variable that quantifies the number of completed subsidized units within 1000 feet of the sale; a variable indicating the share of completed homeownership units within 1000 feet of the sale; and a time trend, TPost, that equals the number of years between the date of sale and the project completion date for properties in the 1,000-foot ring.[5] The coefficient on InRing captures baseline differences in sales prices between properties located within a 1,000-foot ring of subsidized housing sites and those outside; the coefficient on PostRing provides the simplest impact estimate; and the coefficients on the remaining ring variables allow impacts to vary with the project scale and tenure mix, and with the time elapsed since completion. We include a separate set of ring variables for each of the three types of subsidized housing investments that we identify: city-sponsored projects involving construction of new units or gut rehabilitation of vacant units, city-sponsored projects involving rehabilitation of occupied units, and federally-

[3] In preliminary work we used census tract-quarter fixed effects and (census tract + community district x quarter) fixed effects, thus taking advantage of the imperfect overlap of the boundaries of school zones with the boundaries of census tracts to identify the effect of school attributes on property values. Results are robust to the choice of fixed effects and thus we opt to present the more parsimonious specifications based on zone fixed effects.

[4] We borrow this methodology from our previous research that investigates the impact of subsidized housing on property values in New York City (see, for example, Schwartz et al., 2006, and Ellen et al., 2007).

[5] To be clear, Tpost equals 1/365 if a sale is located within the ring of a subsidized housing site and occurs the day after its completion; it equals one if the sale occurs one year after the project completion; and so on.

subsidized projects.[6]

With our second model, we attempt to gain a better understanding of how the different school choices available to residents affect property values. Specifically, we test whether the presence of a choice school matters to property owners, and allow for different property value effects of the characteristics of the locally zoned school(s) and the characteristics of the nearby choice school(s). This model is described as follows:

$$(2) \qquad \ln P_{izdt} = \alpha + \beta X_{it} + \varphi^{Z} S_{zt-1}{}^{Z} + \lambda^{Z} N_{zt-1}{}^{Z} + \omega UZ_{zt-1} + \varphi^{UZ} S_{zt-1}{}^{UZ} + \lambda^{UZ} N_{zt-1}{}^{UZ} + \theta R_{it} + \delta_z W_z + \rho_{dt} V_{dt} + \varepsilon_{it}$$

where UZ is a dummy variable indicating the existence of a nearby choice school, and superscripts ^{Z} and ^{UZ} denote the attributes (and their associated coefficients) of the zoned and choice school(s), respectively.[7]

Finally, we modify the previous model to replace the number of schools variable with regressors that indicate whether the property is sold after a school opening or closing. The altered model is:

$$(3) \quad \ln P_{izdt} = \alpha + \beta X_{it} + \varphi^{Z} S_{zt-1}{}^{Z} + \eta^{Z} PostO_{zt}{}^{Z} + \pi^{Z} TPostO_{zt}{}^{Z} + \sigma^{Z} PostC_{zt}{}^{Z} + \tau^{Z} TPostC_{zt}{}^{Z} + \omega UZ_{zt-1} + \varphi^{UZ} S_{zt-1}{}^{UZ} + \eta^{UZ} PostO_{zt}{}^{UZ} + \pi^{UZ} TPostO_{zt}{}^{UZ} + \sigma^{UZ} PostC_{t}{}^{UZ} + \tau^{UZ} TPostC_{zt}{}^{UZ} + \theta R_{it} + \delta_z W_z + \rho_{dt} V_{dt} + \varepsilon_{it,}$$

where PostO(C) is a dummy variable that indicates whether the property sale occurs after the opening (closing) of a local school, and TPostO(C) is a post opening (closing) time trend that equals the number of years between the date of sale and the school opening (closing) date.[8] Thus, the coefficient on PostO(C) captures the relative[9] change in property values in the zone immediately following a school opening (closing), and TPostO(C) allows impacts to vary with the time elapsed since opening (closing).

[6] Federally subsidized housing programs, not including the larger Low Income Housing Tax Credit (LIHTC) program, accounted for about 9,000 units during our study period. Many city-assisted projects received LIHTC assistance and to avoid double-counting, we exclude LIHTC housing from the set of federally subsidized developments. Note also that the set of ring variables for federally-subsidized projects does not include the share of homeownership units because these projects consist only of rental units.

[7] As before, if the sale is associated with multiple zoned (unzoned) schools, we use their average attributes.

[8] The date of school closing is assumed to be June 30 of the last academic year in which the school was active. The date of school opening is assumed to be September 1 of the first academic year in which the school was active. In cases where a sale is in the proximity of more than one school opening (closing), we use the opening (closing) date of the first school opened (closed). In preliminary work, we used the opening (closing) date of the last school opened (closed), and the results were very similar to the ones presented in the paper (perhaps because there are very few sales associated with multiple school openings or closings).

[9] That is, relative to price changes in the larger school district.

4. Data

New York City provides an ideal site in which to conduct the research outlined above. The city's neighborhoods have undergone dramatic transformations in recent years, including public housing investment and the accompanying revitalization of many neighborhoods. More than 70,000 new assisted housing units, either publicly-financed or tax-encouraged, have been built across New York City in the past 15 years, revitalizing many neighborhoods devastated by abandonment and arson during the 1970s. This development was part of the larger 'Ten Year Plan for Housing' through which the city spent over $10 billion to build or rehabilitate almost 200,000 housing units.[10]

The city's public school system has also experienced significant change across the past decade, as student population has increased, hundreds of new small schools have been created, and large high schools have been closed and restructured, all within the context of massive school reform initiatives and increasing spending at the local, state and federal levels.

The pace and extent of neighborhood change and school reform make New York City an ideal setting in which to explore the effectiveness of investments in public schools as a tool for neighborhood economic development. Moreover, New York City's diversity of neighborhoods makes the results useful for a range of other types of jurisdictions. Further adding to New York City's appeal is the availability of detailed data on housing and schools from a number of unique city data sources. These data sources include subcity information (both cross-sectional and longitudinal) about the location and nature of (1) property sales (address-specific), (2) individual school performance and student characteristics, and (3) housing production, renovation, and investment.

Property Sales

Through an arrangement with the New York City Department of Finance (DOF), we have obtained a confidential database that contains sales prices and dates for all transactions of apartment buildings, condominium apartments and single-family homes over the period 1989-2004. We have obtained information about the characteristics of these properties from an administrative data set gathered by the DOF for the purpose of assessing property taxes (the Real Property Assessment Data [RPAD] file).[11] Our sample includes over 350,000 residential property sales, spread across 32 community school districts (CSDs) that administer elementary and middle schools. Both because of the long time span of the data and New York City's size, this is a very large sample size compared with much of the literature.

[10] Announced in 1985 by former mayor Edward I. Koch, the 10-Year Plan represents the largest local housing investment initiative in U.S. history, encompassing a wide variety of programs to stimulate the production and rehabilitation of housing (see Schill et al., 2002, for more detail). For discussions of the origins of the 10-Year Plan, see Schwartz (1999) and Van Ryzin and Genn (1999).

[11] These characteristics are used as explanatory variables in the hedonic regressions. RPAD data contain information about buildings rather than individual units (except in the case of condominiums). Nonetheless, these building characteristics explain variations in prices surprisingly well, suggesting the data are rich enough for estimating hedonic price equations (see Ellen et al., 2001, for more detail on these data). In a cross-section regression including only RPAD variables, the R^2 is 0.68.

Table 1 shows summary statistics for the sales sample. Most of the sales in our sample were located in Brooklyn and Queens, largely because those boroughs include a relatively large share of smaller properties, which sell more frequently than apartment buildings. 71 percent of all buildings sold were either one- or two-family homes, and 84 percent were single-family homes, two-family homes, or small apartment buildings. Over one third of the transacting properties had garages and 70 percent were built before the Second World War. Finally, 21.2 percent of the transacting properties were located within 1,000 feet of a city-assisted new housing site, and 68.4 percent were within 1,000 feet of a city-assisted rehabilitated housing site. 17.8 percent of the properties sold were within 1,000 feet of a completed new city unit and 58.9 percent were within 1,000 feet of a rehabilitated city unit.

School Data

With the cooperation of the New York City Department of Education (NYC DOE), we compiled a data set that includes information for the period 1988 to 2003 about the full set of elementary public schools in New York City.[12] We focus on elementary schools because of the strong tie between residential location and the choice of elementary and middle schools. Most elementary and middle school students in public schools choose either their local zoned school or another school in their CSD.[13] Although New York City also offers zoned high schools, there is considerably more choice in high school grades, and more students commute to attend high schools at some distance from their homes; therefore, the tie between housing and school quality is weaker. The sample size varies between 622 schools in 1988 and 708 schools in 2003. The number of zones served by these elementary schools ranges from 593 in 1988 to 611 in 2003.[14]

For each school, we have data on enrollment; educational outcome variables such as performance on standardized reading and math tests (i.e., the percentage of students scoring at or above the national median);[15] inputs (i.e., the percentage of teachers with more than five years of experience, the percentage of teachers with less than two years of experience in the current school, the percentage of teachers with a master's degree, and the teacher-pupil ratio);[16] and the socioeconomic characteristics of the students (i.e., the percentage of students eligible for free or

[12] This dataset was compiled from the NYC DOE's *Annual School Reports* (ASRs), 1987-88 to 2002-03. The selection of elementary schools is based on information on the lowest grade in school. Schools with the lowest grade less than or equal to grade 4 are included in the elementary category. The year 1988 denotes the 1987 to 1988 academic year, 1989 denotes the 1988 to 1989 academic year, and so on.

[13] Note that nationally roughly 95% of school aged children attend public schools, in New York City that number is considerably lower and may be as low as 85%. In future research, we plan to incorporate middle schools, in our analysis.

[14] The number of school zones is smaller than the number of schools because two or more schools may serve the same zone and because some schools do not have a designated attendance zone. Zone boundaries were obtained from the New York City Department of Education (DOE) and they pertain to 2003. Schools in our sample that were not assigned a zone by the DOE in 2003 (e.g., school closings in years prior to 2003, magnet schools), representing up to 10 percent of our school sample (depending on the year), were assigned by the authors to the zone in which they were physically located.

[15] Student performance on standardized tests is reported for a citywide test in reading (CTB/McGraw Hill Test of Basic Skills or New York State English Language Assessment) and mathematics (California Achievement Test or CAT or New York State Math Assessment).

[16] Several educational input variables are unavailable for some years in the sample. To cope with this problem, we imputed the missing values via linear extrapolation, based on the coefficient estimates from simple ordinary least squares (OLS) regressions of the relevant variables on a time trend.

reduced-price lunch and the percentages of limited English proficient [LEP], black, Hispanic, and Asian students).

As pointed out above (see footnotes 2 and 13), in some cases, school zones may overlap, partially or entirely, and thus there may be multiple schools serving the same area. Properties served by multiple schools are assigned weighted means of the characteristics of these schools (including enrollment), with weights given by school enrollment.[17] For a more in-depth analysis of the available school choices, we create separate sets of school variables for the zoned and choice schools associated with a given property.

Educational outcomes and measures of resources directly available to students, including the percentage of teachers with a master's degree, the percentage of teachers with more than five years of experience, and the teacher-pupil ratio, are expected to exhibit a positive effect on house values. Larger schools might be expected to be associated with lower house prices, following the notion that larger schools provide less personalized instruction, fewer resources, and poorer quality education. At the same time, if larger schools offer a broader range of services, larger enrollment may imply higher house prices.

The percentage of LEP students and the percentage of students eligible for free or reduced-price lunch are two variables that are likely to be correlated with the cost of education. This is because of the greater cost of educating students from disadvantaged backgrounds and those in need of remedial language courses. Therefore, we expect a negative relationship between these variables and house values.

Homeowners appear to be sensitive to the racial composition of the local schools, usually yielding negative correlations between house prices and the shares of black and Hispanic students, and yielding a positive correlation between house values and the share of Asian students.[18]

Table 2 provides a description of the elementary schools. The first three columns of panel A show statistics for our full sample of schools, and the remaining columns compare the characteristics of the zoned and choice schools. Note that this table shows averages for schools – that is, it describes the average school – rather than averages over students, which would describe the characteristics of the whole student population. Looking at the statistics for all schools, note that the three educational inputs pertaining to the education and experience of the teachers underwent the most significant changes during our study period. Specifically, there was a substantial decline in teachers' experience but a significant improvement in their education level: the (average) percentage of teachers with more than five years of experience declined by 27.6 percentage points, the percentage of teachers with less than two years in the school increased by 24 percentage points, and the percentage of teachers with master's degrees increased

[17] Assuming that the probability of attending a given school is equal to the share of that school's enrollment in total enrollment across all schools serving the property, the weighted average of a characteristic can be interpreted as an expected value.

[18] Although a very interesting and complex issue, the justification of the racial mix effect on house values is not within the scope of this article.

by 11.5 percentage points. The other measure of resources directly available to students, the teacher-pupil ratio, increased by 1.2 percentage points[19] – a non-negligible change in relative terms, given the small values of this ratio. Attendance rates also increased, albeit only slightly, and average school enrollment remained virtually unchanged. Changes in student outcomes were mixed: performance on math tests worsen whereas performance on reading tests improved between 1988 and 2003. Among the more notable changes in student demographics, the percentage of students eligible for free or reduced-price lunch increased significantly (from 62.7 percent in 1988 to 74.2 percent in 2003), as did the percentages of Hispanic and, especially, Asian minorities.

The last six columns of panel A reveal some systematic differences between the choice schools and those which were assigned specific attendance zones. The experience and education levels of the teachers in the choice schools are lower, whereas the teacher-pupil ratio is slightly higher. The choice schools are smaller and the significant decline in their enrollment between 1988 and 2003 has increased the size gap between zoned and choice schools. The academic performance of the students of the choice schools is weaker, although strong improvements over the study period has brought them almost on par with the students of zoned schools with respect to reading performance. As for student demographics, it is worth noticing that choice schools started with significantly higher proportions of minorities and students from disadvantaged backgrounds or in need of remedial language courses. However, by 2003 most of these differences had virtually disappeared. These statistics make clear that these choice schools are not predominantly magnet schools but include a range of schools including those designed to serve low performing students. Finally, note that the number of zoned schools far outweighs the number of choice schools; only 6 to 10 percent of all elementary schools are choice schools.

Table 2B provides information on the number of school openings and closings during our study period. Note that the frequency of both openings and closings is fairly high, however the number of openings is almost twice as large as that of closings. And, most of the action occurs among choice schools, for which the numbers of openings and closings far outweigh the pool of schools that have been active the whole period.

Table 2C compares the attributes of opening and closing schools, separately for the samples of zoned and choice schools. Not surprisingly, closing schools exhibit, in general, weaker test score performance than opening schools. On the other hand, closing schools appear to have more resources, perhaps because the 'fixed costs' are spread over a shrinking enrollment as the school 'fails'. Both opening and closing schools have lower student achievement and resources and are smaller than schools that have been active during the whole study period.

Publicly-assisted Housing Investment

From New York City's Department of Housing Preservation and Development (HPD), HUD USER and the New York City Housing Authority (NYCHA), we have obtained data describing

[19] We express teacher-pupil ratio as a percentage to facilitate interpretation of its regression coefficient as elasticity. With this transformation, a teacher-pupil ratio of 0.1, for example, becomes 10% (i.e., the number of teachers represents 10% of the number of students).

all housing built or renovated under the city's Ten Year Capital Plan[20], as well as housing sponsored through federal programs. For each housing development, this dataset indicates its precise location (to the tax lot or block level), the date the project was completed, the type of building structure, the number of units that were built or rehabilitated, the program name, the type of intervention (new construction or rehabilitation), and if units are rental or owner-occupied.

We used GIS techniques to measure the distance from each sale in our database to all Ten Year Plan and other housing sites and, from these distance measures, created a variable that identified properties within 1,000 feet of housing investments of different types.[21]

The effect of subsidized housing investments on property values is likely to vary across programs and even particular projects, depending on what is replaced, the size and design of the new development, the characteristics of the tenants, housing market conditions, and the characteristics of the surrounding neighborhood.[22]

Table 3 shows the distribution of city-assisted housing units built or rehabilitated in New York City between 1987 and 2000, by program type and completion year. We group this housing into four broad categories defined by type of intervention and tenure. In total, over 170,000 housing units were built or rehabilitated through the Ten Year Plan during our time period, with new units accounting for 38 percent of the total. Homeownership units represent about 30 percent of all new units but only about 14 percent of all the rehabilitated units. The pace of development was brisk throughout the period, although significantly more units were created during the early periods than in the later years.

[20] Announced in 1985 by former mayor Edward I. Koch, the Ten Year Plan represents the largest local housing investment initiative in U.S. history, encompassing a wide variety of programs to stimulate the production and rehabilitation of housing (see the article by Schill et al. [2002] for more detail). For discussions of the origins of the 10-Year Plan, see the articles by Schwartz (1999) and Van Ryzin and Genn (1999).

[21] Since all buildings in New York City have been geocoded by the New York City Department of City Planning we used a "cross-walk" (the "Geosupport File") which associates each tax lot with an x,y coordinate (i.e. latitude, longitude using the US State Plane 1927 projection), police precinct, community district and census tract. A tax lot is usually a building and is an identifier available to the homes sales and RPAD data. We are able to assign x,y coordinates and other geographic variables to over 98 percent of the sales using this method. For most of the HPD units, we had both tax block and tax lot. If the tax lot was unavailable, then we collapsed the Geosupport file to the tax block level (i.e. calculating the center of each block) in order to assign x.y coordinates. We were unable to assign an x,y coordinate to 6 percent of the HPD units, largely due to missing block information. For federal housing units, we used a coordinate conversion software (PROLAT) to convert the latitude and longitude coordinates - available from HUD - into x,y coordinates.

[22] See Schwartz et al. (2006) and Ellen et al. (2007) for discussions of the mechanisms through which subsidized housing might affect the value of neighboring properties, and empirical findings on the impact of Ten Year Plan and federally-subsidized housing investments.

5. Results

Table 4 shows the key coefficients and their standard errors from the three regressions described above. Coefficients for structural variables are included in Table A1 in the appendix. The relatively high R^2s (0.82), together with the fact that the coefficients on the structural variables are consistent with expectations, suggest that these variables provide adequate controls for the characteristics of the properties sold.

Looking at the estimates of the model in column (1), which corresponds to equation (1) above, notice first that the coefficients on both academic performance measures have positive signs, as expected, and, although small in magnitude, are statistically significant. A 10 percentage-point increase in the percentages of students passing math and reading is associated with increases of 0.2 percent and 0.6 percent, respectively, in house prices. Among the education inputs, the percentage of teachers with more than five years of experience and the teacher-pupil ratio are statistically significant and have expected signs. Specifically, if the percentage of teachers with more than five years of experience rises by 10 percentage points, on average, a 0.5 percent increase in house values would result. And, a one percentage point increase in the teacher-pupil ratio is associated with a 0.5 percent increase in house values. School size negatively affects house prices, although the magnitude of this effect is small -- a 10 percent increase in enrollment results in a 0.12 percent decline in property values. Among the coefficients for student demographics, the only significant findings are the negative coefficients for the percentage of students eligible for free or reduced-price lunch and the percentage of students who are LEP. A 10 percentage-point increase in the former variable is associated with a 0.7 percent drop in house prices, and a similar increase in the latter variable results in a 0.6 percent reduction in house prices.

The coefficient on number of schools is positive and statistically significant, indicating that an increase in the number of local schools by one results in a 1.2 percent increase in house values. Thus, the mere number of school choices available to the community, controlling for their average attributes, may be capitalized in the value of the house.

Column (2) displays the estimation results for the regression equation (2), which allows for different coefficients on the characteristics and number of locally zoned school(s) and those of the nearby choice school(s). The estimates reveal that the house price effects of the attributes of zoned schools are, with few exceptions, similar to the impacts of the average characteristics across all schools presented in column (1). This is not surprising, given that zoned schools far outnumber the choice schools. The exceptions suggest that higher percentages of Hispanic and Asian students in the locally zoned schools are associated with modest increases in house prices.

Turning to the choice school characteristics, notice first that the coefficient on the choice school dummy is positive and highly significant, and has a large magnitude. Specifically, the presence of a choice school raises neighborhood property values by 21.8 percent. The reason for this large effect is not entirely clear, however, results could provide support for the hypothesis that the proximity of choice schools represents a valued alternative school choice in the neighborhood. It is also possible that parents view the presence of choice schools as a sign of an effective neighborhood lobby that is able to get such amenities as an additional type of school or that the

school district is investing in improving the schools in the neighborhood. At the same time, these schools may serve as proxies for additional (and better) school choices, i.e., private schools, or for other institutions that might be good for the neighborhood (e.g., choice schools may be 'lab' schools in partnership with institutions of higher education). Whether choice schools serve their neighborhoods or students from all over the city, their physical presence seems to have a significant effect on property values. More research is needed to gather information on the choice schools and explore what parents might find attractive about them. Coefficients on education outcomes for the choice schools are similar to those for zoned schools, indicating positive and statistically significant, albeit small, effects for reading performance and insignificant influence of math performance. The coefficient estimates for the inputs of these schools are more mixed. Higher teacher-pupil ratios and percentages of teachers with masters are associated with higher property values, whereas, surprisingly, teachers' experience (whether general or school specific), appears to negatively influence house prices.[23] Like in the case of zoned schools, a larger school size is associated with lower property values. As for the socio-economic characteristics of the students in choice schools, larger Hispanic and Asian minorities are associated with lower house prices, and a higher percentage of LEP is associated with higher house prices – quite the opposite of findings for the zoned schools.

Interestingly, the coefficient on the number of zoned schools is not statistically significant, while that on the number of choice schools is negative and significant. These findings suggest that while the presence of alternative school choices is highly valued (as indicated by the large positive coefficient on the choice school dummy), the marginal impact of an additional school is negative. This negative marginal impact might reflect increased flows of kids from outside the neighborhood and also the fact that as the number of alternative choices grows it becomes more difficult and time consuming for parents to choose the right school. In the light of these results, and because much of the variation in the number of schools within and across school zones comes from the presence or absence of choice schools,[24] it becomes apparent that the positive coefficient on total number of schools estimated from model (1) largely reflects the effect of the presence of a nearby choice school.

The model in the last column of Table 4, described by equation (3) explores how property values respond to school openings and closings. Notice first that the coefficients of school attributes, especially those pertaining to zoned schools, are, in general, fairly robust to the inclusion of the school opening and closing indicators. The exceptions are the choice schools' coefficients on test score outcomes and teacher-pupil ratio, which become statistically insignificant, and those on the percentage of students eligible for free lunch and percentage of black students, which become statistically significant.

Turning to the newly added variables, it appears that the opening of a zoned school does not affect house values but the closing of one is associated with a 2.6 percent drop in values. The opening of a choice school has an initial negative impact of 2.6 percent, however this effect diminishes rapidly over time (it drops to 0 in about two years) and, eventually, may even become

[23] We could not estimate the effects of the percentage teachers with masters, attendance rate, and school enrollment because these variables were highly correlated with the unzoned school dummy and thus, their inclusion in the model would have generated multicolinearity problems.
[24] The vast majority of attendance zones with multiple schools have two schools - one zoned and one choice.

positive. Quite the opposite, the closing of a choice school has a positive impact on house prices (a 3.6 percent boost), which declines slightly over time. The findings with respect to the effects of openings and closings of choice schools are consistent with the descriptive statistics from Table 2C, which suggest that newly opened schools and closing schools have relatively weak performance.[25]

6. Conclusion

This paper advances the literature on the relationship between public schools and house prices in several ways: it investigates which specific characteristics of schools matter most to differential housing demands for particular neighborhoods and whether those characteristics matter even for schools which do not use student residence as the sole determinant of admission, which we call 'choice schools', and it measures the impact of school openings and closings on property values.

Our results suggest that the quality of locally zoned schools, as measured by education outcomes and school inputs, is valuable to the public and therefore, investments or reforms that increase that quality may spur neighborhood economic development. Specifically, we find that improvements in reading performance and, especially, measures of resources directly available to students, such as teacher-pupil ratio and teachers' experience, are associated with increases in property values. The positive effect of teacher-pupil ratio on house prices is particularly strong – a one percentage point increase in this measure is associated with a 0.3 to 0.5 percent increase in house values. School size has a negative, albeit very small effect on house prices. Apart from their effects on test scores, these results suggest that increasing school resources whether by increasing teacher-pupil ratios or decreasing school size (enrollment) should have a positive effect on property values and, more generally, neighborhood economic development. This is an important and intriguing finding that should be explored more fully in future research.

We also find that the presence of alternative school choices in the form of choice schools has a large positive impact on neighborhood property values. While this result suggests that investments that provide such schooling alternatives may be potent tools for neighborhood improvement, more research is needed to better understand the reasons for this large effect before deriving any strong policy implications. Moreover, too many schooling alternatives may actually be detrimental to the community, perhaps because of residents' increased exposure to 'undesirable' kids from outside the neighborhood or because parents may have a harder time choosing the right school among many. The link between property values and the quality of nearby choice schools is less evident in our data.

School openings and closings have mixed impacts on property values, depending on whether the school is zoned or choice. Specifically, we find that the opening of a choice school has a short-lived negative impact on property values whereas the closing of a choice school has a positive effect. These findings are consistent with descriptive statistics suggesting that both newly opened schools and closing schools are relatively weak performers. On the other hand, the closing of a zoned school has a negative impact on house prices. Perhaps we observe these effects because the closing of a zoned school is seen as a loss of a neighborhood amenity or a community

[25] True, we control for many school attributes, however it is possible that schools which are weak with respect to observable performance indicators are also inferior with respect to unobservables.

institution, no matter the 'quality' of that institution. More research is needed to fully understand the underlying mechanisms through which these effects occur. Nonetheless, the results so far suggest that investments in new schools might not be conducive to neighborhood revitalization if those schools have weak performance. Thus, policymakers contemplating the opening of new schools should be mindful of the quality of the new schools and not just the quantity.

Among student demographics, we find that the percentage of LEP students and the percentage of students eligible for free or reduced-price lunch in zoned schools are negatively correlated with property values, and that higher shares of Hispanic and Asian students in these schools are associated with slightly higher house prices. For choice schools, these demographics have quite opposite and significantly larger effects on property values. Again, these findings are intriguing and suggest that further research exploring the way in which property values are shaped by the relationship between the composition of the school population and the composition of the neighborhood population is needed.

Our research is focused in New York City, but, given the diversity of the city's schools and neighborhoods, the lessons we learn should be broadly applicable to other large urban areas. In future research, we plan to further explore the generalizability of our results by testing whether the responsiveness of property values to changes in schools differ according to the type of housing, such as owner-occupied versus rental, and to the characteristics of the neighborhood.

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Table 1. Characteristics of residential properties sold

	Percentage of all property sales
Borough	
Manhattan	10.1
Bronx	9.5
Brooklyn	30.8
Queens	37.1
Staten Island	12.5
Building Class	
Single-family detached	25.8
Single-family attached	15.2
Two-family	29.9
Walk-up apartments	13.0
Elevator apartments	0.4
Loft buildings	0.0
Condominiums	12.4
Mixed-use, primarily residential (includes store or office plus residential units)	3.2
Other Structural Characteristics	
Built pre-World War II	70.1
Garage	37.4
Corner location	8.5
Major alteration prior to sale	1.6
Within 1000 feet of:	
Any city-assisted new housing site	21.2
Any completed city-assisted new housing project	17.8
Any city-assisted rehabilitated housing site	68.4
Any completed city-assisted rehabilitated housing project	58.9
N	352,339

Table 2A. Descriptive statistics for the whole school sample

	All schools			Zoned schools			Choice schools		
			Change[1]			Change[1]			Change[1]
Statistics	1988	2003	1988-2003	1988	2003	1988-2003	1988	2003	1988-2003
Mean % students passing math	62.8	56.3	-6.5	63.4	56.7	-6.8	53.4	52.7	-0.7
Mean % students passing reading	44.4	53.6	9.1	45.1	53.8	8.6	34.2	51.7	17.6
Mean % teachers with more than 5 years experience	80.3	52.7	-27.6	80.6	53.5	-27.2	75.0	45.2	-29.7
Mean % teachers with masters	66.7	78.2	11.5	67.4	78.4	11.0	57.2	76.3	19.1
Mean % teachers with less than 2 years in this school	11.7	35.7	24.0	11.4	34.6	23.2	16.3	46.1	29.8
Mean teacher-pupil ratio[2]	5.6	6.9	1.2	5.6	6.7	1.1	6.0	8.1	2.1
Mean school enrollment	751.9	747.3	-0.6	758.3	769.9	1.5	656.0	534.1	-18.6
Mean % of students who are:									
free lunch eligible	62.7	74.2	11.5	61.5	74.3	12.8	79.8	72.4	-7.4
white	23.3	15.8	-7.5	24.3	16.0	-8.4	7.6	14.4	6.8
black	36.1	33.7	-2.4	36.0	33.5	-2.6	37.7	35.8	-1.9
hispanic	33.9	38.4	4.4	32.8	38.0	5.2	51.2	42.1	-9.1
asian	6.7	12.2	5.5	6.9	12.6	5.7	3.5	7.7	4.1
LEP	10.4	11.4	1.0	10.3	11.5	1.3	13.0	10.0	-3.0
N	622	708	86	583	640	57	39	68	29

Notes:

1) For enrollment, this figure represents the percentage change in mean between the two years; for the other characteristics (which are themselves percentages), this figure represents the change in mean between the two years.

2) Teacher-pupil ratio is expressed as a percentage.

Table 2B. Number of school openings and closings

	Existing[1]	Openings	Closings
All schools	592	157	79
Zoned schools	569	72	23
Choice schools	23	85	56

Notes:

1) Represents the number of schools that have been active in each year of the study period, 1988-2003 (i.e., schools that neither opened nor closed during the study period)

Table 2C. Descriptive statistics for the opening and closing schools

	Zoned schools			Choice schools		
Statistics	Existing[1]	Opening	Closing	Existing[1]	Opening	Closing
Mean % students passing math	58.7	42.2	42.8	54.8	46.9	43.3
Mean % students passing reading	49.4	36.0	30.8	45.2	44.7	35.4
Mean % teachers with more than 5 years experience	68.2	50.5	61.5	66.7	46.3	58.7
Mean % teachers with masters	74.2	69.6	70.0	72.0	65.7	66.3
Mean % teachers with less than 2 years in this school	24.9	43.6	29.4	26.0	45.4	35.1
Mean teacher-pupil ratio[2]	6.1	6.4	6.0	7.3	8.7	5.5
Mean school enrollment	800.4	654.3	605.7	675.5	378.6	465.6
Mean % of students who are:						
free lunch eligible	69.6	82.6	81.9	81.6	72.6	79.1
white	20.6	6.8	4.4	8.9	14.2	7.9
black	9.9	6.9	7.7	6.2	5.2	3.1
Hispanic	35.4	32.0	33.7	37.0	38.5	39.3
Asian	34.0	54.2	54.2	47.8	41.8	49.4
LEP	13.7	21.3	20.5	13.8	16.4	19.3

Notes:

Statistics represent averages across all schools and years (1988-2003)

1) Represents the number of schools that have been active in each year of the study period (1988-2003) (i.e., schools that neither opened nor closed during the study period)

2) Teacher-pupil ratio is expressed as a percentage.

Table 3. Distribution of Ten Year Plan subsidized units by program type and completion year

Completion Year	Program Type			
	New units		Rehabilitation of occupied units	
	Number of units	% homeownership	Number of units	% homeownership
1987-1990	16,010	28.0	49,234	10.2
1991-1995	35,365	24.5	36,941	15.5
1996-2000	14,534	44.3	21,290	20.0
Total	65,909	29.7	107,465	13.9

Table 4. Selected regression results

	(1)		(2)			(3)		
	all schools		zoned schools		choice schools	zoned schools		choice schools	
choice school dummy					0.2183	***			0.2671	***
					(0.0387)				(0.0382)	
% students passing math	0.0002	*	3.1E-05		-0.0003		2.3E-05		-7.7E-05	
	(1.3E-04)		(1.3E-04)		(0.0002)		(1.3E-04)		(0.0002)	
% students passing reading	0.0006	***	0.0005	***	0.0005	**	0.0005	***	-0.0001	
	(1.3E-04)		(1.3E-04)		(0.0002)		(1.3E-04)		(0.0002)	
% teachers with more than 5 years experience	0.0005	***	0.0004	***	-0.0009	***	0.0003	***	-0.0009	***
	(7.6E-05)		(7.7E-05)		(1.6E-04)		(7.8E-05)		(1.6E-04)	
% teachers with masters	-3.7E-05		-9.3E-05		0.0004	**	-7.5E-05		0.0004	***
	(6.9E-05)		(6.9E-05)		(1.6E-04)		(6.9E-05)		(1.6E-04)	
% teachers with less than 2 years in this school	4.8E-05		-5.2E-05		2.0E-04	*	-5.7E-05		0.0003	**
	(6.6E-05)		(6.8E-05)		(1.0E-04)		(6.9E-05)		(1.1E-04)	
teacher-pupil ratio[1]	0.0047	***	0.0033	***	0.0037	***	0.0027	***	-0.0004	
	(0.0009)		(0.0009)		(0.0009)		(0.0009)		(0.0009)	
school enrollment (logs)	-0.0123	**	-0.0148	***	-0.0256	***	-0.0139	**	-0.0372	***
	(0.0055)		(0.0056)		(0.0048)		(0.0056)		(0.0049)	
% of students who are:										
free lunch eligible	-0.0007	***	-0.0006	***	0.0000		-0.0006	***	0.0005	**
	(9.4E-05)		(9.4E-05)		(0.0003)		(9.4E-05)		(0.0003)	
black	4.9E-05		7.4E-05		-0.0003		-9.8E-05		-0.0006	*
	(1.3E-04)		(1.3E-04)		(0.0003)		(1.3E-04)		(0.0003)	
hispanic	0.0003		0.0004	**	-0.0012	***	0.0003	*	-0.0017	***
	(0.0002)		(0.0002)		(0.0004)		(0.0002)		(0.0004)	
asian	0.0002		0.0004	*	-0.0021	***	0.0004	**	-0.0026	***
	(0.0002)		(0.0002)		(0.0006)		(0.0002)		(0.0006)	
LEP	-0.0006	***	-0.0009	***	0.0020	***	-0.0009	***	0.0019	***
	(1.5E-04)		(1.5E-04)		(0.0003)		(1.5E-04)		(0.0003)	

Table 4. Selected regression results (continued)

	(1)	(2)		(3)	
	all schools	**zoned schools**	**choice schools**	**zoned schools**	**choice schools**
N schools	0.0116 ***	-0.0090	-0.0342 ***		
	(0.0035)	(0.0082)	(0.0107)		
Post opening				-0.0141	-0.0265 ***
				(0.0089)	(0.0065)
Tpost opening				-0.0026	0.0127 ***
				(0.0016)	(0.0013)
Post closing				-0.0261 **	0.0361 ***
				(0.0121)	(0.0093)
Tpost closing				0.0040	-0.0048 **
				(0.0029)	(0.0024)
R-squared	0.8167	0.8168		0.8169	
N	352339	352339		352339	

Notes:

All regressions include school zone and school district-quarter dummies, ring variables for subsidized housing and the full set of building controls, like in the appendix. When the sale is within a zone served by multiple schools, we use a weighted average of school characteristics, with weight given by school enrollment. Standard errors in parentheses. *** denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

[1] Teacher-pupil ratio is expressed as a percentage.

APPENDIX
Complete Regression Results for Model (1)

	(1) all schools	
School variables		
% students passing math	2.2E-04	*
	(1.3E-04)	
% students passing reading	0.0006	***
	(1.3E-04)	
% teachers with more than 5 yrs. experience	0.0005	***
	(7.6E-05)	
% teachers with masters	-3.7E-05	
	(6.9E-05)	
% teachers with less than 2 years in this school	4.8E-05	
	(6.6E-05)	
teacher-pupil ratio[1]	0.0047	***
	(0.0009)	
school enrollment (logs)	-0.0123	**
	(0.0055)	
% of students who are:		
free lunch eligible	-0.0007	***
	(9.4E-05)	
black	4.9E-05	
	(1.3E-04)	
hispanic	0.0003	
	(0.0002)	
asian	1.7E-04	
	(0.0002)	
LEP	-0.0006	***
	(1.5E-04)	
N schools	0.0116	***
	(0.0035)	
Subsidized housing within 1000 feet of sale		
NYC Ten-Year Plan, new construction and rehab of vacant bldgs.		
In Ring	-0.0669	***
	(0.0034)	
Post Ring	-0.0192	***
	(0.0046)	
Number of units at the time of sale	1.7E-05	
	(1.4E-05)	

Complete Regression Results for Model (1) (continued)

Share of owner units at the time of sale	0.0341	***
	(0.0037)	
Tpost	0.0020	***
	(0.0004)	
NYC Ten-Year Plan, rehab of occupied bldgs.		
In Ring	-0.0356	***
	(0.0022)	
Post Ring	-0.0272	***
	(0.0033)	
Number of units at the time of sale	3.9E-05	***
	(5.1E-06)	
Share of owner units at the time of sale	0.0171	***
	(0.0026)	
Tpost	0.0010	***
	(0.0002)	
Federal Programs (excluding LIHTC)		
In Ring	-0.0274	*
	(0.0158)	
Post Ring	-0.0160	
	(0.0160)	
Number of units at the time of sale	-9.2E-05	***
	(4.8E-06)	
TPost	0.0006	***
	(1.2E-04)	
Characteristics of properties sold		
Odd shape	0.0201	***
	(0.0017)	
Garage	0.0352	***
	(0.0013)	
Extension	0.0236	***
	(0.0019)	
Corner	0.0332	***
	(0.0019)	
Major alteration prior to sale	0.0709	***
	(0.0044)	
Major alteration prior to sale missing	0.0936	***
	(0.0120)	
Age of unit	-0.0040	***
	(1.0E-04)	

Complete Regression Results for Model (1) (continued)

(Age of unit)2	2.3E-05	***
	(8.9E-07)	
Age of unit missing	-0.0830	***
	(0.0038)	
Log square feet per unit	0.5403	***
	(0.0017)	
Number of buildings on same lot	-0.0015	**
	(0.0006)	
Includes commercial space	-0.0193	***
	(0.0047)	
Square feet missing	3.7719	***
	(0.0174)	
Condo and square feet missing	0.0574	***
	(0.0149)	
Single-family detached	0.1416	***
	(0.0018)	
Two-family home	-0.2602	***
	(0.0018)	
Three-family home	-0.4863	***
	(0.0026)	
Four-family home	-0.6329	***
	(0.0041)	
Five/six-family home	-1.0324	***
	(0.0047)	
More than six families, no elevator	-1.3886	***
	(0.0051)	
Walkup, units not specified	-1.3500	***
	(0.0075)	
Elevator apartment building, cooperatives	-1.8143	***
	(0.0468)	
Elevator apartment building, not cooperatives	-1.4068	***
	(0.0088)	
Loft building	-0.7207	***
	(0.0324)	
Condominium, single-family attached	-0.2502	***
	(0.0117)	
Condominium, walk-up apartments	-0.2140	***
	(0.0046)	
Condominium, elevator building	-0.4005	***
	(0.0047)	
Condominium, miscellaneous	0.0348	
	(0.0299)	

Complete Regression Results for Model (1) (continued)

Multi-use, single family with store	-0.0036	
	(0.0077)	
Multi-use, two-family with store	-0.3737	***
	(0.0061)	
Multi-use, three-family with store	-0.6036	***
	(0.0099)	
Multi-use, four or more family with store	-0.7709	***
	(0.0074)	
N	352,339	
R^2	0.8167	

Notes:

All regressions include school zone and school district-quarter dummies. When the sale is within a zone served by multiple schools, we use a weighted average of school characteristics, with weight given by school enrollment. Standard errors in parentheses. *** denotes 1% significance level; ** denotes 5% significance level; * denotes 10% significance level.

1) Teacher-pupil ratio is expressed as a percentage.