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Publisher Routledge

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Journal of the American Planning Association

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t782043358>

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Online publication date: 12 April 2011

To cite this Article Chellman, Colin C. , Ellen, Ingrid Gould , McCabe, Brian J. , Schwartz, Amy Ellen and Stiefel, Leanna(2011) 'Does City-Subsidized Owner-Occupied Housing Improve School Quality?', Journal of the American Planning Association, 77: 2, 127 – 141

To link to this Article: DOI: 10.1080/01944363.2011.567894

URL: <http://dx.doi.org/10.1080/01944363.2011.567894>

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Does City-Subsidized Owner-Occupied Housing Improve School Quality?

Evidence From New York City

Colin C. Chellman, Ingrid Gould Ellen, Brian J. McCabe, Amy Ellen Schwartz, and Leanna Stiefel

Problem: Policymakers and community development practitioners view increasing subsidized owner-occupied housing as a mechanism to improve urban neighborhoods, but little research studies the impact of such investments on community amenities.

Purpose: We examine the impact of subsidized owner-occupied housing on the quality of local schools and compare them to the impacts of city investments in rental units.

Methods: Using data from the New York City Department of Education (DOE) and the New York City Department of Housing Preservation and Development (HPD), we estimate three main sets of regressions, exploring student characteristics, school resources, and school outcomes.

Results and conclusions: The completion of subsidized owner-occupied housing is associated with a decrease in schools' percentage of free-lunch eligible students, an increase in schools' percentage of White students, and, controlling for these compositional changes, an increase in scores on standardized reading and math exams. By contrast, our results suggest that investments in rental housing have little, if any, effect.

Takeaway for practice: Policies promoting the construction of subsidized owner-occupied housing have solidified in local governments around the country. Our research provides reassurance to policymakers and planners who are

The recent foreclosure crisis raises serious questions about the value of homeownership and should give policymakers pause before embarking on new policies to subsidize owner-occupied housing. However, many planners and community development practitioners warn that we should not give up on efforts to create affordable owner-occupied housing, arguing that homeownership, when promoted responsibly, holds the promise of producing significant benefits for communities. Yet, despite significant investment in subsidized owner-occupied housing around the country, we have very little evidence about the impacts of these investments on neighborhood conditions

concerned about the spillover effects of subsidized, citywide investments beyond the households being directly served. It suggests that benefits from investments in owner occupancy may extend beyond the individual level, with an increase in subsidized owner-occupancy bringing about improvements in neighborhood school quality.

Keywords: subsidized housing, homeownership, education

Research support: None.

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or the quality of local public services. Especially in light of the recent foreclosure crisis, understanding whether (and how) subsidized homeownership programs, which offer responsible financing, affect urban neighborhoods is critical for housing and neighborhood planning.

The available evidence on community-level benefits of owner-occupied housing suggests that higher rates of owner occupancy are associated with positive community outcomes, including lower crime rates (Glaeser & Sacerdote, 1999) and increased residential stability (Rohe & Stewart, 1996); however, the direction of causality is unclear. Meanwhile, research examining the community impacts of developing *subsidized* owner-occupied housing focuses only on impacts on property values, leaving unexamined changes in other community amenities (e.g., the quality of local schools) that may accrue to communities receiving subsidized housing investments (Ellen, Schill, Schwartz, & Susin, 2002; Lee, Culhane, & Wachter, 1999; A. E. Schwartz, Ellen, Voicu, & Schill, 2006).

To broaden our understanding of how subsidized investments in owner-occupied housing can shape local communities, this article examines how one large, well-regulated program to invest in subsidized owner-occupied housing in New York City affected the quality of local schools. Specifically, we investigate the relationship between the construction of new, affordable owner-occupied homes and subsidies for the renovation of existing owner-occupied housing on the one hand and changes in three sets of school characteristics on the other: the composition of students, the mix of teachers, and the average test scores of local public schools. By explicitly comparing the impacts of subsidized owner-occupied units to the impacts of subsidized renter-occupied units, we are able to estimate the impacts of investment in home ownership.

We begin with a discussion of why subsidized investments in owner-occupied housing might generate improvements in the quality of local schools. Separate from broader investments in subsidized housing, we argue that investments in *owner-occupied* housing could generate improvements in the quality of local schools by attracting more civically active parents, bringing in higher-achieving students, and making neighborhood schools more appealing to experienced teachers. We then describe the unique data sources that enable us to capture the effect of subsidized housing investment on local school quality. We outline our methods, paying particular attention to whether the investment in owner-occupied housing leads to observed changes in school characteristics and student performance, and whether these impacts are larger than those from rental housing investment. In the remaining sections, we describe our results and provide guidance for

planners and community development practitioners eager to understand whether and how responsible efforts to promote owner-occupied housing can transform local communities.

Background

In cities across the country, many local communities have invested in the construction of affordable owner-occupied housing. Government officials and community leaders often advocate for these programs, arguing that increasing the number of homeowners is critical to stabilizing, and even transforming, a neighborhood. Given their greater financial stake and longer expected tenure, homeowners are expected to take better care of their homes and become more involved in local organizations and activities aimed at improving local neighborhoods.

Despite this fondness for subsidized homeownership programs, there is little research examining whether such investments lead to community improvements that are larger than those delivered by similar investments in rental housing, and there is virtually no research examining their impacts on local schools. There are at least five pathways through which investments in subsidized owner-occupied units in urban areas might lead to improvements in schools.

First, the children of the families who move into owner-occupied homes may perform better in school on average than existing children in the neighborhood. To start, families in owner-occupied homes, even subsidized owner-occupied homes, are typically moderate- or middle-income families. In New York City, the families who moved into the owner-occupied housing were typically higher income than those who moved into rental housing and were often higher income than those already existing in the community (Schill, Ellen, Schwartz, & Voicu, 2002). Thus, in distressed, high-poverty neighborhoods, investments in owner-occupied homes may attract a higher-income and more-educated set of families whose children are likely to do better in school. Plus, controlling for observed family income and education, research consistently finds that the children of homeowners perform better in school than the children of renters, a finding particularly strong for low-income households (Aarons, 2000; Green & White, 1997; Harkness & Newman, 2003; Haurin, Parcel, & Haurin, 2002).

Second, the presence of these higher-performing students in the neighborhood may improve the educational experiences of other children through peer effects, assuming that the new homeowner families send their children to

local schools.¹ Given that the programs aim to provide owner-occupied housing for moderate-income families, it is likely that they will use the local public schools.

Third, investments in subsidized owner-occupied housing may attract parents who are more civically engaged and actively involved in local schools. There is ample evidence that homeowners are more invested and politically engaged in their communities (DiPasquale & Glaeser, 1999; Rohe & Stegman, 1994; Rohe, van Zandt, & McCarthy, 2002; Rossi & Weber, 1996). (Whether this relationship is causal remains contested, although the association is widely reported. Recent research [Engelhardt, Eriksen, Gale, & Mills, 2010] challenges this causal link with experimental evidence from a low-income sample.) Homeowners tend to participate more actively in local organizations and spend more time volunteering than renters (DiPasquale & Glaeser, 1999; Rohe & Stegman, 1994). Thus, homeowners may be more successful at garnering resources for their local schools and pressuring schools to address underperforming teachers. They may also become more involved in other local organizations and activities that support children and youth, including libraries, churches, and community centers. (On the other hand, occupants of these newly constructed or renovated housing units who do not have children might be more likely to invest their political activism toward improving other urban services or institutions.)

Fourth, investments in owner-occupied housing may reduce turnover in local schools, as homeowners remain in their homes for longer periods than comparable renters (Rohe & Stewart, 1996). With fewer students moving into and out of a school, teachers may be able to accomplish more in the classroom. Thus, investments in owner-occupied housing are likely to introduce greater stability into neighborhoods than comparable investment in renter housing.

Fifth and finally, investments in owner-occupied housing may help to attract and retain qualified and experienced teachers. As crime rates decline and the physical environment improves, these neighborhoods could become more attractive to teachers selecting schools on the basis of local communities. These teachers may be more willing to work in schools when the surrounding neighborhood appears to be safer, more stable, and more attractive.²

Of course, the construction of new subsidized housing units could lead to a decline in the quality of local schools, as well. The construction of new subsidized owner-occupied units might generate neighborhood opposition, which, rather than improving school quality, may lead to the retraction of financial and political support for neigh-

borhood institutions seen as disproportionately benefiting new residents, including local public schools. It is also possible that new homeowners will opt for private schools and provide less support to the local public schools than renters.

These pathways offer ways in which investments in subsidized owner-occupied housing could affect the quality of local schools. However, addressing the endogeneity of homeownership remains the key challenge facing studies that attempt to identify the impact of homeownership on community characteristics (Haurin, Dietz, & Weinberg, 2003). Because many characteristics vary between communities with high and low homeownership rates, it is difficult to attribute community differences to the homeownership rate itself. In the ideal study, we would want to compare changes in a neighborhood that experiences an exogenous increase in the rate of homeownership, or, in other words, a change in the homeownership rate that is not driven by underlying changes in community characteristics, to changes in similar neighborhoods that do not experience such an increase.

Further, the more relevant question for local planners and policymakers relates to the impact of homeownership programs subsidized by local governments. These programs might not have the same effect on a community as an increase in the share of unsubsidized homeowners, and sorting out the unique effect of government-subsidized homeownership programs offers guidance for planners and community development practitioners evaluating local housing programs in the wake of the foreclosure crisis.

Fortunately, the experience of New York City offers a potential opportunity to study arguably exogenous public investments in owner-occupied housing and to compare their effects to those of similar public investments in rental housing. During the late 1980s and 1990s, the City invested an unprecedented amount of resources in rebuilding the city's housing stock and constructing new units. The focus was to rebuild the 100,000 units of housing and the vacant land of which the City had taken ownership through tax foreclosure. This effort, dubbed the "Ten Year Plan for Housing," ultimately resulted in the construction or rehabilitation of over 182,000 housing units over a period of more than 15 years, making it the largest municipally supported housing program in the history of the United States (A. Schwartz, 1999).

As of 2000, nearly 17,000 new homeownership units had been constructed and another 18,000 owner-occupied units had been renovated under the City's Ten Year Plan, accounting for an estimated 19% of total units completed. In addition, approximately 5,000 new rental units had

been constructed and another 143,000 rental units had been rehabilitated during this period (Schill et al., 2002). Importantly, the scale and scope of the investment meant that virtually all the eligible housing units and land were redeveloped, thus leaving little room for City officials to selectively invest in neighborhoods that they expected to improve, thereby minimizing concerns that rising property values “caused” the investments. Even more, the City had little control over the *timing* of the investments. Thus, there is little reason to believe that they were able to time the investment to take advantage of market opportunities.

To be sure, it is possible that the City’s planners targeted sites in improving neighborhoods for investment in owner-occupied homes, rather than multi-family rental buildings. But discussions with City officials, as well as an inspection of baseline conditions in neighborhoods, suggest that there was little (if any) such selective siting. Indeed, the City typically built owner-occupied housing on large swaths of vacant land, which were often located in very poor communities. Further, there is little evidence that the neighborhoods where new homeownership units were constructed were different than those where new rental units were built (Schill et al., 2002).³

The fact that the scope of the City’s investment in subsidized housing was unprecedented raises obvious questions about the generalizability of our findings. Still, there are reasons to think that the results may be generalizable beyond New York City. First, New York City is composed of a diversity of neighborhoods, including many comprised mostly of single-family homes throughout Brooklyn, Queens, and Staten Island. In that respect, the characteristics of many of the local communities where the City invested in subsidized housing are typical of communities nationwide. Second, the types of homeownership programs enacted through the Ten Year Plan could be replicated in particular neighborhoods in other cities if the investments are clustered citywide, even if not on the same scale. Finally, while the subsidies provided by New York City were large (both in terms of donated land and capital subsidies), the required subsidies in other cities would be smaller due to lower land costs. That said, it is possible that unique features of the market in New York City, such as its tight housing market, made the investments particularly beneficial.

It is important to underscore that the New York City programs in question supported responsible and sustainable homeownership. The City engaged developers to build modest owner-occupied homes on city-owned land and provided subsidies so units could be sold at prices affordable to households earning below-median income. Nonprofit organizations, like Nehemiah and the Partner-

ship for New York City, marketed the units and screened the credit history of applicants. Purchasers were required to obtain prime mortgages, make down payments, and often mandated to attend counseling on the fiscal responsibilities of homeownership (Powell, 2010). A recent survey by the New York City Department of Housing Preservation and Development (HPD) estimates that more than three quarters of homeowners in the City’s subsidized units attended homeownership counseling before completing their purchase (Bahchieva, 2006). Perhaps as a result of this stringent screening and widespread counseling, the default rates for purchasers of subsidized housing units in New York City has been close to zero (Powell, 2010).

Other research on the investment in subsidized housing under the Ten Year Plan suggests that these investments improved the physical conditions in local neighborhoods. In neighborhoods receiving investments, the number of boarded-up properties and vacant buildings declined, while the proportion of buildings rated as excellent or good increased (A. Schwartz, 1999; Van Ryzin & Genn, 1999). This investment in subsidized housing developments also appears to have led to an increase in local property values (Schill et al., 2002; A. E. Schwartz et al., 2006). Despite these benefits, the Ten Year Plan investments may have also contributed to the concentration of poverty. During the period of the Ten Year Plan, poverty rates increased and median household incomes declined in neighborhoods receiving subsidized housing investments (Van Ryzin & Glenn, 1999).

In this study, we extend research on subsidized housing investments in New York City by studying impacts on local schools. In addition, by explicitly comparing the impacts of investments in subsidized owner-occupied homes to the impacts of investments in subsidized rental housing, we can learn whether targeting dollars to owner-occupied housing brings unique benefits above and beyond the general benefits that result from housing improvements.⁴

Our analysis considers three key questions about the impacts of investments in subsidized owner-occupied housing. First, we explore whether the school population changes in observable ways after housing investments are completed. Do subsidized owner-occupied housing units attract families with different demographics than those in the community? Second, we examine whether the housing investments spur changes in the characteristics of teachers in public elementary schools located in neighborhoods with substantial housing investment. Finally, we investigate whether subsidized housing investments are associated with changes in the academic performance of local students. In particular, we ask whether investments in

homeownership units are associated with changes in student attendance or the percentage of students passing standardized math and reading exams.

For each outcome, we separately consider the effects of providing subsidies to rehabilitate existing units and the effects of providing subsidies toward the construction of new units. In addition, in all cases, we compare the impacts of investments in owner-occupied housing with the impacts of similar investments in subsidized rental housing to test whether the impacts differ. In doing so, our research helps to shed light on whether observed changes in school characteristics after the construction of subsidized housing are the result of a shift in homeownership or whether they result from other features of subsidized housing investment.

Data

In an effort to understand the impact of investments in owner-occupied housing on school quality in New York City, we use two rich, longitudinal administrative datasets. The first focuses on New York City's public elementary schools, while the second provides the locations, types, and timing of subsidized housing investments. We link the school and housing datasets by identifying the elementary school attendance zone in which each subsidized housing unit is located, creating a single dataset containing longitudinal data on New York City's elementary school zones. For each zone and year, our dataset includes information on the characteristics and performance of its elementary schools, the number and type of subsidized housing units completed there, and the characteristics of residents. We focus on elementary schools because elementary school attendance is closely linked to the attendance zone of the student's residence. While middle school and high school attendance may also depend on residential location, many students travel outside their zones to attend schools, thereby rendering the link between school and home considerably weaker.

Data on Schools

Data from the New York City Department of Education (NYCDOE) include information on student demographics and performance, teacher qualifications and experience, and school resources and enrollment for 14 academic years between the 1987–1988 school year (hereafter 1988) and the 2000–2001 school year (hereafter 2001).⁵ Using these data, we construct a longitudinal dataset in which the unit of analysis is the elementary school attendance zone in a year.⁶ The sample size varies between 615 school zones in 1988 and 682 zones in

2001.⁷ We exclude citywide special education schools, high schools, middle schools, and a small number of schools missing a preponderance of data. In the period we examine, New York City was subdivided into 32 Community School Districts (CD) that were governed by local boards with oversight from the central board of education.

Demographic characteristics include eligibility for free lunch (which indicates that family income is no more than 130% of the poverty line and is our proxy for poverty), race and ethnicity, and the percentage of students qualified as limited English proficient (LEP).⁸ Student performance is reported as the percentage of students who score above the median on citywide tests 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) for Grades 3–8, combined, depending on which grades are present in a school.

Table 1 presents descriptive statistics on the school zones in our data at the beginning and the end of the 14-year period. While the percentage of students passing reading tests increased slightly from 45% to 50%, the percentage of students passing math tests declined significantly from 63% to 46%.⁹ In the average elementary school zone, the percentage of Asian and Hispanic students increased (from 7% to 12% and 33% to 37%, respectively), while the percentage of Black students remained essentially constant, and the percentage of White students declined (from 36% to 35% and 24% to 17%, respectively). The percentage of poor (free-lunch eligible) students increased (from 62% to 74%), as did the attendance rate (from 89% to 92%) and the percentage of students who were LEP (from 10% to 13%). Taken together, we note that the average elementary school in New York City educated students who were poorer, more likely to be Asian or Hispanic, and more likely to have limited English skills at the end of our 14-year period than at the start. The passing rate for reading tests increased somewhat, but the passing rate for math tests declined significantly.

Data on City-Assisted Housing Investment

Data from HPD describes all housing built or renovated under the City's Ten Year Capital Plan. For each development, our data indicate the precise location (to the tax lot or block level) of the project, the date of completion, the type of building structure, the number of units created, the type of intervention (new construction or rehabilitation), and details on whether units were renter or owner occupied. We use GIS techniques to identify the elementary school attendance zone in which each subsidized housing unit is located.

Table 1. School zone descriptive statistics, 1988 and 2001.

Variable	1988				2001			
	Obs	Mean	Min	Max	Obs	Mean	Min	Max
Housing								
New owner occupied, total	587	0.9	0	158	617	29.6	0	659
New owner occupied, t1-t3	587	0.0	0	0	599	4.2	0	201
New owner occupied, t3-t5	587	0.0	0	0	588	3.6	0	190
New owner occupied, t5	587	0.0	0	0	588	19.6	0	629
Rehab owner occupied, total	587	1.2	0	109	617	23.2	0	684
Rehab owner occupied, t1-t3	587	0.0	0	0	599	2.7	0	108
Rehab owner occupied, t3-t5	587	0.0	0	0	588	3.3	0	85
Rehab owner occupied, t5	587	0.0	0	0	588	16.6	0	537
New rental, total	587	0.6	0	92	617	65.8	0	1,193
New rental, t1-t3	587	0.0	0	0	599	4.4	0	416
New rental, t3-t5	587	0.0	0	0	588	5.0	0	286
New rental, t5	587	0.0	0	0	588	53.0	0	990
Rehab rental, total	587	13.3	0	1,635	617	144.2	0	5,577
Rehab rental, t1-t3	587	0.0	0	0	599	13.3	0	1,058
Rehab rental, t3-t5	587	0.0	0	0	588	10.8	0	795
Rehab rental, t5	587	0.0	0	0	588	115.5	0	5,508
School								
% Students passing Reading	587	45.1	7.7	92.7	617	50.0	15.3	96.0
% Students passing Math	587	63.2	19.5	99.4	617	45.8	9.0	94.3
% Asian	587	6.8	0.0	90.1	617	11.8	0.0	91.5
% Black	587	36.1	0.0	98.4	617	34.7	0.2	97.3
% Hispanic	587	33.1	0.5	98.3	617	36.6	1.4	97.8
% Non-Hispanic White	587	24.0	0.0	97.5	617	16.9	0.0	94.4
% Limited English Proficient	587	10.3	0.0	48.6	615	12.5	0.3	47.2
% Free-lunch eligible	587	61.8	1.4	100.0	613	74.3	7.2	100.0
% Attendance	587	89.1	76.1	96.0	617	92.1	86.6	97.3
Teacher–pupil ratio (per 100 students)	587	5.6	0.6	9.6	617	7.0	4.1	37.4
% Teachers with more than 5 years experience	0	.	.	.	617	53.5	19.6	88.7
% Teachers with master's degree or higher	0	.	.	.	617	75.5	32.4	100.0
% Teachers in this school less than 2 years	0	.	.	.	617	37.4	7.9	100.0
Total enrollment	587	764	128	1983	617	820	163	2,134
Total spending per student	0	.	.	.	617	9,516	6,394	17,374
Neighborhood								
% Owner-occupied housing	587	29.3	0.2	93.1	617	29.5	0.0	87.7
% Population below the poverty line	587	22.7	2.0	65.6	617	24.4	2.3	63.1
% Population foreign born	587	25.2	2.2	68.7	617	33.0	4.6	74.7
% Population 65+	587	12.5	2.4	39.0	617	11.4	3.5	36.0

Notes: Subsidized housing labeled “new” includes gut rehabilitation. Pass rates are for general education students. Teacher–pupil ratio expressed as teachers per 100 students. Number of full-time equivalent teachers not available for 1995, 1996, and 1997. Percentage of teachers with greater than five years of experience and percentage with less than two years in this school were not available for 1988, 1989, and 1990. Percentage of teachers with a master's degree or higher was not available for 1988, 1989, 1990, and 1991. Spending per pupil is for general education students. Spending data are available from 1996 to 2001.

We expect the impact of the housing investment to build over time or to have a delayed effect as the neighborhood changes and families and teachers respond accordingly. Thus, we test for both short- and long-term impacts. To test for longer-term effects, we include a variable meas-

uring the cumulative number of housing units assisted in the school zone five years prior to the current school year ($t5$).¹⁰ To capture shorter-term effects, we include the number of housing units assisted between five and three years prior to the current school year ($\Delta:t3$, $t5$) and the

number of housing units assisted between one and three years earlier ($\Delta:t1, t3$). Again, in Table 1 we report descriptive statistics for the number of subsidized housing units in school zones in the first and last years of our data. We note that very few units in the zones had received any Ten Year Plan subsidies in 1988, as the program had only started a year earlier. By 2001, approximately 30 owner-occupied units had been newly constructed and an additional 23 owner-occupied units had been rehabilitated in the average zone. These investments, however, were not uniformly spread across the zones. While some zones received no new owner-occupied units or rehabilitation subsidies, other zones received more than 650 units of newly constructed owner-occupied units and over 680 rehabilitation subsidies for owner-occupied units during our period of study.

Data on Neighborhood Demographics

To control for the socioeconomic characteristics of the elementary school zones, we use 1990 and 2000 Census tract-level information from the Geolytics Neighborhood Change Database (NCDB). From these tract-level data, we compute school zone weighted means of the available variables with weights given by the number of residential units from the zone that fall within a given tract.¹¹ For 1988 through 1994, we assigned values from the 1990 decennial Census. For 1995–2001, we assigned values from the 2000 Census. We focus on four demographic variables to describe the local population in an attendance zone: the percentage of the population that is foreign born; the poverty rate; the percentage of the population older than 65; and the homeownership rate. From Table 1, we note that the average share of the population that is foreign born increased from 25% to 33% between 1990 and 2000. By contrast, the average percentage of owner-occupied units, percentage of the population that is poor, and percentage of the population over 65 years of age stayed relatively constant between the first and last year of our data. However, these relatively constant average values conceal considerable changes within some individual school zones.

Methods

To explain the impact of investments in subsidized owner-occupied housing on school characteristics, we estimate three main sets of regressions, exploring: 1) student characteristics; 2) school resources; and 3) school outcomes. Our basic model of student characteristics can be represented as follows, where elementary attendance zones are the unit of analysis:

$$\text{Student Characteristics}_{idt} = b_0 + b_1 \text{Housing Investments}_{it} + b_2 \text{Neighborhood Characteristics}_{it} + b_3 \text{School Zone}_i + b_{4dt} \text{Year*Community School District}_{dt} + e_{it}, \quad (1)$$

where Student Characteristics_{it} describes the socioeconomic characteristics of the students in elementary schools in school zone *i* in community school district *d* at time *t*; Housing Investments_{it} is a vector of variables describing lagged subsidized housing investment; Neighborhood Characteristics_{it} is a vector of variables describing the neighborhood conditions (e.g., percentage of the population older than 65, percentage of the population living below the poverty line) in zone *i* at time *t*; School Zone_i is a set of school zone dummy variables that control for any time-invariant differences across school zones; Year*Community School District_{dt} is a series of year*community school district dummy variables that allow us to control for characteristics common to all school zones within a community school district in a particular year, as well as for any changes in policies over a wide range of educational issues set by the community school districts; and *e_{it}* is an error term. We use two variables to measure student characteristics: the percentage of free-lunch eligible students and the percentage of White students in the school.

Throughout the analysis, our focus is on the coefficient *b₁*, which captures the effects of housing investments of various types in school zones on student characteristics of elementary schools in the zones. The variable for housing investments (Housing Investments_{it}) includes several different measures of lagged housing activity. As noted above, we include the cumulative number of subsidized housing units completed in the zone five years before the current school year (*t*5) to capture any long-term effects. To capture shorter-term effects, we include the number of new subsidized units built between three and five years prior (*t*3 – *t*5) and between one and three years prior (*t*1 – *t*3) to period *t*. In addition, we distinguish two types of owner-occupied and two types of renter-occupied housing: new and rehabilitated. These distinctions allow us to separate the effects of owner-occupied units from rental units, both for new and rehabilitated housing.

In the second set of regressions, we estimate the relationship between school resources and lagged housing investment, controlling for the other changes, as in Model (1) above. We measure school resources using the percentage of teachers with more than five years of experiences and the percentage of teachers with a master's degree. Again, our interest is in the coefficient on the variable for Housing Investment, which captures the impact of lagged housing investments on various types of school resources.

In our third set of regressions, we follow the literature on education production functions (see, e.g., Hanushek, 1986, 2002) and model school outcomes in elementary zones as a function of school inputs and characteristics of students, adding lagged housing investments and other zone attributes. We estimate the following two models:

$$\begin{aligned} \text{School Outcomes}_{it} = & b_0 + b_1 \text{Housing Investments}_{it} \\ & + b_2 \text{School Zones}_i \\ & + b_{3dt} \text{Year} * \text{Community School Districts}_{it} + e_{it} \end{aligned} \quad (2a)$$

$$\begin{aligned} \text{School Outcomes}_{it} = & b_0 + b_1 \text{Housing Investments}_{it} \\ & + b_2 \text{School Zones}_i \\ & + b_{3dt} \text{Year} * \text{Community School Districts}_{it} \\ & + b_4 \text{Neighborhood Characteristics}_{it} \\ & + b_5 \text{School Resources}_{it} \\ & + b_6 \text{Student Characteristics}_{it} + e_{it}, \end{aligned} \quad (2b)$$

where $\text{School Outcomes}_{it}$ is the performance of schools in elementary zone i at time t , $\text{School Resources}_{it}$ is a set of variables describing the instructional resources at the school (e.g., the teacher–pupil ratio, the percentage of teachers with a master’s degree), $\text{Student Characteristics}_{it}$ is a set of variables describing the socioeconomic characteristics of the student population (e.g., the percentage of poor students, the percentage of White students) and all other variables are defined as previously. Again, our focus is on the coefficient on housing investments.

We use three variables to measure school outcomes. The first is the attendance rate of students within the school zone, the second measures the percentage of students in the zone scoring at or above the national median on standardized math tests, and the third measures the percentage scoring at or above the national median on standardized reading tests. Regression (2a) captures the association between city housing investments and school outcomes. In Regression (2b), we add variables capturing school resources, student demographics, and neighborhood characteristics to test whether investments in owner-occupied housing (compared to renter occupied) lead to gains in academic performance above and beyond those induced by changes in measured neighborhood, school, and student characteristics.

As noted earlier, the primary challenge is pinpointing causality. To the extent that we see changes in schools, can we attribute them to subsidized investments in owner-occupied housing? While we are cautious in inferring causal impacts, several features of our estimation model, and the features of underlying policy intervention, boost our confidence that the associations we find reflect underlying causal relationships. First, as explained above, there is

no evidence that the characteristics of neighborhoods played a role in the City’s decision to subsidize the construction of owner-occupied housing in particular neighborhoods.

Second, the school zone fixed effects help to eliminate any baseline differences between the schools in elementary school zones with subsidized sites and other school zones across the City. These fixed effects help control for any nonrandom siting patterns, for example, the siting of subsidized housing in zones that were more distressed (or had lower-performing schools).

Third, we include year-specific, community school district fixed effects, which help to disentangle the specific effects of subsidized housing from other market or policy changes occurring simultaneously in the larger neighborhoods or districts, such as changes in educational policies or programs adopted by community school districts, reductions in crime, or increases in property values.

Finally, for each lagged time period, we test whether the coefficient estimated on owner-occupied housing is significantly different from the coefficient estimated on rental housing. This allows us to determine whether the *type* of subsidized housing matters, net of any effect resulting from the City’s simple decision to invest in subsidized units in particular neighborhoods. In other words, our results estimate the *difference* between the impacts of investments in subsidized owner-occupied housing and those delivered by investments in similar subsidized rental housing.

It is possible that the school zones where owner-occupied housing was built were improving before the addition of the owner-occupied housing. For this story to hold, we would need to believe that City officials were constructing subsidized owner-occupied housing in neighborhoods where school quality was already improving. As noted above, there is little evidence that the City was picking winners in deciding on sites for owner-occupied housing. Moreover, the inclusion of zone fixed effects and time-specific community school district fixed effects acts to minimize the potential for selection bias in our estimates.

Results

In brief, we find that investments in subsidized homeownership housing are followed by an increase in the percentage of White students and a decrease in the percentage of poor students in local schools. We also find that such investments are followed by increases in both math and reading scores. Contrary to expectations, however, we find that the construction of subsidized owner-occupied

housing is associated with a decline in attendance rates. Moreover, our results on teacher characteristics are mixed. On the one hand, we find that subsidies for the renovation of owner-occupied housing are followed by increases in the percentage of teachers with advanced degrees. On the other hand, we find that the construction of new owner-occupied units is associated with a long-run decline in the percentage of teachers with advanced degrees, as well as decline in the percentage of experienced teachers. That said, this latter effect is indistinguishable from that following the construction of new rental units, so it is not an impact of any increases in owner-occupied units, *per se*.

Our first model focuses on changes in the composition of students attending schools in a zone. As shown in Table 2 (column 1), the construction and rehabilitation of homeownership units in a school zone is associated with an increase in the representation of White students in the local elementary school. For example, an increase of 100 new subsidized owner-occupied units is associated with an increase in the percentage of White students of 0.5 percentage points after five years. The results are even stronger for rehabilitated owner-occupied units, and the increase in the representation of White students appears immediately after rehabilitation is completed (see coefficient on units rehabilitated between years t_1 and t_3). We find that an increase in 100 rehabilitated owner-occupied units is associated with an increase in the share of students in a zone who are White by 2.0 percentage points after five years.

At the bottom of Tables 2–4, we report on statistical tests that show if there are differences between investments in owner-occupied and rental housing in the nature of demographic changes that follow. Our comparison of coefficients for rehabilitated owner-occupied and renter units at the bottom of column 1 of Table 2 indicates that, both in the short-term and the long-term, the observed changes in demographics are significantly greater for investments in owner-occupied housing, suggesting that these changes are attributable to owner-occupied rehabilitation, not simply rehabilitation of subsidized housing, more generally.

Similarly, we find that the percentage of students who are eligible for free lunch in a zone's schools tends to decrease as new city-assisted homeownership units are built in the zone. Here, the effect is a decrease of 0.9 percentage points for every 100 new owner-occupied units constructed after five years. This is aligned with our expectations, as subsidized homeownership units are generally aimed at moderate- and middle-income households who are likely to have incomes above the neighborhood mean. That said, we find no statistically significant difference between the change in the share of students eligible for free

lunch following investments in owner-occupied and rental housing, suggesting that any effect is not due to an increase in homeownership but rather to investments in subsidized housing more generally.

We show results from our regressions modeling school resources in Table 3.¹² Column 1 of Table 3 reports that an increase in 100 rehabilitated owner-occupied housing is associated with a significant increase in the share of teachers with a master's degree. The *F* tests comparing the coefficients for owner-occupied and rental housing suggest that these effects are significantly larger than those for rehabilitated rental units. It is likely that rehabilitation subsidies encourage residential stability and that long-term stability encourages community participation. In fact, recent research finds that the effect of homeownership on community participation is stronger for long-term residents, so rehabilitation subsidies that encourage stability for homeowners are likely to encourage greater activism in improving school and neighborhood characteristics as well (McCabe, 2010).

The results for newly constructed housing are less hopeful. Table 3 shows that the construction of new owner-occupied homes is weakly associated with reduced shares of teachers with master's degrees and with significant teaching experience in the long run. Specifically, an increase of 100 new city-subsidized owner-occupied units five years earlier is associated with a 1.5 percentage point decline in the share of teachers with a master's degree and a 1.4 percentage point decline in the share of teachers with five year's teaching experience. Significantly, however, the *F* tests at the bottom of Table 3 suggest that the reduction in the share of teachers with advanced degrees is significantly smaller than the reductions associated with new rental units. For the percentage of experienced teachers, the *F* tests find no significant difference between the effects of new owner-occupied and rental housing, suggesting that these impacts result from the construction of new subsidized housing rather than the construction of subsidized owner-occupied housing, *per se*.

Although initially counterintuitive, one possible explanation points to the increased activism of households in neighborhoods where subsidized housing is constructed. Subsidized housing investments may attract new residents to the community, and these residents could pressure schools to hire new teachers in an effort to improve their quality. New teachers are less likely to hold advanced degrees or have extensive teaching experience, thereby explaining the relationship between subsidized housing investments and changes in teacher characteristics. This pressure from new residents to institute changes could result in experienced teachers deciding to leave local

Table 2. Regression coefficients, student characteristics, 1988–2001.

	(1) % White	(2) % Free-lunch eligible
New owner occupied, t1-t3	0.004 (0.002)	-0.011 ** (0.004)
New owner occupied, t3-t5	0.003 * (0.002)	-0.004 (0.004)
New owner occupied, t5	0.005 ** (0.002)	-0.009 ** (0.004)
Rehab owner occupied, t1-t3	0.017 * (0.010)	0.008 (0.012)
Rehab owner occupied, t3-t5	0.017 * (0.010)	0.006 (0.013)
Rehab owner occupied, t5	0.020 * (0.010)	0.001 (0.010)
New rental, t1-t3	0.001 (0.002)	-0.008 * (0.004)
New rental, t3-t5	0.004 (0.003)	-0.009 (0.007)
New rental, t5	0.002 (0.002)	-0.004 (0.004)
Rehab rental, t1-t3	0.000 (0.001)	-0.001 (0.002)
Rehab rental, t3-t5	0.001 (0.001)	-0.003 (0.002)
Rehab rental, t5	0.002 (0.001)	-0.003 (0.002)
% owner-occupied housing	-0.005 (0.033)	0.018 (0.053)
% pop below pov line	-0.047 ** (0.019)	0.112 *** (0.039)
% foreign born	-0.173 *** (0.026)	0.130 *** (0.034)
% 65+	0.509 *** (0.057)	-0.336 *** (0.072)
Constant	17.801 *** (1.594)	71.320 *** (2.592)
Zone fixed effects	607	607
R-squared	0.99	0.96
N	5,592	5,592
Difference in coefficients		
New owner-occupied and rental, t1-t3	0.003	-0.003
New owner-occupied and rental, t3-t5	-0.001	0.005
New owner-occupied and rental, t5	0.003	-0.005
Rehab owner-occupied and rental, t1-t3	0.017 *	0.009
Rehab owner-occupied and rental, t3-t5	0.016	0.009
Rehab owner-occupied and rental, t5	0.018 *	0.004

* $p < .10$ ** $p < .05$ *** $p < .01$

Notes: Robust Standard Errors in parentheses. Models include school zone fixed effects and year*Community School District fixed effects. Subsidized housing labeled “new” includes gut rehabilitation. Percentage of teachers with greater than five years of experience and percentage with less than two years in the same school were not available for 1998, 1989, and 1990. Percentage of teachers with master’s degree or higher was not available for 1988, 1989, 1990, and 1991.

Table 3. Regression coefficients, teacher characteristics, 1988–2001.

	(1) % with master's or higher	(2) % greater than 5 years of experience
New owner occupied, t1-t3	-0.001 (0.009)	-0.009 (0.007)
New owner occupied, t3-t5	-0.005 (0.010)	-0.012 * (0.007)
New owner occupied, t5	-0.015 * (0.008)	-0.014 ** (0.007)
Rehab owner occupied, t1-t3	0.067 *** (0.025)	0.010 (0.014)
Rehab owner occupied, t3-t5	0.042 * (0.023)	-0.020 (0.014)
Rehab owner occupied, t5	0.023 (0.019)	-0.018 (0.012)
New rental, t1-t3	-0.027 *** (0.008)	-0.020 *** (0.004)
New rental, t3-t5	-0.030 *** (0.007)	-0.022 *** (0.004)
New rental, t5	-0.020 *** (0.007)	-0.022 *** (0.004)
Rehab rental, t1-t3	0.002 (0.003)	-0.002 (0.002)
Rehab rental, t3-t5	-0.004 (0.003)	-0.004 * (0.002)
Rehab rental, t5	-0.002 (0.003)	-0.002 (0.002)
Constant	67.419 *** (6.483)	74.595 *** (3.699)
Zone fixed effects	607	607
R-squared	0.67	0.75
N	5,439	5,571
Difference in coefficients		
New owner occupied and rental, t1-t3	0.026 **	0.011
New owner occupied and rental, t3-t5	0.025 **	0.010
New owner occupied and rental, t5	0.005	0.008
Rehabilitated owner occupied and rental, t1-t3	0.065 ***	0.012
Rehabilitated owner occupied and rental, t3-t5	0.046 *	-0.016
Rehabilitated owner occupied and rental, t5	0.025	-0.016

* $p < .10$ ** $p < .05$ *** $p < .01$

Notes: Robust Standard Errors in parentheses. Models include school zone fixed effects and year*Community School District fixed effects. Subsidized housing labeled “new” includes gut rehabilitation. Percentage of teachers with greater than five years of experience and percentage with less than two years in the same school were not available for 1998, 1989, and 1990. Percentage of teachers with master's degree or higher was not available for 1988, 1989, 1990, and 1991.

schools, thereby explaining the decline in the percentage of teachers with more than five years of experience.

In Table 4, we turn to student outcomes, looking both at attendance rates and scores on standardized reading and math tests. In the first column for each outcome (columns 1, 3, and 5), we show results of the total-impact model without controls. These columns show the total change in

school outcomes associated with subsidized housing investments. In the second column for each outcome (columns 2, 4, and 6), we control for both school- and neighborhood-level characteristics, testing whether school performance and attendance increased over and above any gains driven by compositional changes in students and school-level resources.¹³ Overall, results from the uncontrolled

Table 4. Regression coefficients, attendance rates and test scores, 1988–2001.

	(1) Uncontrolled attendance	(2) Controlled attendance	(3) Uncontrolled math	(4) Controlled math	(5) Uncontrolled reading	(6) Controlled reading
New owner occupied, t1-t3	0.001 (0.001)	0.001 (0.001)	0.019 ** (0.007)	0.016 ** (0.007)	0.004 (0.006)	0.002 (0.005)
New owner occupied, t3-t5	0.001 (0.001)	0.001 (0.001)	0.008 (0.006)	0.009 (0.006)	0.006 (0.005)	0.009 * (0.005)
New owner occupied, t5	0.000 (0.001)	0.000 (0.001)	0.011 * (0.006)	0.012 ** (0.006)	0.006 (0.005)	0.007 (0.005)
Rehab owner occupied, t1-t3	-0.001 (0.004)	-0.002 (0.003)	0.025 (0.025)	0.022 (0.018)	0.035 (0.024)	0.028 * (0.016)
Rehab owner occupied, t3-t5	-0.005 (0.004)	-0.006 ** (0.003)	-0.004 (0.026)	0.000 (0.018)	0.022 (0.024)	0.023 (0.016)
Rehab owner occupied, t5	-0.006 ** (0.003)	-0.007 *** (0.002)	0.014 (0.022)	0.023 (0.015)	0.028 (0.021)	0.033 ** (0.014)
New rental, t1-t3	0.002 * (0.001)	0.002 * (0.001)	-0.003 (0.005)	-0.005 (0.005)	-0.004 (0.005)	-0.007 (0.004)
New rental, t3-t5	0.003 *** (0.001)	0.002 *** (0.001)	-0.006 (0.006)	-0.011 ** (0.005)	-0.005 (0.006)	-0.011 ** (0.004)
New rental, t5	0.004 *** (0.001)	0.003 *** (0.001)	-0.009 * (0.005)	-0.015 *** (0.004)	-0.006 (0.005)	-0.013 *** (0.004)
Rehab rental, t1-t3	0.000 (0.001)	0.000 (0.000)	0.000 (0.003)	0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)
Rehab rental, t3-t5	0.001 * (0.000)	0.001 ** (0.000)	0.003 (0.003)	0.002 (0.002)	0.003 (0.002)	0.002 (0.002)
Rehab rental, t5	0.001 ** (0.001)	0.001 ** (0.000)	0.004 * (0.003)	0.003 (0.002)	0.005 ** (0.002)	0.003 * (0.002)
Constant	90.389 *** (0.070)	94.323 *** (1.460)	53.016 *** (0.473)	-92.412 *** (16.463)	48.545 *** (0.413)	-79.052 *** (13.402)
Zone fixed effects	607	607	607	607	607	607
R-squared	0.888	0.899	0.908	0.921	0.910	0.925
N	5,592	5,592	5,592	5,592	5,592	5,592
Difference in coefficients						
New owner occupied and rental, t1-t3	-0.001	-0.001	0.022 **	0.021 ***	0.008	0.009
New owner occupied and rental, t3-t5	-0.002	-0.001	0.014 *	0.020 ***	0.011	0.020 ***
New owner occupied and rental, t5	-0.004 *	-0.003 *	0.020 ***	0.027 ***	0.012 *	0.020 ***
Rehabilitated owner occupied and rental, t1-t3	-0.001	-0.001	0.025	0.022	0.036	0.029 *
Rehabilitated owner occupied and rental, t3-t5	-0.006	-0.007 **	-0.007	-0.002	0.019	0.021
Rehabilitated owner occupied and rental, t5	-0.007 **	-0.008 ***	0.010	0.020	0.023	0.030 ***

* $p < .10$ ** $p < .05$ *** $p < .01$

Notes: Robust Standard Errors in parentheses. Models include school zone fixed effects and year*Community School District fixed effects. Subsidized housing labeled “new” includes gut rehabilitation. Percentage of teachers with greater than five years of experience and the percentage with less than two years in the same school were not available for 1998, 1989, and 1990. Percentage of teachers with master’s degree or higher was not available for 1988, 1989, 1990, and 1991. Each model controls for the percentage of owner-occupied housing, the percentage of the population below the poverty line, the percentage of the population foreign-born, and the percentage of the population over age 65 in each school zone. Models 2, 4, and 6 include neighborhood-level and school-level controls. At the neighborhood level, the controls are the percentage of owner-occupied housing, the percentage of the population below the poverty line, the percentage foreign born, and the percentage over age 65. At the school level, the controls are the percentage of limited English Language Proficiency, the percentage of Asians, the percentage of Hispanics, the percentage of Blacks, the percentage of free-lunch eligible students, the natural log of school enrollment, the attendance rate, the teacher–pupil ratio (per 100 pupils), the percentage of teachers with less than two years experience at the school, the percentage of teachers with a master’s degree, and the percentage of teachers with more than five years of experience teaching.

and controlled models are substantively similar, and our analysis focuses on the latter. While we do not find any link between the construction of new owner-occupied housing units and attendance rates, we do find that the number of owner-occupied units that receive rehabilitation subsidies is linked to very small reductions in attendance rate in the long term.

As reported in column 2 of Table 4, where we control for changes in the composition of students and neighborhood residents, an increase of 100 rehabilitated owner-occupied units is followed by a decline in attendance rates by approximately 0.7 percentage points. The construction of rental units, on the other hand, is followed by a slight increase in attendance rates, both for new rental units and rehabilitated units. The differences in coefficients shown at the bottom of columns 1 and 2 of Table 4 show a significant difference between the effect of owner-occupied and rental housing in the long term, both for new construction and rehabilitated units. Thus, unexpectedly, we find that investments in rental housing are linked to a slight boost in attendance, while investments in owner-occupied housing units are not.

The results for test scores are quite different. We present a model *without* controls for neighborhood and school composition in columns 3 and 5 of Table 4. We then add the full set of controls in columns 4 and 6 of Table 4.¹⁴ Notably, we find that the completion of new owner-occupied housing is associated with an increase in the share of students passing math tests, even after controlling for compositional changes in student characteristics and the larger neighborhood population. As reported in column 4 of Table 4, controlling for neighborhood and school characteristics, an additional 100 units of new owner-occupied housing completed at least five years ago is associated with a 1.2 percentage point increase in students passing math tests in the current year. Notably, these results do not hold for the construction of new rental housing; when we compare coefficients at the bottom of columns 3 and 4 of Table 4, we show a significant difference in the effect of new owner-occupied housing when compared to new rental housing, suggesting particular gains as a result of the construction of subsidized owner-occupied housing.

We find similar increases when we examine reading scores. As shown in Table 4, column 6, the construction of subsidized owner-occupied housing is associated with higher passing rates in reading. Notably, the strongest effects seem to hold for rehabilitated owner-occupied housing. After controlling for neighborhood and school characteristics in Table 4, column 6, results indicate that 100 additional units of rehabilitated owner-occupied housing completed at least five years ago is associated with

a 3.3 percentage point increase in students passing reading exams. Differences in coefficients shown at the bottom of Table 4, column 6 suggest that the estimated effect of owner-occupied housing is significantly larger than that for investments in rental housing.

Conclusion

For years, planners and policymakers have promoted homeownership as a mechanism of community change (Scanlon, 1998). While previous studies have shown a positive association between homeownership and education at the individual level (Aaronson, 2000; Green & White, 1997), ours is the first to systematically report on whether and how investments in owner-occupied housing shape the characteristics of local schools. Similarly, while previous research reports a positive association between subsidized owner-occupied housing and neighborhood property values, our work broadens the scope of this literature by exploring resulting changes in neighborhood schools and by explicitly comparing any changes to those that follow investments in subsidized rental housing.

Our results suggest that benefits from responsible investments in owner-occupied homes may extend beyond the individual level and that programs aimed at building owner-occupied housing for moderate- and middle-income households can bring about improvements in local test scores, over and above those that would be generated by similar investments in rental housing. Still, while our findings should provide some reassurance to planners and policymakers promoting local homeownership, our results should not be read as an unqualified endorsement of policies and programs to encourage homeownership in lower-income neighborhoods.

First, our results are mixed with respect to some school outcomes. For instance, we find expected changes in student demographics, but we also find some evidence that attendance rates decline modestly after investments in renovation subsidies for owner-occupied housing, while the share of teachers with experience and advanced degrees declines after the construction of new subsidized owner-occupied homes. While the positive association with test scores suggests that the net effect of these homeownership investments on school quality is positive, the underlying story remains mixed, and future work is warranted to examine the mechanisms at work.

Second, it is important to note that the results presented for New York City may vary in other locales. New York City is unique among American cities, both in the scope of its investment in subsidized housing and the

diversity of neighborhood types located within the boundaries of the city. While our research does not test for within-city variation in the effect of subsidized owner-occupied housing on school quality, the heterogeneity of neighborhood types in New York City offers some hope that our findings are not unique to New York City. The city's neighborhoods range from densely populated communities in Manhattan to those comprised primarily of single-family homes in Staten Island, Queens, and Brooklyn. Further research would be wise to consider how neighborhood characteristics alter the relationship between neighborhood owner-occupancy rates and local institutions. It is possible that other cities with less tight housing markets accrue fewer benefits from investments in subsidized housing than New York City.

Third, it is worth underscoring that our results suggest only that *responsible* investments in affordable owner-occupied housing can lead to improvements in school quality. As noted, the mortgages originated for program participants were generally carefully underwritten, borrowers were counseled, and the resulting loans have experienced very low rates of default. Our analysis does not examine impacts from changes in the homeownership rate as a result of subprime lending or other aggressive attempts to increase lending in lower-income areas, and our results should not be generalized to cover increases in homeownership driven by such practices. The foreclosure crisis powerfully reminds us that homeownership can be risky, and the zealous promotion of homeownership, especially in low-income communities, can backfire (Shlay, 2006). Neighborhoods benefit from a diversity of housing types, and affordable well-constructed rental housing must clearly be a part of planning viable, vibrant neighborhoods, as well (Retsinas & Belsky, 2008).

Notes

1. Homeownership may *not* shift student demographics if an unusually high percentage of students in New York City attended private school. To explore this, we calculated school enrollment characteristics from the 2000 Census. More than 83% of school-aged children in New York City attend public schools, compared to the national average of 89%. Although the rate is below the national average, New York City is fairly typical in its rate of public school attendance compared to many other large U.S. cities.

2. The subsidized owner-occupied units constructed through New York City's Ten Year plan predate the foreclosure crisis and were emblematic of responsible lending and buying. In communities where homeownership rates rose as a result of subprime lending, elevated rates of foreclosure could result in negative consequences for local schools. To the extent that foreclosures increase residential instability, decrease neighborhood property values, and elevate neighborhood crime rates (e.g., see Immergluck & Smith, 2006; Lin, Rosenblatt, & Yao, 2009; Schuetz, Been, & Ellen, 2008), the construction of owner-occupied housing may

deter teachers and parents who would otherwise consider these neighborhoods attractive places to work or live.

3. Neighborhoods where owner-occupied units received rehabilitation subsidies had slightly higher incomes than those receiving subsidies for the rehabilitation of occupied rental units, but this is not surprising, given the average income differences between owners and renters (Schill et al., 2002).

4. A few studies have estimated the spillover effect of subsidized investments in owner-occupied housing and report gains in property values. In New York City, the investment in building affordable homeownership units through Nehemiah and the New Homes Partnership resulted in increased property values in nearby neighborhoods (Ellen et al., 2002). Homeownership investments in Philadelphia resulted in similar home-price appreciation (Lee et al., 1999).

5. We compile our data from two sources. The Annual School Reports (ASR) supply information on student performance, measured by the percentage of general education students (without special needs) in Grade 3 and above who score above the national median on a national reading and national math test (labeled percentage of passing). Also from the ASRs, we obtained student demographics, teacher characteristics, and school- and grade-level enrollment and attendance. The School Based Expenditure Reports (SBER) provide information on expenditures and funding sources. We combine these datasets to ensure that each school in the ASR is matched with school finance data from the SBER.

6. We define elementary schools as schools in which the lowest grade is less than, or equal to, Grade 4. The vast majority of elementary school zones contain only one school. In the zones with more than one school, we calculated the weighted average for each of our variables of interest at the zone level.

7. We used elementary school zone boundaries as defined for school year 2003. The number of zones changed somewhat across years as new schools opened and others closed. In 1988, for example, there were fewer zones because some of the more recently opened schools did not exist in 1988. If these schools have their own zone, then this zone would contain no schools in 1988. If a school was not in operation in 2003 or no zone was defined, we assigned that school to the zone in which it was geographically located. These "unzoned" schools represent 6.2% of schools in 1988 and 9.8% in 2001. We replicated our analyses without these unzoned schools, and results were qualitatively the same. In addition, some elementary school zones in New York City contain more than one elementary school. This is because some schools are "unzoned." These schools may be magnet schools or have open enrollment policies for students outside the zone.

8. English language proficiency is determined by a student's score on the Language Assessment Battery (LAB). The LAB, in turn, determines eligibility for specialized instructional services.

9. Although the tests changed occasionally during this period, the cut-off scores for passing were reportedly set to the national median, so that this represents a substantial change in math scores.

10. We acknowledge the possibility that long-term effects could take more than five years to materialize. Neighborhoods often change slowly, and changes in school quality as a result of changing neighborhood characteristics could be similarly slow to change. However, given the timing of our research, in which the final wave of our data ends in 2002, we are unable to observe longer time periods in our study.

11. Number of residential units is computed as of 2004, based on property-level information provided in the 2004 PLUTO database maintained by the New York City Department of City Planning.

12. In Table 3, each model controls for the percentage of owner-occupied housing, the percentage of the population below the poverty line, the percentage of the population that is foreign born, and the percentage over age 65 in each school zone.

13. At the neighborhood level, we control for the percentage of owner-occupied housing, the percentage of the population below the poverty line, the percentage of the population that is foreign born, and the percentage over age 65. At the school level, we control for the percentage of students with limited English language proficiency, the percentage of Asians, the percentage of Hispanics, the percentage of Blacks, the percentage of free-lunch eligible students, the natural log of school enrollment, the attendance rate, the teacher-pupil ratio (per 100 pupils), the percentage of teachers with less than two years of experience at the school, the percentage of teachers with a master's degree, and the percentage of teachers with more than five years of experience teaching.

14. Table 4, (columns 4 and 6) includes the same set of neighborhood- and school-level controls as Table 4, column 2.

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