

Do Housing Vouchers Improve Academic Performance? Evidence from New York City

Amy Ellen Schwartz
Maxwell School of Citizenship and Public Affairs
Syracuse University
426 Eggers Hall
Syracuse, NY 13244 USA
amy.schwartz@nyu.edu

Keren Mertens Horn
Department of Economics
University of Massachusetts Boston
100 Morrissey Blvd
Boston, MA 02125 USA
keren.horn@umb.edu

Ingrid Gould Ellen
Wagner School of Public Service
New York University
295 Lafayette Street
New York, NY 10012 USA
ingrid.ellen@nyu.edu

Sarah A. Cordes
College of Education
Temple University
1301 Cecil B. Moore Avenue
Philadelphia, PA 19122 USA
sarah.cordes@temple.edu

INCOMPLETE DRAFT
DO NOT CITE WITHOUT AUTHORS PERMISSION
March 2017

Introduction

There is a historically strong link between housing and education in the United States, with access to high quality schools often limited to middle and upper income families while poor children and households are “stuck” living in poor neighborhoods with low quality schools. Housing subsidies potentially play an important role in addressing this inequality. Specifically, at a cost of 19.3 billion dollars, the federal Housing Choice Voucher (HCV) program provides housing subsidies to families with more than 2.5 million children under the age of 18. Improving outcomes for those children is one of the program’s key goals. Yet evidence on the program’s educational impacts is limited, and the research that exists does little to disentangle potential mechanisms. In this paper we draw on rich administrative data from the nation’s largest school district, New York City (NYC) to shed light on whether – and to what extent – this large national program improves educational outcomes for children whose families receive housing vouchers. We then attempt to get inside the black box, exploring potential pathways through which HCVs may affect performance.

There are several reasons to believe that housing vouchers will improve educational outcomes. First, because vouchers are portable housing subsidies, they may provide poor children with access to safer neighborhoods and higher performing schools. Second, they may provide children with access to higher-quality and less crowded homes. Third, because the primary feature of the housing voucher program is that it ties individual rent payments to income, households receiving these subsidies may pay less in rent and enjoy an effective increase in income. Finally, housing subsidies might increase housing stability over the longer run, decreasing the likelihood that families and children make potentially disruptive moves to new schools and communities.

Despite the large scope of the program, evidence about the effects of vouchers on educational outcomes remains fairly limited. A recent national analysis finds that families with children just reaching school age use vouchers to move to areas with better schools (Ellen, Horn and Schwartz, 2016). While this finding is encouraging, it is unclear whether children in families with vouchers actually *attend* better schools or whether they perform better following voucher receipt. The few studies that explore student outcomes generally find that receipt of a housing voucher has little to no impact on their performance at school in the short-run (Sanbonmatsu, 2006; Jacob, Kapustin and Ludwig, 2014), but may have significant impacts on long-term outcomes such as incarceration and lifetime earnings (Andersson, 2016). It remains unclear why we see impacts in the long-run but not the short-run.

We add to the literature using data from New York City, the largest school district in the country. Specifically, we match over 88,000 voucher recipients to public school records and follow their schooling and residential experiences. To identify the causal impact of vouchers, we use a difference-in-differences strategy, exploiting the random timing of voucher receipt to compare changes in outcomes of students whose families receive a housing voucher to changes in outcomes of students whose families will receive one in the future. We also compare changes in outcomes among children whose families receive vouchers to changes among children whose families receive other forms of housing assistance, specifically those who live in public housing, in order to shed light on the effectiveness of vouchers relative to other forms of assistance. We then explore the extent to which these impacts are concentrated among families who use their vouchers to move. Preliminary results suggest that students in voucher households perform better in both ELA and math in the years they receive a voucher.

Theory and Literature

Why would Housing Choice Vouchers affect performance?

Housing vouchers might improve educational outcomes through a series of mechanisms. First, because housing vouchers are portable rent subsidies, they may enable households to move to better neighborhoods, particularly those with access to higher performing public schools. Although moves might initially have a negative effect on a child's educational outcomes because of disruptions to social capital and schooling, better resources and higher quality peers available in the child's new school and neighborhood may well lead to improved academic performance (Schwartz, Stiefel and Cordes, 2015; Cordes, Schwartz and Stiefel, 2016).

Second, the housing subsidy provided by vouchers may allow households to move out of overcrowded, poorly maintained housing into higher quality apartments and homes. This may be due both to minimum quality standards of the program, including space requirements, and to households' ability to rent more expensive units following the receipt of a subsidy. Larger and higher quality units, in turn, may have important implications for child well-being and academic performance (Mayer, 1997; Klebanov et al, 1997). In particular, living in overcrowded or poor quality housing may make it more difficult for children to focus in school and may negatively affect their health (Coggon et al., 1993; Coley et al., 2013; Galpin, Walker, and Dubiel, 1992; Mann, Wadsworth, and Colley, 1992). This, in turn, may negatively impact performance if children are more likely to be absent and have greater difficulty keeping up with assignments.

Third, voucher receipt may significantly increase disposable family income if it is used to offset rent burdens. To be clear, the amount of assistance provided through the HCV program is substantial, increasing a household's effective earnings by an average of 60 percent. Results from the Welfare to Work Voucher program show that housing vouchers reduced the incidence

of poverty once the value of the housing voucher was taken into account (Wood et al, 2008). There is good reason to believe that such increases in income could lead to improvements in educational outcomes for children in poor families. For example, evidence from the Earned Income Tax Credit program, which is targeted to poor and near-poor families suggests that an additional \$1,000 in income increases children's combined math and reading test scores by 6 percent of a standard deviation (Dahl and Lochner, 2012).

Fourth, vouchers might increase long-term housing stability and help families and children avoid the disruptive effects of moving to new schools and communities (Newman and Harkness, 2002). A large body of work finds that students who move residences experience worse academic outcomes (Haveman, Wolfe and Spaulding 1991; Pribesh and Downey 1999; Swanson and Schneider, 1999; Hanushek, Kain and Rivkin, 2004). Similarly, a review of the literature between mobility and educational outcomes finds that frequent moves due to factors outside the family's control and moves that do not significantly improve housing conditions are detrimental to children (Crowley, 2003). There is also evidence from New York City suggesting that long distance moves (more than 1.5 miles) and those accompanied by school moves, both of which might be viewed as more disruptive than short distance moves, are particularly harmful for performance (Cordes, Schwartz and Stiefel, 2016).

Of course, subsidies like vouchers could also have negative effects on children, if HCV recipients grow less motivated to find work given the higher implicit tax on their earnings, which may lead to decreased academic performance if non-working parents are less helpful role models. Research examining the labor market impacts of vouchers yield mixed results. While Jacob and Ludwig (2012) find that housing voucher use reduces quarterly labor force participation by 4 percentage points and quarterly earnings by \$285 among participants randomly

selected to receive housing vouchers in Chicago, analysis of the Welfare to Work Voucher study suggest that reductions in quarterly employment rates were only statistically significant during the first year following random assignment (Mills et al., 2006).

What is the evidence on the Impact of Housing Choice Vouchers on academic performance?

Most of the evidence on vouchers and academic performances to date comes from the Moving to Opportunity (MTO) experiment, which randomly assigned vouchers to poor households living in high-poverty public housing developments. These studies generally find no significant positive effects of housing vouchers on educational achievement, even for those voucher households required to move to neighborhoods with significantly lower poverty rates (Ladd et al, 2003; Orr et al, 2003; Sanbonmatsu et al, 2006).¹ In a recent study exploring long-term outcomes, however, Chetty, Hendren, and Katz (2015) found that young children (under age 13) who moved to higher quality neighborhoods as part of the experiment were significantly more likely to attend college and enjoyed significantly higher lifetime earnings.

On the one hand, the MTO studies involved a randomized control trial design and therefore provides credibly causal evidence that housing vouchers were effective in improving long-term, but not short-term outcomes for poor children in public housing. On the other hand, *because* the MTO study involved an experimental design, it was limited in sample and scope. In particular, the MTO households receiving vouchers came from highly distressed public housing developments and thus their experience may not be representative of voucher holders more generally, many of whom are renting on the private market before receiving a voucher. In addition, treatment, comparison, and control families all received housing subsidies; the study

¹ Ladd and Ludwig (2003) do find positive impacts on educational outcomes, but only for the Baltimore MTO site. Additionally, the MTO interim evaluation finds positive impacts on educational outcomes in reading in both the Baltimore and the Chicago test sites, though no effects in math (Orr et al, 2003).

did not aim to test the impact of housing subsidies but rather to compare the effects of different kinds of subsidies, especially those restricted to use within low-poverty neighborhoods. Thus, the MTO studies do not explore differences in outcomes between children with and without housing assistance as we aim to do here.

The few studies examining the broader set of households who receive vouchers find mixed evidence on the impacts of vouchers on children's outcomes. Evidence from the experimental Welfare to Work Voucher study suggests that children with vouchers experience no change in behavior problems, an increased likelihood of repeating a grade in school, and a decreased likelihood of missing school due to health, financial or disciplinary problems (Mills et al, 2006). More recently Jacob, Kapustin and Ludwig (2015) explore outcomes for households in Chicago, who were given vouchers through a housing voucher lottery in 1997. They find that among this broader population of households, housing vouchers have no impacts on a child's reading and math scores, with the exception of young males (under age 6) who experience positive impacts. As for longer term outcomes, the authors find voucher receipt has no consistent impact on either graduation rates or criminal activity (Jacob, Kapustin and Ludwig, 2015). Of course, these results are only for Chicago and for a particular period of time.

Perhaps most relevant to our analysis, Andersson et al (2016) examine earnings outcomes for children raised in various assisted housing settings. OLS estimates suggest a substantial negative impact of housing subsidies on earnings, but in models utilizing sibling effects, they find evidence of positive effects on long run earnings and incarceration rates. This analysis suggests not only that housing assistance may be beneficial, but also that addressing selection is critical to identifying impacts of housing assistance on children's life outcomes.

Together, these mixed results combined with a limited understanding of the mechanisms driving the results suggest a need for additional research in other contexts. We expand on prior work using rich data on New York City public school students. We begin by comparing the characteristics of children whose families will, at some point in their elementary school years, receive housing assistance to the characteristics of their public school peers. Next, we estimate the impacts of housing vouchers on student achievement by comparing changes in outcomes of children whose families receive housing vouchers to changes in the outcomes of children who will receive a HCV in the future. Then we expand these findings by comparing the change in educational outcomes experienced by children whose families receive housing vouchers to the change in outcomes experienced by children of households who receive other forms of housing assistance. Finally, we provide some evidence on mechanisms, exploring whether residential mobility and school mobility in the years following initial voucher receipt are associated with improved outcomes for students.

Data and Sample

Data Sources

To conduct our analysis, we link data from four main sources: the Department of Housing and Urban Development (HUD), the New York City Department of Education (NYCDOE), the New York City Housing Authority (NYCHA), and the New York City Department of Finance.

From HUD, we use a panel dataset on subsidized housing tenants from 2002-2012, which contains information on the residential address, certification date, and certification type (i.e.

initial certification, recertification, exit, etc.).² This dataset also contains individual-level information on the race, gender, and birth month and year of each household resident, which we use to link these data to student-level records from the NYCDOE.

From the NYCDOE, we have a complete census of NYC public school students from 1997-2013. These data contain information on student demographics and program characteristics including race, gender, eligibility for free and reduced price lunch, participation in ungraded special education, country of birth, etc. Beginning in 2005, these data also contain student addresses, which we use to identify NYC public school students whose families have vouchers or who live in public housing. Importantly for our analysis, these data also contain information on student outcomes including attendance and scores on standardized state exams as well as unique student identifiers that allow us to follow students over time. This allows us to include student fixed effects in our models so we can compare the performance of individual students before and after his or her family receives a voucher.

We use building identifiers from NYCHA to identify the students living in public housing. Such students may serve as a good comparison group for students in voucher households because they are likely to face similarly high levels of sustained poverty over the course of their childhood. In addition, this allows us to compare the relative effectiveness of vouchers, where families can choose where to live, with public housing, where families are assigned to a unit.

Finally, we supplement these data with information about buildings from the New York City Department of Finance's Real Property Assessment Database. We can identify the type of

² These data also contain information on family income and household composition, which we do not exploit in the current analysis but plan to add in the future.

building (i.e. single family, 2-4 family, 5 or more family, mixed use, etc.) as well as its age, size, number of stories, etc., which can reveal changes in housing characteristics after voucher receipt.

Linking Voucher Records to Student Records

To link voucher records to student records, we attached a BBL (borough block lot) code to each address recorded in the HUD data. This is a unique code that identifies the building where a voucher household lives in a given year. We then identified the set of children in voucher households who were ages 6-14 between 2002 and 2012 to link to student records from the NYCDOE. We then matched voucher records to NYCDOE records in three steps using information on student BBL, month of birth, year of birth, gender, and race/ethnicity (white, black, Hispanic, Asian/other).³

We first employed a direct match on all variables, with which we successfully linked 56 percent of the voucher records. For the second and third steps of the matching process, we used a fuzzy match. Step 2 of the match process required a perfect match on gender, building of residence, and birth date but allowed for differences in race/ethnicity. All possible fuzzy matches were manually reviewed to ensure that only the most likely matches were kept. Finally, to allow for differences in reporting time between HUD and DOE records, we matched the remaining voucher students on gender, birthdate and NYCDOE BBLs one and two years in the future while allowing for non-matches on race/ethnicity. For example, when trying to match voucher holders from 2008 to students in 2008, a student would be counted as a match if he/she had the same gender and birth date as a voucher holder AND he/she lived in the same building as

³ Since we do not have address data for NYCDOE records until 2005, we are only able to use this method to match voucher holders to NYCDOE records from 2005 forward. For those voucher households that enter the program prior to 2005, however, we are able to track the number of years a household has received a voucher going back to 2002 using the data from HUD.

that voucher holder in either 2009 or 2010. We did this with the reasoning that while HUD address records are likely up to date (because of certification requirements), there may be a lag between when a student moves homes and his/her address information is updated in the NYCDOE system. Again, all possible fuzzy matches were manually reviewed and only the most likely matches were kept.

Of the 143,903 unique voucher holders identified from the HUD records, we successfully link 89,169 (62 percent) to DOE records. This match rate reflects, in part, the fact that children in some voucher households do not attend NYC public schools. In particular, we observed a low match rate among voucher holders in areas of the city with large Hassidic Jewish populations, who typically send their children to private religious schools. When we exclude community districts with large Hassidic Jewish populations, our match rate improves to 78.7 percent, which leads us to believe that a large fraction of students we fail to match are not enrolled in NYC public schools. In addition to varying across space, the success rate of the match also varies across years from a low of 61 percent in 2005 to a high of 68 percent in 2009, with an average of 38,000 children in a given year.

While we are undoubtedly missing some children in voucher families who attend public schools, we have no reason to believe that our sample is systematically biased. In particular, those voucher holders we are unable to match are more likely to be white, less likely to be black, more likely to live in Brooklyn, less likely to live in the Bronx, and more likely to live in small buildings as compared to those voucher holders who we match. Thus, if anything we might expect this unmatched group to be higher performing on average.

Sample

We limit our main sample to students in grades 3-8 between academic years (AY) 2005 and 2011, for whom annual test score data are available. We further limit our sample to those students who are even enrolled in NYC public schools in 3rd grade for whom we observe at least two test scores. This allows us to control for prior performance (a proxy for cumulative unobserved inputs into a child's learning process up to time t) and also to estimate student fixed effects models.⁴ Table 1 compares the characteristics of voucher holders, public housing residents, and all other NYCDOE students in grades 3-8 in academic year 2008-2009. This table highlights some key differences between these three groups. First, over 95 percent of NYC public school students with vouchers or living in public housing are black or Hispanic, compared to 63 percent of students who do not receive housing assistance. Further, virtually no voucher recipients or public housing residents are foreign born and the vast majority are eligible for free and reduced price lunch, whereas 13 percent of students living in other types of housing are foreign born and over 30 percent do not receive lunch subsidies. Since, all else equal, both foreign born students and those who do not receive lunch subsidies tend to perform significantly better on exams, this suggests that students who receive housing vouchers or live in public housing are a negatively selected group.

To account for the substantial differences between students who never receive housing assistance and those who ever receive housing assistance, we focus on two primary samples of students: students who ever live in a household that receives a housing voucher and students who ever live in a household that ever receives either a voucher *or* a public housing unit). As seen in Table 1, students in public housing are comparable to those receiving HCVs on most observed characteristics, which suggests that they will serve as a good comparison group.

⁴ Limiting the sample to those students with at least two test scores is standard practice in the education literature.

Measures

We explore several potential outcomes related to academic performance including state test scores in English Language Arts (ELA) and math and attendance. Test scores are standardized by grade and year to have a mean of 0 and standard deviation of 1, such that coefficient estimates can be interpreted in standard deviation units.

Our main independent variable of interest, voucher receipt, is measured as a single indicator, *voucher receipt*, which is equal to one in all years that a student receives a voucher, plus in the years after a student receives a voucher. Specifically, students receive a one on this variable if they are identified in the HUD data as first enrolling in the voucher program in that year (initial certification), or if they have been identified as an initial certification in a prior year in our sample. We create an alternative indicator, *other voucher receipt*, for students whom we observe with a voucher in the DOE data for the first time, but whom HUD does not identify as initial certifications in that year.⁵ To compare the effects of vouchers relative to public housing, we construct an analogous set of variables capturing tenure in public housing.

Next, we try to understand more about the causal pathways through which receipt of a housing voucher may influence educational outcomes. Specifically, we examine the impacts of vouchers conditional on subsequent mobility, exploring separate impacts for those students who moved in the year immediately following voucher receipt, those students who moved more than one year following voucher receipt, and those students whose households leased in place. This will help us begin to parse the extent to which impacts are driven by mobility or an income

⁵ There are several reasons this might occur. These students may have moved into the unit of an existing voucher recipient (perhaps moving in with a grandparent or other family member) or had an existing voucher recipient move into their unit. Alternatively, some of this may be due to simple measurement error resulting from incorrect address or birthdate information in the NYCDOE data.

effect, as any change in performance among households leasing in place is likely driven by a change in disposable household income or increased housing stability.

Methods

One of the primary challenges for identifying the impact of housing vouchers on student performance is selection—namely voucher households are much more disadvantaged than non-voucher households in ways that are unobserved: they are likely to be poor for longer periods, live in larger households with fewer resources, etc. Therefore, in the absence of voucher receipt, children in voucher households are likely to have worse educational outcomes than other observationally similar children. To address this challenge, we limit our sample to those who ever receive a housing voucher and exploit the random timing of voucher receipt to obtain credibly causal estimates of the impact of vouchers on children’s educational outcomes. In addition, because exit from the voucher program is likely to be endogenous, we conduct this as an intent-to-treat (ITT) analysis, where students are identified as receiving a voucher in all years after initial voucher receipt whether or not they actually exit the program.

Our main specification is as follows:

$$Y_{ibt} = \beta_0 + \beta_1 Voucher_{ibt} + \beta_2 OtherVoucher_{ibt} + \mathbf{X}'_{ibt} \boldsymbol{\gamma} + \delta_g + \tau_t + \varphi_b + \eta_i + \varepsilon_{ibt} \quad (1)$$

where Y is an outcome of student i , in borough b , at time t . $Voucher$ is an indicator equal to one in the year a student is identified as an initial certification and all subsequent years,

$OtherVoucher$ is equal to 1 in the year that a student is first observed in our dataset as having a voucher and all subsequent years and is mutually exclusive of $Voucher$, \mathbf{X} is a vector of student

characteristics including eligibility for free or reduced price lunch, receipt of special education services, etc., δ are grade effects, τ are time effects, and φ are borough effects and η are student effects. The primary coefficients of interest are β_1 and β_2 , which can be interpreted as the impact of receiving a housing voucher (measured through our two different approaches) and are identified by comparing changes in a student's performance before receiving a voucher to changes in that same student's performance after receiving a voucher.

These results can be interpreted as causal if timing of voucher receipt is conditionally random. There is good reason to believe this to be the case—as of March 17, 2014 there were 121,999 families on the waiting list for vouchers and the NYCHA website states “it is virtually impossible to establish an average waiting time for a family to enter Conventional Public Housing. Some applicants can be matched up with an available apartment in months, while others often have to wait years.”⁶ It is therefore plausible to assume that a family is unable to anticipate voucher receipt in any given year.⁷

Next, we expand our sample to include all students who ever received any type of housing assistance (vouchers or public housing). This not only expands the size of our comparison group, but allows us to examine the relative impacts of market-based (vouchers) versus place-based (public housing) assistance. In this sample, we augment equation (1) by including a set of variables capturing public housing tenure.

⁶ See <http://www.nyc.gov/html/nycha/html/about/factsheet.shtml>

⁷ Some families receive vouchers through emergency provisions, which might be indicative of many other negative circumstances occurring in their lives. But many households qualify for these priority admissions for many years, so it is still fairly random who gets the vouchers at a given point in time. To the extent that this biases our estimates, it will work against finding any positive impact of vouchers, unless we expect negative circumstances are temporary and outcomes revert to the mean.

$$Y_{ibt} = \beta_0 + \beta_1 Voucher_{ibt} + \beta_2 OtherVoucher_{ibt} + \beta_3 NYCHA_{ibt} + \mathbf{X}'_{ibt} \boldsymbol{\gamma} + \delta_g + \tau_t + \varphi_b + \eta_i + \varepsilon_{ibt} \quad (2)$$

where *NYCHA* is an indicator equal to one if a student lives in public housing in year *t* and all subsequent years and all other variables are as previously defined. The coefficients of interest are β_1 , β_2 , and β_3 , which measure the impacts of vouchers and public housing, respectively and are identified relative to the performance of students whose households will receive a housing subsidy in the future. Finally, to explore potential mechanisms for any observed effects, we re-estimate equations (1) and (2), interacting the *Voucher* and *OtherVoucher* variables for whether the child's family moved in the year immediately receiving voucher receipt, moved more than one year after voucher receipt, or never moved after voucher receipt.

Results

Descriptive Statistics

We begin by examining the characteristics of students who receive housing assistance as well as the neighborhoods that these students live in, which provide important context for interpreting our results.

As shown in Table 1, most students with housing assistance receive such assistance for the entire period they are observed. In particular, 56.5 percent of students with HCVs and 55.8 percent of students who live in public housing *always* receive HCVs or live in public housing. Still, 43.5 percent of students who are ever observed receiving a voucher are also observed without a voucher so that a non-trivial fraction of students contribute to our fixed effects estimates.

Students who receive housing vouchers are also more likely to move residences and also to move neighborhoods than households not receiving assistance, which may not be surprising if households are more likely to move once they receive housing vouchers. Students with housing assistance are slightly more likely to move schools without moving residences than their peers who do not receive housing assistance. Given that school moves are often associated with lower performance (Schwartz, Stiefel, and Cordes, 2015), this provides further reason to believe that students with housing assistance would tend to perform worse than their peers.

Finally, we see that students who receive housing assistance tend to live in different parts of the city and in more disadvantaged neighborhoods. For example, the students who receive housing assistance are much less likely to live in Queens or Staten Island than students who receive no housing assistance, while students in public housing are more likely to live in Manhattan than either students with HCVs or those with no housing assistance. Students receiving housing assistance also live in neighborhoods with higher poverty and unemployment rates and lower median incomes than students who do not receive assistance. In general, however, students in public housing tend to live in the most disadvantaged neighborhoods, which is perhaps not surprising given that public housing complexes in NYC are quite large and can comprise the majority and in some cases the entire census tract.

In general, these results suggest that students who receive housing assistance tend to be different from those who do not in ways that would lead to worse performance: they are more likely to be poor for long periods of time, are more mobile, and live in worse neighborhoods. Thus, the full sample of students who do not receive housing assistance may serve as a poor comparison group for the analysis. Indeed, when we run our analysis for the full sample of households in New York City, we see the estimated associations between vouchers and public

housing and test scores are negative (Table 2). In addition, we see that the relative performance of students with vouchers is similar to that of students who live in public housing, suggesting that these groups may provide an appropriate counterfactual for each other.

Thus, we choose to focus on the sample of students who ever receive a housing voucher, and rely on students who currently do not receive a voucher, but will in the future as our comparison group. To provide some evidence that these households will serve as a compelling counterfactual for households currently receiving a voucher, we present in Table 3 an estimation of the probability that a student will receive a voucher in the following year, dropping students in the years after they receive a housing voucher. Most importantly we see in this analysis that for the households identified as newly receiving a voucher there is no observable difference in their test scores or their attendance rate in the year before they receive a voucher. Additionally we find no observable difference in the probability of receiving free or reduced price lunch in the year before receiving a voucher, another clear indicator for whether a child is experiencing a negative (or positive) shock in the year before receiving a housing voucher. For the remainder of the analysis we rely on the set of children who receive a voucher at some point during our study period, and then further add in children living in public housing as an alternative comparison group.

Voucher Only Sample

Table 4 presents findings from our baseline specification. Here, we see evidence that receiving a voucher increases student performance. We see that students currently receiving a voucher perform 0.058 standard deviations higher in ELA and 0.048 standard deviations higher in math than students whose families are not currently receiving a voucher but will receive one in

the future. Households in our Other Voucher Receipt category also experience improvements in test scores, but these impacts are smaller, as would be expected given our concerns about measurement error. In contrast we see almost no impacts on attendance.

Housing Assistance Sample

We next expand our sample to include the set of students who ever live in public housing, who we expect to be similarly disadvantaged to voucher students. For example, Table 1 shows that students living in public housing are similar to those receiving vouchers on a multitude of characteristics including race and poverty. If anything, this group might be even *more* disadvantaged as students in public housing tend to live in worse neighborhoods. By including them in our comparison group, we can shed some light on the relative effectiveness of these two different forms of housing subsidies.

The results in Table 5 suggest that both vouchers and public housing appear to improve student performance, although the vouchers may be slightly more beneficial. Compared to students who will receive some form of housing subsidy in the future, students with vouchers perform 0.068 standard deviations higher in ELA and 0.049 standard deviations higher in math. Students in public housing perform 0.028 standard deviations higher in ELA and 0.031 standard deviations higher in math. In terms of attendance we see statistically significant, but small, impacts for residents of public housing and very small impacts for housing voucher recipients, as measured only by the ‘other voucher receipt’ metric.

Robustness Checks

We conduct a series of analyses to show that our results are not sensitive to the particular specifications in the model. To begin with we combine our two sets of voucher recipients, and rerun our primary specification on this set of households. We present results in Table 6. We see here that results are similar to our primary specification, with the coefficients only slightly attenuated.

Next we rerun our preferred model specification, but this time randomly assign the date of voucher receipt, to show that our results are not simply a product of the structure of our underlying data. In Table 7 we see that when we randomly assign the new admission variable we find no impacts of voucher receipt on student test scores, providing further support that we are identifying the short term impacts of voucher receipt on student test scores.

Heterogeneity

In this section we explore the extent to which effects vary for different subgroups of students, as prior literature has shown that the impacts of housing assistance may differ by gender (see for example, Andersson et al, 2016 and Jacob, Kapustin and Ludwig, 2015) or age at first voucher receipt (see Chetty, Hendren, and Katz, 2015). Contrary to previous findings, we see no evidence that impacts differ for boys and girls (Table 8) and find only minor differences by age (Table 9). More specifically, when we interact our measures of voucher receipt with indicators for whether a student first received his or her voucher in middle school (grades 6-8), we find no differences in ELA or math performance, and only small impacts on attendance, where positive impacts are concentrated among those voucher recipients who entered the program while still in elementary school.

We also explore whether results are different for children of different racial and ethnic backgrounds, a result which could be driven by the existing residential and school stratifications in New York City. In Table 10 we present interactions of voucher receipt with the student's racial and ethnic background, including non-Hispanic black students as the comparison group. Here we find evidence that results for test scores are strongest for White/Asian students, and also strong for Hispanic students, but not for black students. These results hold for both math and ELA as well as for the sample of students living in public housing. When looking at attendance outcomes, we find the pattern is reversed, with positive impacts for black students and negative impacts for Hispanic students.

Examining Mechanisms

Results presented thus far point to small, positive impacts of vouchers on short term student performance. Next, we begin to explore what might explain these impacts by separately examining both residential and school mobility. We begin by separately looking at outcomes for households that move in the first year they receive their housing voucher, those that remain in place in the year they receive the voucher but then move later, and those that remain in their home for the duration of our study period. Although these results are unlikely to be causal, as mobility decisions made after voucher receipt are likely driven by selection, they will begin to shed light on the pathways through which vouchers may increase performance.

Results presented in Table 11 suggest that *all* voucher households benefit from voucher receipt, regardless of subsequent mobility. Thus it is not only children who move in the year immediately following voucher receipt who experience improvements in test scores, but students whose families move later and those whose families stay in place also experience improvements

of a similar order of magnitude.⁸ This suggests that the positive impacts of voucher receipt may be driven both by a mobility effect as well as an income effect, at least in New York City.

To gain a better understanding of the types of neighborhood changes families are experiencing, we run a set of regressions examining whether neighborhood incomes, poverty rates and racial composition of the neighborhoods voucher holders live in changes after they receive a voucher. In this analysis, presented in Table 12, our key independent variables stay the same, but our dependent variables now include a set of neighborhood characteristics. We see that voucher households are moving to neighborhoods with higher median incomes and slightly lower poverty rates that have slightly higher black populations. Thus overall it does appear that voucher recipients are moving to slightly less disadvantaged neighborhoods.

In the next set of tables we conduct a parallel analysis, but this time focus on school mobility. Again these results cannot be interpreted as causal, but provide a view into which sets of households are benefitting most from receipt of a voucher. For this analysis we separately look at households who move schools in the first year they receive a voucher, households that move schools after the first year they receive a voucher and households that do not change schools. We see that all of these households experience improvements, but particularly for math children who remain in the same school for the entire study period experience the largest gains in test scores. These results conform with the school mobility literature (Cordes et al, 2016) which shows that school moves in these later grades do correspond to negative outcomes in terms of test scores. Again we next examine the characteristics of the schools that students attend after receiving a housing voucher, presenting results in Table 14. We see that students are attending schools with lower poverty rates, higher proficiency rates and higher attendance rates after

⁸ While the magnitudes differ somewhat, the coefficients on these three groups are statistically indistinguishable.

receiving a voucher. This suggests that students who do move schools are moving to measurably better schools and thus even if test score results are not immediately higher for this set of students they may experience improvements in the long run.

Conclusion/Discussion

Results from this analysis suggest that vouchers improve educational outcomes for children whose families receive this type of assistance, regardless of gender, age, or subsequent mobility. Our exploration of mechanisms suggests that results are not driven entirely by neighborhood mobility, but that an income effect is at work as well, as households that remain in the same home after receiving a voucher also experience improvements in test scores.

Additionally our results suggest that impacts are strongest for those students who are able to remain in the same school during this time period, though again these results are not causal.

We hope that through shedding light on the ways in which housing vouchers affect school children this research will help inform a set of policy recommendations that can increase the utility of housing vouchers for low income children.

References

- Andersson, F., Haltiwanger, J., Kutzbach, M., Palloni, G., Pollakowski, H., & Weinberg, D. H. (2016). Childhood Housing And Adult Earnings: A Between-Siblings Analysis Of Housing Vouchers And Public Housing. *US Census Bureau Center for Economic Studies Paper No. CES-WP-13-48*.
- Chetty, R., Hendren, N., & Katz, L. (2015). The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment. Working Paper.
- Coggon, D., Barker, D. J., Inskip, H., & Wield, G. (1993). Housing in early life and later mortality. *Journal of Epidemiology and Community Health*, 47(5), 345-348.
- Coley, R. L., Leventhal, T., Lynch, A. D., & Kull, M. (2013). Relations Between Housing Characteristics and the Well-Being of Low-Income Children and Adolescents. *Developmental Psychology*, 49(9), 1775-1789.
- Cordes, S.A., Schwartz, A.E., & Stiefel, L. (2016). *The Effect of Residential Mobility on Student Performance: Evidence from New York City*. Working paper.
- Crowley, S. (2003). The affordable housing crisis: Residential mobility of poor families and school mobility of poor children. *Journal of Negro Education*, 22-38.
- Dahl, G. B., & Lochner, L. (2012). The impact of family income on child achievement: Evidence from the earned income tax credit. *The American Economic Review*, 102(5), 1927-1956.
- Ellen, I.G., Horn, K.M. & Schwartz, A.E. (2016). Why Don't Housing Choice Voucher Recipients Live Near Better Schools? Insights from Big Data. *Journal of Policy Analysis and Management*, 35(4), 884-905.
- Galpin, O. P., Whitaker, C. J., & Dubiel, A. J. (1992). Helicobacter pylori infection and overcrowding in childhood. *The Lancet*, 339(8793), 619.
- Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Disruption versus Tiebout improvement: The costs and benefits of switching schools. *Journal of Public Economics*, 88(9), 1721-1746.
- Haveman, R., Wolfe, B., & Spaulding, J. (1991). Childhood events and circumstances influencing high school completion. *Demography*, 28(1), 133-157.
- Jacob, B. A., Kapustin, M., & Ludwig, J. (2015). The impact of housing assistance on child outcomes: Evidence from a randomized housing lottery. *The Quarterly Journal of Economics*, 130(1), 465-506.
- Jacob, B. A., & Ludwig, J. (2012). The effects of housing assistance on labor supply: Evidence from a voucher lottery. *The American Economic Review*, 102(1), 272-304.

- Klebanov, P. K., Brooks-Gunn, J., Chase-Lansdale, P. L., & Gordon, R. A. (1997). Are neighborhood effects on young children mediated by features of the home environment. *Neighborhood poverty: Context and consequences for children*, 1, 119-145.
- Ladd, H. F., & Ludwig, J. (2003). The effects of MTO on educational opportunities in Baltimore. *Choosing a Better Life? Evaluating the Moving to Opportunity Social Experiment*, 117-151.
- Mann, S. L., Wadsworth, M. E., & Colley, J. R. (1992). Accumulation of factors influencing respiratory illness in members of a national birth cohort and their offspring. *Journal of Epidemiology and Community Health*, 46(3), 286-292.
- Mayer, S. E. (1997). *What money can't buy: Family income and children's life chances*. Harvard University Press.
- Mills, G., Gubits, D., Orr, L., Long, D., Feins, J., Kaul, B., ... & Jones, A. (2006). Effects of housing vouchers on welfare families. *Washington, DC: US Department of Housing and Urban Development, Office of Policy Development and Research*. Retrieved October, 8, 2010.
- Newman, S. J., & Harkness, J. M. (2002). The long-term effects of public housing on self-sufficiency. *Journal of Policy Analysis and Management*, 21(1), 21-43.
- Orr, L., Feins, J., Jacob, R., Beecroft, E., Sanbonmatsu, L., Katz, L. F., & Kling, J. R. (2003). Moving to opportunity: Interim impacts evaluation.
- Pribesh, S., & Downey, D. B. (1999). Why are residential and school moves associated with poor school performance?. *Demography*, 36(4), 521-534.
- Sanbonmatsu, L., Kling, J. R., Duncan, G. J., & Brooks-Gunn, J. (2006). Neighborhoods and academic achievement results from the Moving to Opportunity experiment. *Journal of Human Resources*, 41(4), 649-691.
- Schwartz, A. E., Stiefel, L., & Cordes, S.A. (2015). *Moving matters: the causal effect of school mobility on student performance*. Working Paper, Institute for Education and Social Policy.
- Swanson, C. B., & Schneider, B. (1999). Students on the move: Residential and educational mobility in America's schools. *Sociology of Education*, 54-67.
- Wood, M., Turnham, J., & Mills, G. (2008). Housing affordability and family well-being: Results from the housing voucher evaluation. *Housing Policy Debate*, 19(2), 367-412.

Table 1. Descriptive Statistics by type of Housing Assistance, 2008-2009 School Year

	Ever Voucher	Ever Public Housing	Never Housing Assistance
<i>Individual Characteristics</i>			
Female	52.72%	52.60%	50.14%
White	1.42%	1.61%	18.55%
Black	47.04%	48.39%	25.14%
Hispanic	49.56%	45.76%	37.38%
Asian	1.98%	4.24%	18.93%
Foreign Born	3.00%	4.33%	13.63%
Born in NYC	91.16%	91.14%	80.71%
Special ed,	14.43%	15.98%	10.69%
Poor (FRPL Eligible)	91.95%	86.15%	66.12%
Non-English at Home	28.64%	25.87%	44.29%
LEP	9.53%	8.09%	12.28%
<i>Housing Assistance</i>			
Ever Voucher	100.00%	0.00%	0.00%
Ever Public Housing	0.00%	100.00%	0.00%
Always Voucher	56.49%	0.00%	0.00%
Always Public Housing	0.00%	55.82%	0.00%
<i>Mobility</i>			
Moved Homes	20.49%	14.66%	11.70%
Moved School Only	20.14%	20.62%	17.52%
Moved Neighborhood Only	6.33%	4.70%	3.46%
Moved School and Neighborhood	8.09%	5.93%	4.17%
<i>Residence Borough</i>			
Manhattan	10.42%	23.71%	10.31%
Bronx	48.23%	28.84%	18.06%
Brooklyn	30.26%	34.72%	31.31%
Queens	8.58%	9.97%	32.92%
Staten Island	2.41%	2.70%	7.37%
Observations	26,902	33,152	233,174

Notes: Sample is limited to students in grades 3 through 8 who were registered in NYC public schools in their 3rd grade year. Census tract characteristics are from the 2012 5-year ACS estimates.

Table 2. Vouchers and Student Performance, NYC Full Sample, Grades 3-8, Academic Year 2005-2011

	ELA (1)	MATH (2)	ATTENDANCE (3)
Voucher Receipt	-0.181*** (0.007)	-0.232*** (0.007)	-0.022*** (0.000)
Other Voucher Receipt	-0.221*** (0.003)	-0.267*** (0.003)	-0.028*** (0.000)
Public Housing	-0.276*** (0.002)	-0.315*** (0.002)	-0.022*** (0.000)
Observations	1,520,178	1,548,892	1,562,343
R-squared	0.175	0.181	0.089

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample includes only those students who are observed in third grade at some point between 2005 and 2011. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher Receipt are mutually exclusive. Public Housing Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in Public Housing. Attendance Rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects.

Table 3. Probability of Receiving Voucher, Voucher Sample, Grades 3-8, Academic Years 2005-2011

	Start Voucher Receipt (1)	Start Voucher Receipt and Other Voucher Receipt (2)
ELA (t-1)	0.013 (0.008)	0.019*** (0.007)
MATH (t-1)	0.003 (0.009)	0.004 (0.007)
Attendance (t-1)	-0.108 (0.102)	-0.129 (0.084)
Free Lunch (t-1)	-0.034 (0.037)	-0.020 (0.030)
Reduced Price Lunch (t-1)	-0.042 (0.041)	0.012 (0.033)
Missing Lunch (t-1)	-0.507 (0.446)	-0.608* (0.313)
Recent Immigrant (t-1)	0.068* (0.038)	0.079** (0.035)
Special Education (t-1)	0.020 (0.027)	0.009 (0.023)
Limited English Proficient (t-1)	0.080*** (0.026)	0.059** (0.023)
Observations	10,218	17,595
Number of Unique Students	4,540	8,460
R-squared	0.776	0.751
Student FE	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample includes students that are observed in third grade at one point between 2005 and 2011, that receive a voucher in this time period and who have at least one observation for the years before receiving a voucher. Children are dropped from the analysis in the year after receiving a voucher. The outcomes variable Start Voucher receipt is an indicator equal to one for the first year a student's family is identified as a new admission in the voucher program. The outcome variable Start Voucher Receipt and Other Voucher Receipt is an indicator equal to one for the first year a student's family receives a voucher (Voucher Receipt and Other Voucher Receipt are merged into one category). All models include controls for grade, borough and year effects.

Table 4. Vouchers and Student Performance, Voucher Sample, Grades 3-8, AY 2005-2011

Variables	ELA (1)	MATH (2)	ATTENDANCE (3)
Voucher Receipt	0.058*** (0.008)	0.048*** (0.008)	-0.000 (0.001)
Other Voucher Receipt	0.015* (0.009)	0.022** (0.009)	0.003*** (0.001)
Observations	135,636	137,493	138,848
R-squared	0.705	0.736	0.671
Student FE	X	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample includes only those students who are observed in third grade at some point between 2005 and 2011 and who receive a voucher at some point during this time period. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher Receipt are mutually exclusive. Attendance Rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving a voucher, but will receive one in the future.

Table 5. Vouchers and Student Performance, Housing Assistance Sample, Grades 3-8, Academic Years 2005-2011

	ELA (1)	MATH (2)	ATTENDANCE (3)
Voucher Receipt	0.068*** (0.008)	0.049*** (0.007)	-0.000 (0.001)
Other Voucher Receipt	0.020** (0.008)	0.018** (0.008)	0.003*** (0.001)
Public Housing	0.028*** (0.006)	0.031*** (0.006)	0.005*** (0.001)
Observations	308,821	312,734	315,889
R-squared	0.709	0.743	0.669
Student FE	X	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample includes only those students who are observed in third grade at some point between 2005 and 2011 and who receive housing assistance at some point during this time period. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher Receipt are mutually exclusive. Public Housing Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in Public Housing. Attendance Rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students whose households will receive some form of housing assistance in the future.

Table 6. New Voucher and Student Performance, Voucher Sample, Grades 3-8,
Academic Year 2005-2011

	ELA (1)	MATH (2)	ATTENDANCE (3)
New Voucher	0.039*** (0.006)	0.036*** (0.006)	0.001 (0.001)
Observations	135,636	137,493	138,848
Unique students			
R-squared	0.705	0.736	0.671
Student FE	X	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample includes those students who are observed in third grade at some point between 2005 and 2011 and who receive a voucher at some point during this time period. New voucher combines voucher receipt and other voucher receipt into one variable. More precisely, new voucher is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program or a student is first observed living in a voucher household. Attendance rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving a voucher, but will receive one in the future.

Table 7 Vouchers and Student Performance, Vouchers Sample, Grades 3-8, Academic Year 2005-2011, Placebo Test

	ELA (1)	MATH (2)	ATTENDANCE (3)
Random New Admission	0.002 (0.005)	-0.007 (0.005)	-0.001 (0.001)
Voucher Receipt	0.034 (0.024)	0.016 (0.024)	0.002 (0.002)
Observations	135,954	137,814	139,171
Unique students			
R-squared	0.705	0.736	0.671
Student FE	X	X	X

Standard errors in parentheses , *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample includes students that are observed in third grade at some point between 2005 and 2011 and who receive a housing voucher at some point during this time period. Random New Admission is an indicator equal to one for the first year and all the following years after a random year of voucher receipt is assigned to the student. The first year was randomly chosen. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. New Admission and Voucher receipt are mutually exclusive: Students identified as New Admissions are never identified as Voucher Recipients. Attendance Rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects.

Table 8. Vouchers and Student Performance by Gender, Grades 3-8, Academic Years 2005-2011

Variables	Voucher Only Sample			Housing Assistance Sample		
	ELA (1)	MATH (2)	ATTEND (3)	ELA (4)	MATH (5)	ATTEND (6)
Voucher Receipt (VR)	0.072*** (0.011)	0.061*** (0.011)	0.000 (0.001)	0.076*** (0.011)	0.057*** (0.011)	-0.000 (0.001)
VR * Female	-0.026 (0.016)	-0.025 (0.016)	-0.001 (0.002)	-0.016 (0.015)	-0.016 (0.015)	0.001 (0.002)
Other VR	-0.004 (0.012)	0.003 (0.012)	0.001 (0.001)	-0.004 (0.012)	-0.004 (0.012)	0.001 (0.001)
Other VR * Female	0.037** (0.017)	0.037** (0.017)	0.003 (0.002)	0.046*** (0.017)	0.044*** (0.016)	0.004** (0.002)
Public Housing				0.026*** (0.009)	0.025*** (0.009)	0.005*** (0.001)
Public Housing * Female				0.004 (0.012)	0.012 (0.012)	0.000 (0.001)
Observations	135,636	137,493	138,848	308,821	312,734	315,889
R-squared	0.706	0.737	0.710	0.672	0.743	0.669
Student FE	X	X	X	X	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample only includes students that are observed in third grade at some point between 2005 and 2011.

For columns 1-3 the sample is further limited to children who receive vouchers at some point during this time period and for columns 4-6 it is limited to those who receive housing assistance at some point during this time period.

Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher Receipt are mutually exclusive. Public Housing Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in public housing. Female is an indicator equal to one if a student is female. All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving housing assistance, but will receive it in the future.

Table 9. Vouchers and Student Performance by Timing of Housing Assistance, Grades 3-8, Academic Years 2005-2011

Variables	Voucher Only Sample			Housing Assistance Sample		
	ELA (1)	MATH (2)	ATTEND (3)	ELA (4)	MATH (5)	ATTEND (6)
Voucher Receipt (VR)	0.067*** (0.011)	0.044*** (0.011)	0.002* (0.001)	0.073*** (0.011)	0.046*** (0.011)	0.003** (0.001)
VR * Middle	-0.016 (0.015)	0.007 (0.015)	-0.005*** (0.002)	-0.011 (0.015)	0.005 (0.015)	-0.006*** (0.002)
Other VR	0.007 (0.011)	0.023** (0.011)	0.003** (0.001)	0.011 (0.010)	0.019* (0.010)	0.003*** (0.001)
Other VR * Middle	0.022 (0.017)	-0.004 (0.017)	-0.001 (0.002)	0.027 (0.017)	-0.003 (0.017)	-0.001 (0.002)
Pub Housing				0.039*** (0.008)	0.040*** (0.008)	0.008*** (0.001)
Pub Housing * Middle				-0.025** (0.012)	-0.019 (0.012)	-0.007*** (0.001)
Observations	135,636	138,848	137,493	312,734	308,821	315,889
R-squared	0.706	0.710	0.737	0.743	0.672	0.669
Student FE	X	X	X	X	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample only includes students who are observed in third grade at some point between 2005 and 2011.

For columns 1-3 the sample is further limited to children who receive vouchers at some point during this time period and for columns 4-6 it is limited to those who receive housing assistance at some point during this time period.

Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher Receipt are mutually exclusive. Public Housing Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in public housing. Middle is an indicator equal to one if the student received Voucher/Public Housing for the first time in grades 6-8. All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving housing assistance, but will receive it in the future.

Table 10. Vouchers and Student Performance by Race/Ethnicity, Grades 3-8, AY 2005-2011

Variables	Voucher Only Sample			Housing Assistance Sample		
	ELA (1)	MATH (2)	ATTEND (3)	ELA (4)	MATH (5)	ATTEND (6)
Voucher Receipt (VR)	0.004 (0.012)	-0.001 (0.013)	0.004*** (0.001)	0.012 (0.012)	-0.003 (0.012)	0.004*** (0.001)
VR * Hispanic	0.078*** (0.015)	0.061*** (0.015)	-0.007*** (0.002)	0.080*** (0.015)	0.064*** (0.015)	-0.007*** (0.002)
VR*White/Asian	0.140*** (0.029)	0.198*** (0.029)	-0.001 (0.003)	0.139*** (0.029)	0.202*** (0.029)	-0.001 (0.003)
Other VR	-0.006 (0.011)	0.011 (0.012)	0.005*** (0.001)	-0.001 (0.011)	0.006 (0.011)	0.005*** (0.001)
Other VR * Hispanic	0.039*** (0.014)	0.019 (0.014)	-0.004*** (0.001)	0.039*** (0.014)	0.021 (0.014)	-0.004*** (0.001)
Other VR*White/Asian	0.022 (0.026)	0.010 (0.026)	0.001 (0.003)	0.022 (0.026)	0.012 (0.026)	0.001 (0.003)
Public Housing				0.005 (0.009)	0.006 (0.009)	0.008*** (0.001)
Pub. Housing *Hispanic				0.031*** (0.011)	0.024** (0.011)	-0.005*** (0.001)
Pub. Housing*White/Asian				0.059*** (0.016)	0.115*** (0.016)	-0.002 (0.002)
Observations	135,636	137,493	138,848	308,821	312,734	315,889
Unique students	32,671	32,707	32,730	74,930	74,453	74,499
R-squared	0.705	0.736	0.672	0.709	0.743	0.669
Student FE	X	X	X	X	X	X

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Notes: This sample only includes students who are observed in third grade at some point between 2005 and 2011. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher Receipt are mutually exclusive. Public Housing Receipt is an indicator equal to one for the first year and all the following years after a student's family is observed living in Public Housing. Hispanic is an indicator equal to one if a student is white. White/Asian is an indicator equal to one if a student is white or Asian. All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving a voucher or public housing, but will receive housing assistance in the future.

Table 11. Vouchers and Student Performance by Housing Mobility, Vouchers Sample, Grades 3-8, Academic Years 2005-2011

	ELA (1)	MATH (2)	ATTENDANCE (3)
<i>Voucher Receipt</i>			
Move First Year	0.070*** (0.011)	0.053*** (0.011)	-0.001 (0.001)
Move after First Year	0.043** (0.017)	0.039** (0.017)	-0.001 (0.002)
Lease in Place	0.044*** (0.014)	0.038*** (0.014)	0.001 (0.001)
<i>Other Voucher Receipt</i>			
Move First Year	0.052*** (0.019)	-0.004 (0.019)	0.010*** (0.002)
Move after First Year	-0.048*** (0.018)	0.018 (0.018)	-0.002 (0.002)
Lease in Place	0.024** (0.011)	0.029*** (0.011)	0.001 (0.001)
Observations	135,636	137,493	138,848
R-squared	0.705	0.736	0.672
Student FE	X	X	X

Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes: This sample only includes students who are observed in third grade at one point between 2005 and 2011 and receive a voucher at some point during this time period. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher receipt are mutually exclusive. Move First Year is an indicator equal to 1 if the student moves to a different building in the same year as receiving a voucher and for all following years. Moves Later is an indicator equal to one if the student first moves to a different building in any year after receiving a voucher. To be clear, this is equal to 1 in the year a student first receives a voucher and for all following years. Lease in Place is an indicator equal to one if the student did not move buildings in any year after receiving a voucher. This is equal to one in the year a student first receives a voucher and for all following years. We also control for students who received a voucher but for whom there is missing information on building of residence in the year prior to voucher receipt. Attendance Rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving a voucher, but will receive one in the future.

Table 12. Neighborhood Characteristics. Vouchers Sample, Grades 3-8, Academic Years 2005-2011

VARIABLES	Voucher Receipt	Other Voucher	R-squared	Student FX
Median Income	808***	-78	0.81	X
	(185.86)	(152.46)		
Poverty Rate (12 months)	-0.01***	-0.00	0.83	X
	(0.00)	(0.00)		
High Poverty Rate	-0.02***	-0.00	0.80	X
	(0.01)	(0.00)		
Extreme Poverty Rate	-0.00	-0.00	0.81	X
	(0.01)	(0.00)		
Asian	-0.00	-0.00	0.85	X
	(0.00)	(0.00)		
Other-Multiracial	-0.02***	-0.00***	0.90	X
	(0.00)	(0.00)		
White	-0.01***	-0.00	0.85	X
	(0.00)	(0.00)		
Black	0.03***	0.01***	0.88	X
	(0.00)	(0.00)		
Observations	131,677			

Note: This sample only includes students who are observed in third grade at some point between 2005 and 2011, who receive a voucher at some point during this time period and for whom information on all tract-level outcome variables is available. All models include student fixed effects and include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. High poverty rate is an indicator equal to 1 if the tract poverty rate is at least 20%. Extreme poverty rate is an indicator equal to 1 if the tract poverty rate is at least 40%. Poverty Rate and Race indicators are measured in a (0-1) range. Standard errors are clustered by tract and year.

Table 13. Vouchers and Student Performance by School Mobility, Vouchers Sample, Grades 3-8, Academic Years 2005-2011

Variables	ELA (1)	MATH (2)	ATTENDANCE (3)
<i>Voucher Receipt</i>			
School Move First Year	0.054*** (0.012)	0.029** (0.012)	-0.002* (0.001)
School Move Later	0.053*** (0.014)	0.038*** (0.014)	-0.003* (0.001)
No School Move	0.069*** (0.013)	0.079*** (0.013)	0.004*** (0.001)
<i>Other Voucher Receipt</i>			
School Move First Year	0.022 (0.016)	-0.020 (0.016)	-0.002 (0.002)
School Move Later	-0.003 (0.013)	0.009 (0.013)	0.001 (0.001)
No School Move	0.034** (0.015)	0.075*** (0.015)	0.008*** (0.002)
Observations	135,636	137,493	138,848
R-squared	0.705	0.736	0.672
Student FE	X	X	X

Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes: This sample only includes students who are observed in third grade at one point between 2005 and 2011 and who receive a voucher at some point during this time period. Voucher Receipt is an indicator equal to one for the first year and all the following years after a student's family is identified as a new admission in the voucher program. Other Voucher Receipt is an indicator equal to one for the first year and all the following years after a student is first observed living in a voucher household. Voucher Receipt and Other Voucher receipt are mutually exclusive. School Move First Year is an indicator equal to 1 if the student moves to a different school in the same year as receiving a voucher and for all following years. School Move Later is an indicator equal to one if the student first moves to a different school in any year after receiving a voucher. To be clear, this is equal to 1 in the year a student first receives a voucher and for all following years. No school move is an indicator equal to one if the student did not move schools in any year after receiving a voucher. This is equal to one in the year a student first receives a voucher and for all following years. We also control for students who received a voucher but for whom there is missing information on building of residence in the year prior to voucher receipt. Attendance Rate is coded as a proportion (0-1). All models include controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. The comparison group is students who are not currently receiving a voucher, but will receive one in the future.

Table 14. School Characteristics. Vouchers and Student Performance, Vouchers Sample, Grades 3-8, Academic Years 2005-2011

	Voucher Receipt	Other Voucher Receipt	R-squared	Student FX
Title I status	-0.01**	0.010***	0.58	X
	(0.00)	(0.00)		
Attendance rate	0.014***	0.006**	0.49	X
	(0.003)	(0.003)		
Share Asian	-0.002	0.000	0.84	X
	(0.001)	(0.001)		
Share Black	0.016***	0.000	0.89	X
	(0.002)	(0.002)		
Share Hispanic	-0.016***	-0.000	0.90	X
	(0.002)	(0.002)		
Share White	0.002	-0.000	0.82	X
	(0.001)	(0.001)		
Share Female	-0.001*	-0.000	0.45	X
	(0.001)	(0.001)		
Share Immigrants	-0.0004	-0.000	0.68	X
	(0.07)	(0.001)		
Share LEP	-0.017***	-0.004***	0.80	X
	(0.001)	(0.001)		
Share Special Ed.	0.004***	-0.000	0.62	X
	(0.001)	(0.001)		
Share Free Lunch	-0.005**	0.001	0.62	X
	(0.002)	(0.002)		
Share Reduced Priced Lunch	0.002***	0.001*	0.66	X
	(0.001)	(0.001)		
Share passing math	0.008***	0.007***	0.80	X
	(0.002)	(0.002)		
Share passing ELA	0.004**	0.006***	0.82	X
	(0.002)	(0.002)		
Enrollment	8.00	9.06*	0.65	X
	(5.64)	(4.75)		

Share advanced math	0.004**	0.004***	0.71	X
	(0.002)	(0.001)		
Share advanced on ELA	0.000	0.000	0.71	X
	(0.001)	(0.001)		
Observations	128,688			

Notes: This sample only includes students that are observed in third grade at some point between 2005 and 2011, who receive a voucher at some point during this time period and for whom information of all outcome variables is available. All models include student fixed effects and controls for free lunch eligibility, LEP, SPED, not speaking English at home, grade, borough and year effects. All outcome variables are measured as proportions (0-1) except for student enrollment. Standard errors are clustered by school and year.