NYU Furman Center

WORKING PAPER

Why Don't Housing Choice Voucher Recipients Live Near Better Schools? Insights from Big Data

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June 2016

furmancenter.org

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Abstract

Housing Choice Vouchers provide low-income households with additional income to spend on rental housing in the private market. The assistance vouchers provide is substantial, offering the potential to dramatically expand the neighborhoods—and associated public schools—that low-income households can reach. However, existing research on the program suggests that housing choice voucher holders live in neighborhoods with schools that are no better than those accessible to other households with similar incomes. Households, in other words, do not seem to spend the additional income provided by the voucher to access better schools.

In this analysis we rely on a large-scale administrative dataset to explore why voucher households typically do not live near to better schools, as measured by school-level proficiency rates. We combine confidential administrative data from the Department of Housing and Urban Development on 1.4 million housing choice voucher holders in 15 states, with school-level data from 5,841 different school districts, to examine why the average housing voucher holder does not live near to higher performing schools than otherwise similar households without vouchers. Specifically, we use the large-scale administrative dataset to test whether voucher holders living in areas with good schools nearby and slack housing markets move towards better schools when schools become salient for them—that is, when their oldest child becomes school eligible. We take advantage of the thick sample of households with young children provided through our administrative data to implement both a household fixed effects and a regression discontinuity design. Together these analyses shed light on whether voucher households are more likely to move towards better schools when schools are most relevant, and how market conditions shape that response.

We find that families with vouchers are more likely to move toward a better school in the year before their oldest child meets the eligibility cut-off for kindergarten, suggesting salience matters. Further, the magnitude of the effect is larger in metropolitan areas with a relatively high share of affordable rental units located near high-performing schools and in neighborhoods in close proximity to higher-performing schools. Results suggest that, if given the appropriate information and opportunities, more voucher families would move to better schools when their children reach school age.

Keywords: Housing Choice Vouchers; School access; Residential mobility; Big data; Regression discontinuity

JEL Codes: R23; R28; I38

Special thanks to:

We would like to acknowledge the John D. and Catherine T. MacArthur Foundation and United States Department of Housing and Urban Development for their generous support of and provision of data for this project. The contents of this report are solely the responsibility of the authors and do not necessarily represent the official views of the funding organizations. We would also like to thank Rob Collinson for exceptional research assistance.

This paper is forthcoming in the Journal of Policy Analysis and Management

INTRODUCTION

Housing choice vouchers provide low-income households with additional income to spend on rental housing in the private market. The assistance vouchers provide is substantial, offering the potential to dramatically expand the neighborhoods—and associated public schools—that low-income households can reach.[i] However, existing research on the program suggests that housing choice voucher holders live in neighborhoods with schools that are no better than those accessible to other households with similar incomes (Horn, Ellen, & Schwartz, 2014). Households, in other words, do not seem to spend the additional income provided by the voucher to access better schools. In this analysis we rely on a large-scale administrative dataset to explore why voucher households typically do not live near to better schools, as measured by school-level proficiency rates. As the housing choice voucher program is the largest federal housing program, with annual appropriations of roughly $19 billion, understanding the underlying reasons for these locational patterns is critical for policy.

We combine confidential administrative data from the Department of Housing and Urban Development on 1.4 million housing choice voucher holders in 15 states, with school-level data from 5,841 different school districts, to examine why the average housing voucher holder does not live near to higher performing schools than otherwise similar households without vouchers. This combined dataset offers three key advantages. First, because the dataset relies on regularly collected administrative records, we can easily track families over time and examine mobility patterns through the course of their tenure in the voucher program. Second, unlike the small samples that are generally observed under experimental settings, this sample is large enough to allow for analysis of important subgroups, such as families whose oldest child is just reaching

school age. Finally, this large dataset allows us to study voucher holder choices in multiple market contexts.

Specifically, we use the large-scale administrative dataset to test whether voucher holders living in areas with good schools nearby and slack housing markets move towards better schools when schools become salient for them—that is, when their oldest child becomes school eligible. We take advantage of the thick sample of households with young children provided through our administrative data to implement both a household fixed effects and a regression discontinuity design. The household fixed effects approach allows us to examine how the residential choices of families change when their children reach school age and tests whether that shift is different from that observed for similar families whose oldest child has not yet become eligible for school. To implement a regression discontinuity approach, we focus on families with children who are between the ages of 4 to 6, and compare the mobility of households whose oldest child has just met the kindergarten eligibility cutoff date to those who have just missed this cutoff.[ii] Together, these shed light on whether voucher households are more likely to move towards better schools when schools are most relevant, and how market conditions shape that response.

In particular, we test whether impacts vary across local housing markets and school contexts, exploring the extent to which family choices are limited by tight housing markets or the distance to better schools. We find that families with vouchers are more likely to move toward a better school in the year before their oldest child meets the eligibility cut-off for kindergarten, suggesting salience matters. Further, the magnitude of the effect is larger in metropolitan areas with a relatively high share of affordable rental units located near high-performing schools and in neighborhoods in close proximity to higher-performing schools. To be sure, the effects we find are not large, but they suggest that voucher holders do, indeed, move toward better schools when

schools are salient and accessible. Further, results suggest that, if given the appropriate information and opportunities, more voucher families would move to better schools when their children reach school age.

This paper proceeds as follows. The next section includes background about the housing choice voucher program, reviews the relevant literature and describes our theoretical framework. The following sections explain our measures and data, present results, and conclude with a discussion of the implications of this work for policy as well as the advantages of relying on large-scale administrative datasets to inform policy decisionmaking.

BACKGROUND

Congress created the Section 8 Existing Housing Certificate program (now the Housing Choice Voucher Program) in 1974. Representing a shift away from the government's historic focus on place-based affordable housing, the tenant-based program awarded vouchers to tenants to rent units on the private market. The basic structure of the program has remained the same over the years, with the voucher paying the difference between 30 percent of a household's income and the rent, up to a specified local payment standard, anchored to the area Fair Market Rent (FMR), which the Department of Housing and Urban Development (HUD) determines for each metropolitan area. Today, the federal government spends approximately 19 billion dollars annually to provide assistance to approximately 2.2 million households, which include over 2.5 million children.[iii] To receive a voucher, households apply to a local Public Housing Authority (PHA), which certifies that the household's income does not exceed the eligibility threshold of 80 percent of the area median income (AMI). In practice, most voucher holders have far lower

incomes, typically at or below the poverty line, as PHAs are required to award 75 percent of their vouchers to households whose incomes do not exceed 30 percent of AMI.

One of the original motivations for establishing portable or "people-based" housing subsidies was their potential to afford low-income families the opportunity to live in neighborhoods with better schools and greater opportunities for economic advancement. Recent research by Chetty and Hendren (2015) and Chetty, Hendren and Katz (2015) highlights the importance of neighborhood and school quality in a household's long-term earnings trajectory. Existing evidence on the locational outcomes for voucher households suggests some modest success in achieving this potential. On average, voucher holders live in less disadvantaged neighborhoods than the residents of public or other HUD-assisted housing (Devine et al., 2003; Hartung & Henig, 1997; Kingsley et al., 2003; Pendall 2000) and also in slightly less disadvantaged neighborhoods than the average poor household (Galvez, 2011; Pendall, 2000; Wood, Turnham & Mills, 2008). That said, voucher holders still live in very disadvantaged neighborhoods, with higher poverty rates than the neighborhoods surrounding developments subsidized through the Low Income Housing Tax Credit, now the largest federal vehicle for low-income housing production (McClure, 2006).[iv]

Only a few studies have focused on access to schools. Analyses of the Gautreaux program in Chicago (which gave low-income, black households living in public housing vouchers and invited them to move into privately-owned apartments either in predominantly white suburbs or in more racially mixed, and typically lower income, areas in the city) show that, on average, students who moved to largely white suburbs attended schools that were much higher-performing and had significantly lower poverty rates than those attended by students who remained in Chicago (Kaufman & Rosenbaum, 1992; Rosenbaum, 1995). In contrast, research

on the Moving To Opportunity (MTO) demonstration program (which randomly assigned low-income families in distressed public housing to an experimental group that received a voucher that could only be used in a low-poverty neighborhood, a comparison group that received a voucher with no restrictions, or a control group that received no additional assistance) finds that households in the experimental group attended schools that were substantially similar to those attended by households in both of the control groups (Sanbonmatsu et al, 2006). While these demonstration programs have helped to answer many critical policy questions, neither sheds much light on whether the broader set of families (not just those living in distressed public housing) who receive conventional, unrestricted vouchers use them to move to better schools.

A few studies have focused on access to schools for the full set of households utilizing housing choice vouchers. Using data on six metropolitan areas, Deng (2007) finds that the average voucher holder lived near to a lower-performing school than the average renter household in the same metropolitan area. More recently, using a national census of voucher holders with children, Horn, Ellen, and Schwartz (2014) find that, on average, voucher holders lived near to lower-performing schools than both other renter households and other poor households in the same metropolitan statistical area. In other words, it appears that voucher holders do not, on average, use their vouchers to reach better schools. These analyses, however, rely on comparison households who may not be truly comparable to voucher holders. Even the typical poor household may not be as disadvantaged as voucher holders given the long waitlists associated with receipt of a voucher.

That said, Jacob, Kapustin and Ludwig (2015) use experimental data from a Chicago housing lottery available to the full set of low-income households in Chicago and find that households who randomly received a voucher offer through a housing assistance lottery did not

attend any better schools relative to control group households not offered a voucher. This recent result suggests that selection may not be a major threat. Their experimental analysis, however, is limited to the city of Chicago. To test whether this finding was generalizable to other cities, we conducted a similar analysis using data from HUD's Welfare-to-Work Housing Voucher Experiment (WtWV), which randomly assigned offers of a housing voucher to 4,690 households on voucher waiting lists in six cities: Atlanta, Augusta, Fresno, Houston, Los Angeles and Spokane in the years 2000 and 2001. The dataset follows 8,590 households for over 18 quarters after initial randomization of voucher offers and identifies the census tract in which they live in each quarter. We then link each household to measures of the performance (proxied by proficiency rates from the 2003-2004 school year) of its nearest school (measured using Euclidian distance) and observe whether households use their voucher to reach higher-performing schools. These experimental results confirm that, on average, voucher holders do not use their vouchers to reach higher-performing schools, consistent with the findings of Jacob, Kapustin, and Ludwig (2015) for Chicago. Further, these results suggest that earlier non-experimental findings that voucher holders generally do not live in neighborhoods with high-performing schools were not driven by selection bias or the unobserved disadvantage level of voucher holders.[v]

One possible explanation is that voucher households, given their many pressing needs, do not prioritize good schools. They may instead use their subsidy to move out of over-crowded living situations (Wood et al., 2008), write down rent burdens, find larger, higher quality homes (Mills et al., 2006; Rosenblatt & DeLuca, 2012), relocate to neighborhoods with lower crime (Lens, Ellen, & O'Regan, 2011), or satisfy other household demands. Certainly voucher holders without school-age children have little motivation to consider school quality in location

decisions. And the long waiting lists for vouchers may, in practice, mean that many voucher holders receive their vouchers after their children have already started school. These voucher holders with children who are already enrolled in school at the time of voucher receipt have to weigh the potential benefits of a new neighborhood against the potential negative effect of school mobility (Chetty, Hendren & Katz, 2015; DeLuca & Rosenblatt, 2010). Thus, only a subset of households are likely to be motivated by a voucher to move toward better schools: those with young children starting school soon.

The experimental data offer too small a sample size to allow us to explore this variation. Instead, we utilize our large scale administrative data and our thick sample of households with children who are about to become school eligible to examine whether voucher families whose oldest child just met the school eligibility cutoff age in their state are more likely to move towards a higher-performing school than are households whose oldest child has just missed the eligibility cutoff.

That said, even if motivated to move to neighborhoods with better schools, voucher holders may still face a number of constraints in doing so. Perhaps most obviously, voucher holders initially have only a narrow window of time (federally mandated to provide at least 60 days though some PHAs provide additional time) to find a suitable apartment and thus may settle for an acceptable housing unit that reduces their rent burden in the short-run (Devine et al, 2003; Rosenblatt & DeLuca, 2012). As a result, we focus on second and subsequent moves by voucher holders, which would be made under less immediate time pressure. There is some evidence that voucher households use these later moves to reach neighborhoods with improved amenities. For example, Eriksen and Ross (2013) examine data from the WtWV experiment and find that while voucher holders initially moved to homes in neighborhoods very similar to their original

communities, as measured by poverty rates, they tended to move towards lower poverty neighborhoods after a few quarters in the program. Similarly, Feins and Patterson (2005) examine geographic mobility patterns of families with children who entered the housing choice voucher program between 1995 and 2002 and find that families who moved after entering the voucher program chose neighborhoods that were slightly less disadvantaged than original neighborhoods, as measured by concentrations of poverty and the owner occupancy rate.

Of course, families may still face difficulties in moving to neighborhoods with higher-performing schools. For some, gaining access to a higher-performing school may require a long distance move. Indeed, they may not even know about these better schools if they are located too far away. Research by Hastings and Weinstein (2008) examines school selection by low-income families, and finds that proximity to a high-scoring school is a key predictor of both the likelihood a family will respond to new information by choosing an alternative school and the ultimate proficiency rate of the school chosen. In this paper we examine whether households move towards higher-performing schools when they have such schools nearby.

Another potential obstacle is the housing market. While voucher holders are free to rent apartments on the private market, HUD will only subsidize rents up to the locally-specified payment standard, which is set at or close to the FMR.[vi] In some markets, such low-cost apartments will be very hard to find and may be concentrated near to lower-performing schools.

In order to examine the importance of such constraints, we leverage our large panel dataset, which spans 5,841 school districts in 424 Core-Based Statistical Areas (CBSAs),[vii] to compare mobility patterns across these different contexts. First, we examine whether voucher holders who live near other high-performing schools are more likely to move to neighborhoods with better schools when schools become salient to them. Second, we test whether voucher

holders are more apt to move towards better schools when there are housing units renting below the FMR near to those schools.

DATA AND MEASURES

Our basic approach is to link data on the residential location of voucher holders to data describing the characteristics of the local public elementary schools that are accessible to them. Below we provide more information about our data sources, definitions, and key measures.

Assisted Households

We rely on the Department of Housing and Urban Development's internal assisted housing dataset, which includes information about all voucher holders in the country between 2003 and 2012, to track residential mobility. Our sample includes voucher holders in 15 states, with a total of approximately 1.4 million voucher households, in each of our sample years, in 424 CBSAs across the country. We focus on large states where proficiency data are available for the majority of the years in our sample period. We are also careful to include representation from all four regions of the country. Our final sample includes households in Arizona, California, Florida, Illinois, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, and Texas.

This dataset provides information about each household in the voucher program at every income recertification, which is required annually as well as each time a household moves. The dataset includes each household's address at the time of income recertification as well as a wide

range of household attributes, including a household's wage income, its number of adults, the number of children in the household and their ages, the number of years a household has had a housing voucher, and an indicator for whether the household has moved since its previous income certification. This dataset, however, does not include information on where households lived before entering the housing choice voucher program.

Table 1 shows the geographic distribution and household characteristics of each unique housing voucher household in our 15-state administrative data sample. The first column shows descriptive characteristics for the full sample of voucher households, the second voucher households with children, the third shows those whose oldest child is not yet school age, or has a child between the ages 0 and 6 and the fourth includes our narrowest sample, those with children between the ages of 4 and 6.

As shown, voucher households have very low incomes and are disproportionately black. The typical household has been in the voucher program for three years. Just over half of voucher holders have children, and over 70 percent are headed by a single woman. About one in ten voucher holders moves each year. The set of voucher households with young children have much younger household heads than other voucher holders and slightly higher mobility rates (16 percent vs. 14 percent).

[Insert Table 1 here]

Schools

Capturing the quality of a school is challenging. Ideally, we would obtain information about teacher qualifications and skills, extra-curricular offerings, students' sense of comfort and safety in the school and some measure of how much students learn. Such data are, unfortunately,

unavailable for the full set of schools in our study. Following previous research, we rely on proficiency rates as a summary measure of school performance or quality.[viii] We also supplement the test performance data with measures of school resources and the composition of the student body to examine whether households move towards schools with higher funding and more advantaged students. We focus on elementary schools because of the strong tie between the location of a family's home and the elementary school their children attend, reflecting the widespread reliance upon geographic attendance zones for elementary school assignments. (Middle and high school assignment policies often allow more choice.)

School data are drawn from three different sources. First, we use the Common Core of Data to select our sample. We limit our sample to schools that have at least seven students in the 4th grade, to ensure we are capturing only elementary schools. We create a panel of 4th grade test performance for elementary schools around the country from two other key data sources, the National Longitudinal School-Level State Assessment Database (NLSSAD) for the years 2001-2002 through 2004-2005 and Great Schools for 2005-2006 through 2010-2011.[ix] Our key variable of school performance is the average of the share of 4th graders testing proficient in math and the share proficient in reading.[x] In order to make proficiency rates comparable across states, we convert these average proficiency rates into Z-scores for the state.[xi] We merge these data with our sample of schools from the Common Core of Data to obtain information on the location of each elementary school, its teacher/pupil ratio, the share of students eligible for free-lunch, and the share that are black and Hispanic. Finally, we utilize data on the state's school eligibility cutoff date, or the date by which a student must be 5 years old so that they can begin kindergarten, to create our comparison groups (Bedard & Dhuey, 2006).

Data Construction

For each household in our two voucher datasets, we determine the elementary school within the boundaries of its school district that is nearest to its home, measured using Euclidian distance, as well as the two that are second closest. While ideally we would link each household to the schools its children actually attend, we cannot identify the school that each of the children in these households attends nor the specific elementary school for which each is zoned to attend on such a large scale.

To test the accuracy of our nearest school method, we compare the actual zoned school to the nearest school for voucher holders in 13 metropolitan areas for which we have information on the elementary school attendance zone boundaries.[xii] We find that for 64 percent of all voucher households, the nearest school within the district is in fact their zoned school. For the remaining 36 percent, the differences between the zoned and nearest schools are substantively unimportant. The nearest schools have slightly lower proficiency rates (approximately 1 to 2 percentage points lower), slightly lower teacher-pupil ratios (approximately 0.2 fewer children per teacher), and slightly higher poor and minority shares (1 percent more black students, 2 percent more Hispanic students and 3 percent more students eligible for free and reduced-price lunch). Thus, the nearest school meaningfully captures the characteristics of an elementary school that the children in a household can attend.

We combine these into one large dataset, covering the universe of voucher holders in 15 states. To do so, we link data on voucher households to information about local elementary schools, for each year in our sample. For example, we link households in 2003 to the 2002-2003 proficiency rate for their nearest elementary school. This allows us to examine the performance of the school nearest to each voucher family.

EMPIRICAL APPROACH AND RESULTS

We begin by examining how the likelihood a voucher holder moves towards a better school changes when schools become most salient to them—that is, when their oldest child becomes eligible for Kindergarten. Specifically, we estimate the following empirical model:

$$MBSch_{imt} = \alpha + \beta_1 AgeOldestChild_{imt} + \beta_2 HH_{imt} + \eta HHFE_i + \gamma YRFE_t + \varepsilon_{imt} \quad (1)$$

where *i* indexes the household, *m* the CBSA and *t* the year. $MBSch_{imt}$ indicates whether household *i* in CBSA *m* moved to a better school between year *t*-1 and *t* (i.e., the proficiency rate of the school nearest to a family's location at time *t* is higher than that at their location at time *t*-1).[xiii] $AgeOldestChild_{imt}$ represents a series of dummy variables, for pre-school-aged children (0 to 4), young elementary school-aged children (5 to 8), older elementary school-aged children (9 to 11), middle school-aged children (12 to 14) and high school-aged children (15 to 18). Households without children are the omitted group. HH_{imt} is vector of time-varying household-level characteristics, specifically wage income, number of adults and number of children. We also include individual household fixed effects (HHFE) and year fixed effects (YRFE).[xiv] Table 2 presents the results of this simple descriptive regression and shows that households with children of any age are more likely to move to a better school than those without children, and that the probability is highest for households with young elementary school-aged children, and declines as household's oldest child approaches middle and high school.

[Insert Table 2 here]

To isolate the impact of school salience on voucher households' residential decision, we use state-specific, kindergarten eligibility cutoffs to compare the residential choices of households with an oldest child who has just met the cutoff, i.e., is now eligible for kindergarten, to the choices of households with children of similar ages who are not eligible to start school in that year. This allows us to compare the mobility rates of families with children of a similar age, so our results will not be biased by any lifecycle shifts in residential patterns related to children's ages that are independent of school eligibility. For this portion of the analysis we rely on a sub-sample of voucher holders, focusing only on families with children under the age of 7. Our regression equation is as follows:

$$MBSch_{imt} = \alpha + \beta_1 EligCutoff_{imt} + \beta_2 HH_{imt} + \eta HHFE_i + \gamma YRFE_t + \varepsilon_{imt} \quad (2)$$

Where $MBSch_{imt}$ indicates whether a household moved to a neighborhood with a better school over the previous year, and HH_{imt} represents a vector of time-varying household characteristics, as before.[xv] The independent variable of interest is $EligCutoff_{imt}$, which is a dummy indicating whether a student was above age 5 and under age 6 on the state cutoff date for kindergarten eligibility for this academic year, i.e., the child is eligible to start kindergarten in the current school year.[xvi] A positive and significant coefficient on $EligCutoff_{imt}$ indicates that families are more likely to move to better schools in the year before their oldest child becomes eligible for kindergarten.

As shown in Figure 1, as a household's oldest child approaches school age, the likelihood that a family moves towards a neighborhood with a higher-performing school increases. We observe a bump up in this likelihood when the oldest child becomes school eligible, of

approximately 0.3 percentage points. Figures 2 through 4 present similar analyses for other observable household characteristics, specifically number of adults in the household (Figure 2), number of children in the household (Figure 3), and wage income (Figure 4), and show no similar bump in these variables at the eligibility cutoff.

[Insert Figure 1, Figure 2, Figure 3, and Figure 4 here]

Table 3 presents our regression results. The first column shows results for our household fixed effects specification, focusing on the sample of households with an oldest child of less than 6 years. We include household fixed effects, so we observe how the probability of a move changes as the oldest child crosses this eligibility threshold. That is, the effect is identified by the within-family variation. The coefficient on the school eligibility variable is actually larger than the uncontrolled results of 0.3 percentage points. The coefficient is statistically significant, indicating that families are 0.7 percentage points more likely to move to a neighborhood with a better school when their oldest child reaches school age.

[Insert Table 3 here]

While the household fixed effects models control for time invariant family characteristics, unobserved time varying differences that are correlated with the age of the oldest child—and, therefore, school eligibility—may remain. As an example, families with only very young children (infants or toddlers) may be struggling with "new parenthood," with reduced mobility as they "learn the ropes." Thus, mobility may increase with the age of the oldest child and using the early parenthood years as a counterfactual may bias the results. We address this by implementing a regression discontinuity design, using the number of days between a child's birthdate and the eligibility cutoff as the running variable. We also restrict our sample to households where the oldest child is between the ages of 4 and 6—that is, we focus only on the

set of households with an oldest child who is close to the school eligibility cutoff date. Finally, we introduce an interaction between eligibility cutoff and the running variable, to allow the slope to differ on each side of the cutoff. These models also include metropolitan area (CBSA) fixed effects in addition to year fixed effects. Specifically, we estimate the following model:

$$MBSch_{imt} = \alpha + \beta_1 EligCutoff_{imt} + \gamma_1 DaystoElig_{imt} + \gamma_2 EligCutoffXDaystoElig_{imt} + \beta_2 HH_{imt} + \eta CBSAFE_m + \gamma YRFE_t + \varepsilon_{imt} \quad (3)$$

As shown in column 2 of Table 3, in the parsimonious specification families are more likely to move to better schools when their oldest child becomes school eligible, though the magnitude of the coefficient on $EligCutoff_{imt}$ falls from 0.7 percent to 0.3 percent. Column 3 narrows the bandwidth by limiting the sample to households with an oldest child between 4 and 6 years of age. Point estimates are little changed, but standard errors increase. Column 4 adds the interaction between the running variable and school eligibility, allowing the slope to differ on either side of the cut-off. In this final specification, we no longer detect an increase in the probability of moving to a better school at the eligibility threshold. Thus, these results provide some evidence, but not strong evidence, that housing voucher holders move to incrementally better schools when their child becomes school eligible.[xvii]

The dependent variable we have used so far captures whether proficiency rates of the school nearest to a family's new location are *any* better than those of the school nearest to their previous location—so that our definition of moving toward a better school includes moves made to schools only marginally better. To probe whether families make residential choices that lead to meaningful improvements in schools, we employ a more restrictive definition for our

dependent variable—moving to a much better school—defined as a school with a standardized proficiency rate at least one half a standard deviation above that of the previous school nearby. In Table 4 we see that results for the first specification are very similar. For the RD specifications, results look quite similar, though, again, coefficients are statistically insignificant in the fully specified model.

[Insert Table 4 here]

Taken together, the results suggest that voucher holders for whom schools should be most important are more likely to use their vouchers to move to better schools. That said, the effects are quite small, and not all of our results attain conventional levels of statistical significance. The probability that a voucher family whose oldest child has just reached school age will move to a significantly better school is about one fifth a percentage point higher than the probability that a voucher holder whose oldest child has just missed the cutoff and is not yet eligible to start school. (The overall mobility rate for voucher holders with young children is 16 percent.)

As discussed earlier, the ability of voucher holders to move towards better schools is likely to be constrained. One possible constraint is a lack of high quality schools near to a voucher holder's home, following the underlying intuition that households may be less likely to know about higher-performing schools that are farther away because information on school quality is local, or will find them less appealing because it would mean moving farther from jobs, friends, and family. In practice, when households move within a metropolitan area, they tend to move quite near to their original homes (Kan, 2007).

To test the importance of this constraint, we examine whether voucher households who have better school options near to their homes are more likely than other voucher holders to move to a much better school (>0.5 SD) when their oldest child reaches school age. "Better

school nearby" is an indicator variable, then, that takes a value of one if the standardized proficiency rate of the second- and third-nearest schools to a household's original address are higher than those of the nearest school.

Table 5 shows the same specifications as in Tables 3 and 4, with an added indicator for whether a household has better schools nearby as well as an interaction between this indicator and school eligibility. The results consistently show that voucher holders with a better school nearby originally are significantly more likely to move to a better and a much better school than other voucher holders. For all voucher holders in our sample, the presence of a better school nearby is associated with between a 2 and a 6 percent increase in the likelihood that the household will move towards a better or a much better school. Focusing on the set of households for whom schools are now most salient, (i.e., their child is about to start kindergarten), our results indicate that they are even more likely to move towards a higher performing school. Specifically they are between 1 and 2 percentage points more likely to move towards a better and a much better school than other voucher households whose child is not eligible to start school in the upcoming year. The coefficients are consistently significant at the 1 percent level. By contrast, we now find no evidence that voucher holders eligible to start school without better schools nearby are moving towards better schools when their oldest child reaches school age (as evidenced by the insignificant coefficients on the school eligibility indicator variable). These results provide evidence that opportunities matter. Our largest estimates suggest that families with housing vouchers are up to 8 percentage points more likely to move towards better schools when they have such options nearby and their oldest child reaches school age (our smallest estimates suggest this may be closer to 4 percentage points).

[Insert Table 5 here]

Another constraint faced by voucher holders is the availability of affordable rental units, or homes renting at less than the payment standard. To examine the extent to which housing market constraints are limiting the ability of housing voucher holders to move towards higher-performing schools, we examine differences in mobility patterns of households across metropolitan areas depending on the share of units renting below the FMR that are near to higher-performing schools. Specifically, we add an interaction between the presence of better schools nearby and an indicator for a metropolitan area with a share of FMR units located near above-average schools in the top quarter of metropolitan areas, based on the 2005 to 2009 ACS estimates and the 2003-2004 school year data. In addition, we add another interaction between this variable and the indicator of school eligibility. We present these results in Table 6. (As the indicator we are using for high FMR access is a time-invariant, metropolitan level variable, it cannot be identified on its own in our models, which include CBSA fixed effects.) Once again, we find that the less constrained households are much more likely to move to better schools, but it does not appear that the availability of FMR units near to good schools is providing much of an additional constraint. (Note that when separately modeling the relationship between living in a high FMR access metropolitan area on housing voucher holder mobility patterns, we find some evidence that these households are slightly more likely to move towards higher-performing schools.)

[Insert Table 6 here]

Thus far, we have measured the quality of schools solely based on proficiency rates. In Table 7, we instead test whether households are moving towards schools that have more resources or more advantaged students. Table 7 tests whether voucher holders, when their oldest child becomes eligible for kindergarten, move towards schools with a much lower share of

students eligible for free or reduced-price lunch (0.5 standard deviations, which is equal to approximately 13 percentage points) a much lower teacher/pupil ratio (0.5 standard deviations, which is equal to 5.7 fewer students) or a much lower share of black or Hispanic students (0.5 standard deviations, which is equal to a decline of 15.5 percentage points). We present only results from our final specifications (i.e., our specification in column 4 in Table 3) where we limit our analysis to the narrowest bandwidth, and include both the running variable (days from eligibility cutoff) and the interaction between days from cutoff and school eligibility. We find some evidence that voucher holders move towards schools with a smaller share of students eligible for free or reduced-price lunch (approximately 0.5 percentage points). We also find small, though statistically insignificant, results for measures of pupil/teacher ratios and minority concentrations. In results not shown, we find, as above, that these results are driven largely by children who have better schools nearby and live in metropolitan areas with a greater share of units renting below the FMR located near to good schools.[xviii] These results show that when schools are most salient to them, voucher holders appear to select a substantially different set of schools when they have the opportunity to do so.

[Insert Table 7 here]

DISCUSSION

While the Housing Choice Voucher program has achieved notable success in improving housing conditions for poor families and reducing rent burdens (Wood et al, 2008), it has been far less effective in inducing households to move to more advantaged neighborhoods and schools. Importantly, recent research on the long-run effects of Moving to Opportunity by Chetty, Hendren, and Katz (2015), provides tantalizing evidence that households receiving vouchers to move out of distressed, high-poverty public housing developments experienced some positive

outcomes in the long run over those households who remained in public housing. These long-term improvements include an increased likelihood of attending college, getting married, and having a child with a father present. Results are even stronger for families who were required to reside in a low-poverty neighborhood, highlighting the importance of understanding the conditions that both encourage and enable voucher holders to move to neighborhoods with better schools.

Our aim is to analyze large-scale administrative data to further explore why we do not observe more households utilizing vouchers to move to neighborhoods with higher-performing schools. We point out that many households have little incentive to move to areas with better schools because either they have no children or their children are older and the costs of disrupting their education to move them to a new school would be high. We find some evidence that the families for whom schools are most critical use vouchers to move towards higher-performing schools. We also find evidence that constraints matter. The only voucher holders who move to better schools are those who have better schools nearby. We find modest evidence that housing market constraints matter too. While removing these structural problems is well beyond the scope of the voucher program, federal policymakers and local program administrators can take several steps to help voucher holders overcome them. For example, they could do more to ensure that voucher families have good information about local schools when deciding where to live. The U.S. Department of Housing and Urban Development (HUD) recently took a promising first step in partnering with Great Schools to provide more information about local educational options to local housing authorities, which they can share with voucher recipients.

Additionally HUD could make it easier for voucher holders to move to other jurisdictions, through relaxing portability rules or through encouraging housing authorities in the same metropolitan area to form a regional collaborative.[xix] HUD could also make it easier for voucher holders to move to higher-rent areas by changing its calculation of fair market rents. Currently, HUD pays the difference between 30 percent of a voucher holder's income and the rent of any unit, up to a rent level that is pegged to the area's FMR. Because FMRs are typically set at the 40th percentile of rents of the metropolitan area, voucher holders are likely to end up concentrated in lower-rent communities, which also typically have lower-performing schools. HUD has recently launched the Small Area Fair Market Rent Demonstration Project, which allows housing authorities to use separate FMRs for individual zip codes. The goal is to give voucher holders housing options in every zip code within a metropolitan area by encouraging more landlords in higher-rent areas to rent to voucher holders. An early effort in Dallas led tenants to move to better neighborhoods without any additional cost to the government (Collinson & Ganong, 2013).

Most fundamentally, these findings suggest that we should adjust our expectations for the voucher program and not imagine that all recipients will necessarily want to move towards schools with higher pass rates. And to the extent that we believe a key objective of the voucher program is to help families with children reach higher-performing schools, we might target vouchers to families with children who are approaching school eligibility age. The new results by Chetty, Hendren, and Katz (2015) show that young children assigned to the voucher and experimental MTO groups experienced the largest gains. Unfortunately, the long voucher waiting lists that exist in many, indeed most, metropolitan areas make it difficult to do such

targeting, since young mothers often have to wait many years before they are able to receive a voucher.

Finally, this research highlights the benefits of utilizing large-scale administrative data to answer difficult policy questions. By using this large-scale dataset, we are able to improve our understanding of why households are typically not using housing vouchers to reach better schools. The thick sample allows us to explore whether particular subgroups are more likely to move towards better schools and whether school locations and housing market constraints shape these outcomes. We are able to show that households with housing vouchers do move towards better schools when schools become relevant to their families and when the housing market and school environment allow them to do so. A further advantage of utilizing this large-scale administrative dataset is that these data are regularly collected, and thus policymakers can continue to track and monitor the residential choices of families at a relatively low cost.

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REFERENCES

Bedard, K., & Dhuey, E. (2006). The persistence of early childhood maturity: International evidence of long-run age effects. The Quarterly Journal of Economics, 121, 1437–1472.

Caetano, G., & Macartney, H. (2014). Quasi-Experimental Evidence of School Choice Through Residential Sorting. Working Paper.

Cascio, E. U., & Lewis, E. G. (2006). Schooling and the Armed Forces Qualifying Test: Evidence from School Entry Laws. Journal of Human Resources, 16, 294–318.

Chetty, R., & Hendren, N. (2015). The Impacts of Neighborhoods on Intergenerational Mobility: Childhood Exposure Effects and County-Level Estimates. NBER Working Paper.

Chetty, R., Hendren, N., & Katz, L. (2015). The Effect of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment. NBER Working Paper.

Collinson, R., & Ganong, P. (2013). Incidence and Price Discrimination: Evidence from Housing Vouchers. Working Paper.

DeLuca, S., & Rosenblatt, P. (2010). Does Moving To Better Neighborhoods Lead to Better Schooling Opportunities? Parental School Choice in an Experimental Housing Voucher Program. Teachers College Record, 112, 1443–1491.

Deng, L. (2007). Comparing the Effects of Housing Vouchers and Low-Income Housing Tax Credits on Neighborhood Integration and School Quality. Journal of Planning Education and Research, 27, 20–35.

Devine, D. J., Gray, R. W., Rubin, L., & Taghavi, L. B. (2003). Housing Choice Voucher Location Patterns: Implications for Participant and Neighborhood Welfare. Washington, DC: U.S. Department of Housing and Urban Development.

Dobkin, C., & Ferreira, F. (2010). Do school entry laws affect educational attainment and labor market outcomes? Economics of Education Review, 29, 40–54.

Ellen, I. G., & Horn, K. M. (2011). Creating a Metric of Educational Opportunity for Assisted Households. Report prepared for the Department of Housing and Urban Development.

Eriksen, M. D., & Ross, A. (2013). The Impact of Housing Vouchers on Mobility and Neighborhood Attributes. Real Estate Economics, 41, 255–277.

Feins, J. D., & Patterson, R. (2005). Geographic Mobility in the Housing Choice Voucher Program: A Study of Families Entering the Program, 1995–2002. Cityscape, 8, 21–47.

Fitzpatrick, M. D. (2010). Preschoolers Enrolled and Mothers at Work? The Effects of Universal Prekindergarten. Journal of Labor Economics, 28, 51–85.

Galvez, M. (2011). Defining “Choice” in the Housing Choice Voucher Program. Dissertation Manuscript.

Hastings, J. S., & Weinstein, J. M. (2008). Information, School Choice and Academic Achievement: Evidence from Two Experiments. The Quarterly Journal of Economics, 123, 1373–1414.

Hartung, J. M., & Henig, J. (1997). Housing Vouchers and Certificates as a Vehicle for Deconcentrating the Poor: Evidence from the Washington, D.C., Metropolitan Area. Urban Affairs Review, 32, 403–419.

Horn, K. M., Ellen, I. G., & Schwartz, A. E. (2014). Do Housing Choice Voucher holders live near good schools? Journal of Housing Economics, 23, 28–40.

Jacob, B. A., Kapustin, M., & Ludwig, J. (2015). The impact of housing assistance on child outcomes: Evidence from a randomized housing lottery. Quarterly Journal of Economics, 130, 465–506.

Kan, K. (2007). Residential mobility and social capital. Journal of Urban Economics, 61, 436–457.

Kaufman, J. E., & Rosenbaum, J. E. (1992). The Education and Employment of Low-Income Black Youth in White Suburbs. Educational Evaluation and Policy Analysis, 14, 229–240.

Kingsley, T. G., Johnson, J., & Pettit, K. L. S. (2003). Patterns of Section 8 Relocation in the HOPE VI Program. Journal of Urban Affairs, 25, 427–447.

Lens, M., Ellen, I. G., & O’Regan, K. (2011). Do Vouchers Help Low-Income Households Live in Safer Neighborhoods? Evidence on the Housing Choice Voucher Program. Cityscape, 13, 135–159.

McClure, K. (2006). The Low-Income Housing Tax Credit Program Goes Mainstream and Moves to the Suburbs. Housing Policy Debate, 17, 419–446.

Mills, G., Gubits, D., Orr, L., Long, D., Feins, J., Kaul, B., Wood, M., Jones, A., Cloudburst Consulting Associates, & the QED group. (2006). The Effects of Housing Vouchers on Welfare Families. Washington, DC: U.S. Department of Housing and Urban Development, Office of Policy Development and Research.

Pendall, R. (2000). Why Voucher and Certificate Users Live in Distressed Neighborhoods. Housing Policy Debate, 11, 881–909.

Rosenblatt, P., & DeLuca, S. (2012). We Don’t Live Outside, We Live in Here: Neighborhoods and Residential Mobility Decisions Among Low-income Families. City and Community, 11, 254–284.

Rosenbaum, J. E. (1995). Changing the geography of opportunity by expanding residential choice: Lessons from the Gautreaux program. Housing Policy Debate, 6, 231–269.

Wood, M., Turnham, J., & Mills, G. (2008). Housing affordability and family well-being: Results from the housing voucher evaluation. Housing Policy Debate, 19, 367–412.

Table 1. Summary Statistics of Large Scale Administrative Data Voucher Households at Baseline.

	Full Sample of Households	Households with Children	Households with Oldest Child <6	Households with Oldest Child 4-6
Geographic Distribution				
Arizona	1.8%	2.0%	1.8%	1.9%
California	23.0%	19.2%	14.7%	15.0%
Florida	5.8%	5.6%	5.6%	8.7%
Illinois	5.5%	6.1%	5.0%	4.9%
Maryland	3.0%	3.0%	2.7%	2.7%
Massachusetts	7.7%	8.5%	8.3%	5.8%
Michigan	4.2%	4.6%	4.4%	4.5%
Minnesota	2.4%	2.4%	3.3%	3.2%
New Jersey	5.2%	5.0%	4.6%	4.7%
New York	11.0%	9.7%	9.3%	8.9%
North Carolina	4.0%	4.5%	4.9%	4.9%
Ohio	7.5%	8.2%	10.3%	10.4%
Pennsylvania	4.8%	4.8%	7.2%	6.5%
South Carolina	2.1%	2.5%	2.9%	2.9%
Texas	11.9%	14.0%	15.1%	15.1%
Household Characteristics				
Median Household Income ($2013)	$10,440	$12,118	$9,720	$10,080
% Poor	65.0%	72.2%	75.8%	75.3%
% White	32.5%	22.1%	27.5%	26.7%
% Black	45.3%	55.1%	54.0%	54.5%
% Hispanic	19.2%	20.6%	17.2%	17.5%
% Asian	2.8%	2.1%	1.2%	1.2%
Mean Age of Household Head	46.5	36.1	30.6	30.7
% Female Headed Households	72.1%	81.9%	80.3%	80.5%
% with Children	53.3%	100.0%	100.0%	100.0%
% with School Age Children	50.8%	89.4%	29.6%	41.1%
Mobility Rate	10.4%	14.0%	16.0%	16.9%
Years in Program	3.1	3.0	2.0	2.4
Sample Size	1,400,921	678,327	106,030	77,902

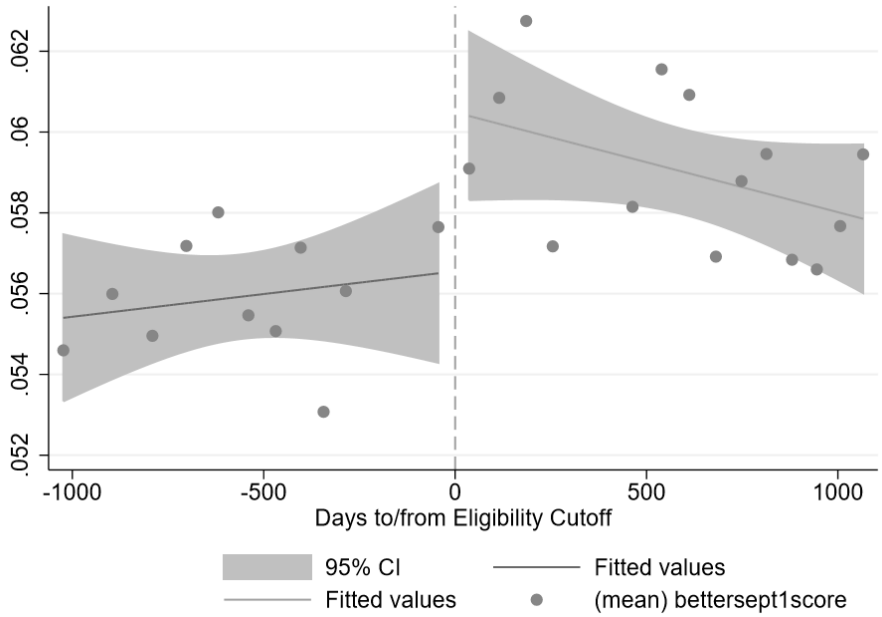
Notes: Table displays characteristics of unique households in the voucher sample. Characteristics are as of the earliest year for which the household appears in the relevant sample. Sample includes only households that appear for at least two periods for the years 2003 to 2012, in CBSAs in the 15 listed states.

Table 2. Probability of Moving to a Better School by Age of Oldest Child.

	P(Moves to a Better School=1)
Age of Oldest Child:	
Age 0-4	0.003***
	(0.001)
Age 5-8	0.007***
	(0.001)
Age 9-11	0.005***
	(0.001)
Age 12-14	0.004***
	(0.001)
Age 15-18	0.003***
	(0.001)
Constant	0.021***
	(0.001)
Observations	4,523,839
R-squared	0.65
FE	Household & Year
Controls	Yes

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Notes: The dependent variable is an indicator for whether the household moved to a neighborhood where the local school had a higher standardized proficiency rate than the originating school. Sample includes only households that appear for at least two periods for the years 2003-2012, in CBSAs in our 15 state sample. The excluded category is households without children. Age categories are based on the age of the oldest child. The model includes controls for time since last recertification, wage income, number of adults and number of children.

Figure 1. Moves to Better School, Days from School Eligibility Cutoff.



Notes: Age cutoffs are divided into 15 quantiles before and after the cutoff date for each state. Each dot represents the conditional mean of moving to a better school. The line represents standard linear fits to the left and right of the cutoff.

Figure 2. Number of Adults, Age from Eligibility Cutoff.

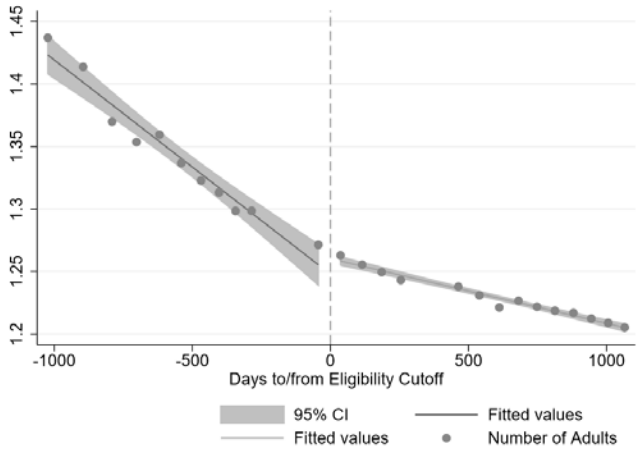


Figure 3. Number of Children, Age from Eligibility Cutoff.

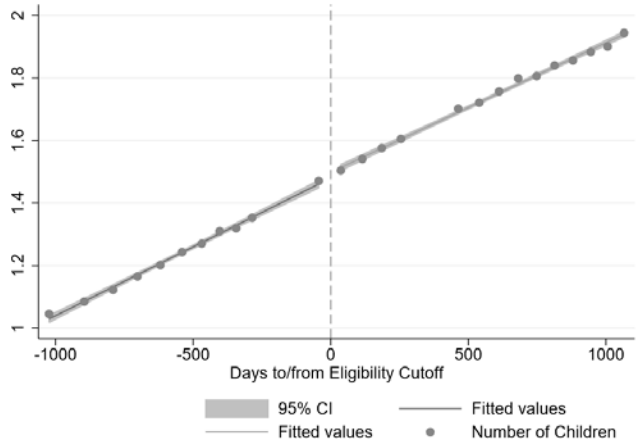


Figure 4. Log (Wage-Income), Age from Eligibility Cutoff.

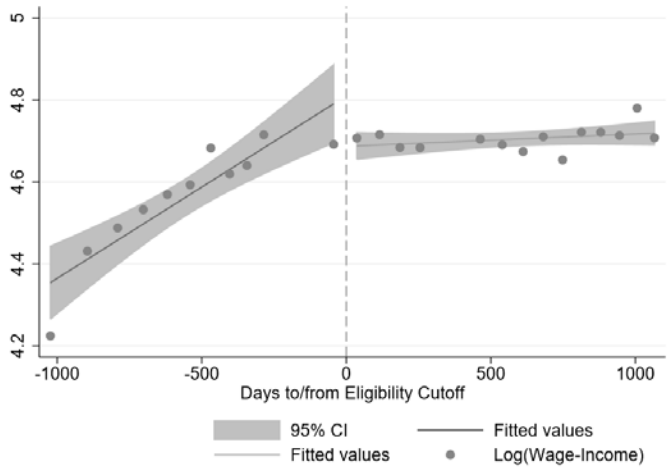


Table 3. Moves to Better Schools and Oldest Child School Eligibility.

Dependent Variable: Move to Better School	(1)	(2)	(3)	(4)
School Eligible at Cutoff Date	0.007***	0.003**	0.003	0.001
	(0.003)	(0.002)	(0.002)	(0.002)
Days from Eligibility Cutoff		-0.00001***	-0.00001	-0.00001**
		(0.000)	(0.000)	(0.000)
Days from Eligibility Cutoff X School Eligibility at Cutoff Date				0.00001*
				(0.000)
Constant	0.028***	0.040***	0.041***	0.040***
	(0.010)	(0.003)	(0.004)	(0.004)
Observations	169,892	169,892	105,314	105,314
FE	HH & Year	CBSA & Year	CBSA & Year	CBSA & Year
Controls	Yes	Yes	Yes	Yes
Sample	0<Age<6	0<Age<6	4<Age<6	4<Age<6

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Notes: The dependent variable is an indicator for whether the household moved to a neighborhood where the local school had a higher standardized proficiency rate than the originating school. The variable "School-Eligible on September 1st" is an indicator for whether the oldest child is school-eligible for the first time (age<6) during the current calendar year. Column (1) includes household and year fixed effects for the sample where the oldest child is between 0-6 years old. Column (2) drops the household FE and adds days relative to the oldest child being school eligible (negative value before eligibility, positive after). Column (3) uses the sample of households with oldest child 4-6 years old. The sample is further restricted to households where the oldest child is the same person and increases by one year in age since the previous year. The sample covers all 15 previously listed states. All models control for time since last recertification, wage income, number of adults and number of children.

Table 4. Moves to Much Better Schools and Oldest Child School Eligibility.

Dependent Variable: Move to Much Better School	(1)	(2)	(3)	(4)
School Eligible at Cutoff Date	0.005**	0.003**	0.004**	0.003
	(0.002)	(0.001)	(0.002)	(0.002)
Days from Eligibility Cutoff		-0.00001***	-0.00001**	-0.00001**
		(0.000)	(0.000)	(0.000)
Days from Eligibility Cutoff X School Eligible at Cutoff Date				0.00001
				(0.000)
Constant	0.020**	0.026***	0.025***	0.025***
	(0.009)	(0.002)	(0.003)	(0.003)
Observations	169,892	169,892	105,314	105,314
FE	HH & Year	CBSA & Year	CBSA & Year	CBSA & Year
Controls	Yes	Yes	Yes	Yes
Sample	0<Age<6	0<Age<6	4<Age<6	4<Age<6

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Notes: The dependent variable is an indicator for whether the household moved to a neighborhood where the local school had a 0.5 standard deviation higher standardized proficiency rate than the originating school. The variable "School-Eligible on September 1st" is an indicator for whether the oldest child is school-eligible for the first time (age<6) during the current calendar year. Column (1) includes household and year fixed effects for the sample where the oldest child is between 0-6 years old. Column (2) drops the household FE and adds days relative to the oldest child being school-eligible (negative value before eligibility, positive after). Column (3) uses the sample of households with oldest child 4-6 years old. The sample is further restricted to households where the oldest child is the same person and increases by one year in age since the previous year. The sample covers all 15 previously listed states. All models control for time since last recertification, wage income, number of adults and number of children.

Table 5. Moves to Better Schools and Proximity to Better Schools.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Better School				Much Better School			
School Eligible at Cutoff	-0.005	0.0001	-0.002	-0.004	-0.005*	-0.0003	-0.002	-0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)
Better Schools Nearby	0.056***	0.035***	0.031***	0.031***	0.046***	0.028***	0.025***	0.025***
	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Better Schools Nearby × School Elig	0.023***	0.007***	0.011***	0.011***	0.020***	0.007***	0.010***	0.010***
	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Constant	-0.002	0.023***	0.027***	0.026***	-0.008	0.012***	0.014***	0.014***
	(0.011)	(0.003)	(0.004)	(0.004)	(0.009)	(0.003)	(0.003)	(0.003)
Observations	169,892	169,892	105,314	105,314	169,892	169,892	105,314	105,314
FE	HH & Year	CBSA & Year	CBSA & Year	CBSA & Year	HH & Year	CBSA & Year	CBSA & Year	CBSA & Year
Days from Elig Cutoff		X	X	X		X	X	X
Days from Elig Cutoff × School Elig				X				X
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	0<age<6	0<age<6	4<age<6	4<age<6	0<age<6	0<age<6	4<age<6	4<age<6

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Notes: The dependent variable is an indicator for whether the household moved to a neighborhood where the local school had a higher standardized proficiency rate than the originating school (columns 1 through 4), or a 0.5 SD higher proficiency rate (columns 5 through 8). The variable "School-Eligible at the Eligibility Cutoff Date" is an indicator for whether the oldest child is school-eligible for the first time (age<6) during the current calendar year. Each specification includes an indicator for whether a "Better Nearby School" exists, which is the second- or third-closest school that has a higher test-score, and an interaction of this variable with the eligibility indicator. Column (1) includes household and year fixed effects for the sample of households with an oldest child<6. Column (2) uses CBSA and year fixed-effects for households with oldest child<6. Column (3) uses the specification from column (2) for the sample of households with 4<oldest child age <6. Column (4) interacts the running variable with the eligibility dummy for the sample 4<oldest child age <6. Columns (5) through (8) repeat the specifications of (1) through (4) with the "much better school" dependent variable. The sample covers all 15 previously listed states. All models control for time since last recertification, wage income, number of adults and number of children. Standard errors are clustered at the household level.

Table 6. Moves to Better Schools, Proximity to Better Schools and FMR Units Near Good Schools.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Better School				Much Better School			
School Eligible at Cutoff Date	-0.001	0.001	-0.0004	-0.002	-0.001	0.001	-0.0002	-0.0007
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)
Better Schools Nearby	0.059***	0.036***	0.035***	0.035***	0.047***	0.027***	0.029***	0.029***
	(0.005)	(0.002)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)
Better Schools Nearby × High FMR Access	-0.003	-0.001	-0.004	-0.004	0.001	0.002	-0.004	-0.004
	(0.006)	(0.003)	(0.004)	(0.004)	(0.005)	(0.002)	(0.003)	(0.003)
Better Schools Nearby × High FMR Access	0.024***	0.007**	0.010***	0.010***	0.018***	0.005**	0.010***	0.010***
× School Eligible	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)
Constant	-0.079***	0.017***	0.026***	0.025***	-0.074***	0.006**	0.013***	0.013***
	(0.030)	(0.003)	(0.004)	(0.004)	(0.027)	(0.003)	(0.003)	(0.003)
Observations	169,892	169,892	105,314	105,314	169,892	169,892	105,314	105,314
FE	HH & Year	CBSA & Year	CBSA & Year	CBSA & Year	HH & Year	CBSA & Year	CBSA & Year	CBSA & Year
Days from Eligibility Cutoff		X	X	X		X	X	X
Days from Eligibility × School Eligible				X				X
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	0<age<6	0<age<6	4<age<6	4<age<6	0<age<6	0<age<6	4<age<6	4<age<6

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Notes: The dependent variable is an indicator for whether the household moved to a neighborhood where the local school had a higher standardized proficiency rate than the originating school (columns 1 through 4), or a 0.5 SD higher proficiency rate (columns 5 through 8). The variable "School-Eligible at the Eligibility Cutoff Date" is an indicator for whether the oldest child is school-eligible for the first time (age<6) during the current calendar year. Each specification includes an indicator for whether a "Better Nearby School" exists, which is the second- or third-closest school that has a higher test-score. In addition, these specifications include an indicator for whether the metro area was in the top quarter of metros in terms of the accessibility of affordable units to good schools (as measured by the percent of units renting at below fair market rents that are near above-average schools) interacted with better nearby schools, and an interaction of both these variables with the eligibility indicator. Column (1) includes household and year fixed effects for the sample of households with an oldest child<6. Column (2) uses CBSA and year fixed-effects for households with oldest child<6. Column (3) uses the specification from column (2) for the sample of households with 4<oldest child age <6. Column (4) interacts the running variable with the eligibility dummy for the sample 4<oldest child age<6. Columns (5) through (8) repeat the specifications of (1) through (4) with the "much better school" dependent variable. The sample covers all 15 previously listed states. All models control for time since last recertification, wage income, number of adults and number of children. Standard errors are clustered at the household level.

Table 7. Moves to Better Schools, Alternative Dependent Variables.

	(1)	(2)	(3)	(4)
Dependent Variable:	Much Lower Share Free/Reduced Price Lunch	Much Lower Pupil/Teacher Ratio	Much Lower Share Black Students	Much Lower Share Hispanic Students
School Eligible at Cutoff Date	0.005*	0.001	0.002	0.002
	(0.003)	(0.002)	(0.002)	(0.002)
Constant	0.097***	0.053***	0.026***	0.023***
	(0.005)	(0.003)	(0.003)	(0.003)
Observations	105,314	105,314	105,314	105,314
FE	CBSA & Year	CBSA & Year	CBSA & Year	CBSA & Year
Days from Eligibility Cutoff	X	X	X	X
Days from Elig x School Eligible	X	X	X	X
Controls	Yes	Yes	Yes	Yes
Sample	4<age<6	4<age<6	4<age<6	4<age<6

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Notes: Dependent variable for column (1) is an indicator equal to one if the household moved to a school with a much lower share of free- and reduced-price lunch students (a reduction of 0.5 SD =13 percentage points). Column (2) is an indicator equal to one if the household moved to a school with a much lower pupil to teacher ratio (a reduction of 0.5 SD =5.7 students). Column (3) is an indicator equal to one if the household moved to a school with a much lower share Black/African-American Students (a reduction of 0.5SD = 15.5 percentage points). Column (4) is an indicator equal to one if the household moved to a school with a much lower share of Hispanic students (a reduction of 0.5SD = 15.6 percentage points). The sample covers all 15 previously listed states. All models control for time since last recertification, wage income, number of adults and number of children. Standard errors are clustered at the household level.

APPENDIX

Welfare to Work Voucher Analysis

We begin by describing the set of households participating in the Welfare to Work Voucher (WtWV) program. Appendix Table A1 provides descriptive characteristics of these households at baseline. Overall these households have very low incomes, and over three quarters of these families receive TANF. They live in extremely disadvantaged neighborhoods, with poverty rates of 29 percent and schools that perform three quarters of a standard deviation below the mean of schools in their city. The table shows that the experimental and treatment group had nearly identical demographic characteristics and lived in very similar neighborhoods at baseline.

We then compare the schools accessible to those WtWV experimental households who were initially awarded vouchers to the schools accessible to WtWV households who were not immediately assigned housing vouchers. That is, we conduct a simple comparison of the schools nearest to households assigned vouchers and those nearest to the comparison group households who were not assigned vouchers four years after random assignment. We estimate the following empirical model:

$$Sch_{imt} = \alpha + \beta_1 Voucher_{imt} + \eta City_{mt} + \varepsilon_{imt} \quad \text{(A1)}$$

where *i* indexes the household and *m* the core based statistical area. *Sch* represents the standardized pass rates in the school for the 2003-2004 school year, which will generally be the year prior to which we observe the voucher holders' locations (four years after random assignment). We construct our test performance measure as the average school-level proficiency

rates in ELA and Math at the school-level (weighted equally), standardizing over the state-year distribution.[xx] *City* represents a city fixed effect for each of the six cities in our sample.

Because we are studying a randomized-controlled trial, we can interpret the coefficient on voucher assignment as the effect of a voucher offer in year one. One concern with these results is that many of the households in the treatment group received vouchers by the end of the four years. The coefficient thus more accurately captures the effect of receiving a voucher four years earlier rather than one to two years earlier or not at all. Because of this potential "contamination" of the control group, we also test for differences in the performance of the nearest school across one year, two years, and three years after the treatment group was originally awarded vouchers. We find similar results.

Appendix Table A2 presents results for this analysis. We find that when comparing voucher households that were randomly assigned to receive a voucher to those randomly assigned to the control group, they lived near to schools with almost identical pass rates at baseline and also 16 quarters later. Columns 2 through 4 show that this basic result holds for math tests, reading tests, and math and reading scores combined. We also estimate treatment on the treated results, i.e., only looking at households that utilized their voucher, and find similar results. [xxi] These experimental results confirm that, on average, voucher holders do not use their vouchers to reach higher performing schools, consistent with the findings of Jacob, Kapustin, and Ludwig (2015) for Chicago. Further, these suggest that earlier non-experimental findings showing that voucher holders generally do not live in neighborhoods with high-performing schools were not driven by selection bias, or the unobserved disadvantage level of voucher holders.

Table A1. Summary Statistics of Welfare to Work Voucher Study Participants at Baseline.

	Control Group	Treatment Group
Geographic Distribution		
Atlanta	13%	13%
Augusta	9%	9%
Fresno	30%	30%
Houston	23%	24%
LA	12%	12%
Spokane	13%	13%
Household Characteristics		
Age of Household Head	31	31
Earnings of Household Head	$6,143	$6,192
% Black	49%	49%
% Hispanic	22%	20%
% Employed	43%	44%
% Receiving TANF	76%	76%
Neighborhood Characteristics		
Nearest School Std ELA Score	-0.75	-0.76
Nearest School Std Math Score	-0.69	-0.69
Tract Poverty Rate	29%	29%
Sample	4,690	3,900
F-Statistic:		0.29
p-value		0.5888

Notes: Table reports means for sample at baseline (quarter 0) for households assigned to treatment and control. Values are weighted by survey weights. The reported F-statistic and p-value are from an omnibus regression of treatment on every outcome, where each outcome is stacked in a seemingly unrelated regression set-up, and standard errors are clustered at the household level. The F-statistic and corresponding p-value suggest no major differences between treatment and control groups at baseline.

Table A2. WtWV Results—Effect of Voucher on Neighborhood School Quality.

VARIABLES	(1) Baseline Combined Score	(2) Quarter 16 Combined Score	(3) Quarter 16 ELA proficiency	(4) Quarter 16 Math proficiency
Treatment	0.000525	-0.00515	-0.0154	0.00307
	(0.0211)	(0.0211)	(0.0202)	(0.0210)
Constant	-0.917***	-0.937***	-0.852***	-1.021***
	(0.0374)	(0.0375)	(0.0360)	(0.0373)
Observations	8,590	8,505	8,501	8,501
Outcome	Combined Score	Combined Score	ELA	Math
FE	Site	Site	Site	Site

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

Notes: Column (1) and Column (2) dependent variable is combined standardized math and reading proficiency rates in AY 2003/2004 of the closest school, standardized over state distribution. Column (3) is the standardized ELA proficiency rate at the closest school. Column (4) is the standardized Math proficiency rate at the closest school.

[i] The median voucher household with children has a family size of four, earns approximately $13,000 annually and lives in a unit that rents at $1,000 per month. For this family the voucher is equivalent to an increase in post-tax income of 60 percent.

[ii] There is a large body of literature that has relied on this approach to identify the impact of school eligibility on academic outcomes. Some notable examples include Cascio and Lewis (2006), Dobkin and Ferreira (2010) and Fitzpatrick (2010). We follow the approach of Caetano and Macartney (2014) and utilize the cutoff rule to identify residential choices that are directly tied to public school options.

[iii] Based on the Department of Housing and Urban Development's 2013 Budget available at http://portal.hud.gov/hudportal/documents/huddoc?id=CombBudget2013.pdf.

[iv] We do not focus on results from the Gautreaux and Moving to Opportunity voucher experiments as our analysis is focused on the full sample of households receiving vouchers, in comparison to the overall population. These experiments provided vouchers to households previously in public housing, and required households to move towards lower poverty neighborhoods as part of the experimental analysis, thus they do not inform us about how the overall population of voucher holders utilizes vouchers.

[v] The full analysis is presented in Appendix A. All appendices are available at the end of this article as it appears in JPAM online. Go to the publisher's website and use the search engine to locate the article at http://onlinelibrary.wiley.com.

[vi] Voucher holders are allowed to rent apartments with rents above the FMR but they must pay the full difference between the higher rent and the FMR, as the maximum subsidy provided is the difference between the FMR and 30 percent of a tenant's income. That said, a voucher holder's total rent cannot exceed 40 percent of their income upon initial occupancy. Thus, most voucher holders (65 percent in our sample) live in units that rent below the FMR.

[vii] A Core Based Statistical Area (CBSA) is a U.S. geographic area that includes an urban center of at least 10,000 people and adjacent areas that are socioeconomically tied to the urban center by commuting. These geographic areas are defined by the Office of Management and Budget (OMB).

[viii] See Ellen and Horn (2011) for a detailed discussion on creating a measure of educational opportunity for assisted households.

[ix] For New York and Ohio we relied on testing information obtained directly from the state, as these were not available through these alternative sources.

[x] We separately test math and reading proficiency rates in all cases, but results are the same.

[xi] We omit schools that are missing scores for more than half of the years they appear in the data. We then impute missing gaps in proficiency rates. We average the standardized values for that same school for the next year before and after the missing year. If the missing value is the first (last) year in the sample it is imputed with the closest value after (before) it.

[xii] These metropolitan areas include Tuscon, Bakersfield-Delano, Hartford, Washington-Arlington-Alexandria, Miami-Fort Lauderdale-Pompano Beach, Orlando-Kissimmee-Sanford, Tampa-St. Petersburg-Clearwater, Atlanta-Sandy Springs-Marietta, Kansas City, Philadelphia-Camden-Wilmington, Houston-Sugar Land-Baytown, Virginia Beach-Norfolk-Newport News, Milwaukee-Waukesha-West Allis.

[xiii] We model whether the household is at a different address at the start of the current school year (September 1) than they were at the start of the prior year. If "yes" then they are coded as "moved." If the school nearest to that household has a higher proficiency rate than the school in the previous neighborhood, they are coded as "moved to a better school." To be clear, we observe individuals only at the time their incomes are being recertified and therefore do not know exactly when households move. We make the assumption that if they are at a new address at the time of recertification then they moved at the time of recertification (even if perhaps the move occurred a few weeks prior). For example, if we observe a household at a different address on October 1 than a year earlier, then we assume they were at their old address at the start of the school year.

[xiv] For the typical household in our sample, we identify impacts off of a single move. This means that for households who are only in the sample for one year, we do not get any identifying variation from them. We also include only households who have the same oldest child from year to year, where that child ages by one year.

[xv] We have also run these analyses without this set of control variables and results are consistent.

[xvi] As each state has its own eligibility cutoff date, we calculate whether the child will meet the state-specific cutoff date. If the child will be above 5 and less than 6 on the state's cutoff date they are coded as "eligible." These dates vary from September 1st through January 1st. To provide an example, if a student turns 5 on December 15th and they live in Connecticut, where the eligibility cutoff date is January 1st, then they would be considered "eligible" for this school year.

[xvii] As a specification test we have run a similar analysis for households with older children, ages 6 through 8, and find no significant results for this age group.

[xviii] Results available from authors upon request.

[xix] Recently, eight housing agencies in the Chicago metropolitan area collaborated on a regional housing initiative to encourage voucher holders in the region to move to high opportunity areas.

[xx] To standardize proficiency rates we demean each score by the state- and year-specific average and then divide by the state- and year-specific standard deviation. We do this for math and ELA, and then construct an average of these two standardized scores. This combined measure retains a mean of zero and standard deviation of 1.

[xxi] As a robustness check we also estimated intent-to-treat (ITT) and treatment-on-treated (TOT) every two quarters (bi-annually) from quarter 2 to quarter 18. We find that neither the ITT results nor the TOT results are ever statistically significant at conventional levels.