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## Long-Term Effects of Public Low-Income Housing Vouchers on Neighborhood Quality and Household Composition

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## Long-Term Effects of Public Low-Income Housing Vouchers on Neighborhood Quality and Household Composition

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### Abstract

In this paper we estimate the effect of housing voucher receipt on the composition of recipient households and the quality of the neighborhoods in which recipient households reside. Drawing on a dataset that contains extensive information on a large and diverse panel of low-income families for up to five years following voucher receipt, we isolate the effects of voucher receipt using propensity score matching techniques together with regression adjustment. Full-sample results show voucher receipt to have little effect on neighborhood quality in the short-term, but some positive long-term effects. We also find that voucher receipt is tied to a higher probability of change in household composition in the year of voucher receipt, but greater stability in subsequent years. Our large sample allows us to explore differential responses of geographic and socioeconomic subgroups. Our findings have several implications for both research and policy.

**JEL Classifications:** I30, I38

**Keywords:** housing vouchers; neighborhood quality; household composition; matching

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## I. INTRODUCTION

Since its inception in the mid-1970s, the Section 8 housing voucher program has grown from a small pilot project to become one of the primary programs for providing housing assistance to low-income households in the United States; over 2.2 million households received vouchers through the Section 8 program in 2008. Accompanying this policy expansion has been a growing number of studies that examine the effect of voucher receipt on a variety of individual behavioral responses, especially labor market supply (Newman, Holupka, and Harkness 2009; Jacob and Ludwig 2012; Susin 2005; Mills et al. 2006; U.S. Department of Housing and Urban Development 2003; U.S. Department of Housing and Urban Development 2011; Ludwig et al. 2011; Carlson et al. 2011; Carlson et al. 2012); relatively few examine the effect of voucher receipt on other important social and household-related outcomes.

This paper explores the effect of voucher-based housing assistance on geographic moves, neighborhood quality, and household composition. In doing so it builds upon the limited previous work on the topic in two ways. First, we specify the counterfactual in our analysis as a world in which there is no housing assistance and cases must seek housing in the private market. Most previous work on this topic employs a counterfactual of public housing receipt. Second, whereas prior research has focused primarily on the effects of voucher receipt in large urban settings, this study analyzes voucher recipients who applied for or received TANF or Food Stamps (now called the Supplemental Nutrition Assistance Program) in all parts of a medium-sized, diverse state.<sup>1</sup> As a result, we exploit the size and diversity of our sample to separately

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<sup>1</sup> We use the term ‘recipients’ to describe households that have received a Section 8 voucher, and have successfully used it to obtain private rental housing. An equivalent term would be ‘users’ of Section 8 vouchers. Due to our analysis of “users”, comparisons with the results previous experimental studies (i.e. Moving to Opportunity and Welfare to Work) should draw on the treatment-on-the-treated (ToT) results.

analyze the effect of voucher receipt on neighborhood quality and household composition outcomes for several policy-relevant geographic and demographic subgroups.

We perform this analysis using a dataset constructed from administrative records maintained by the State of Wisconsin, combined with information from the 2000 U.S. Census. The dataset contains information on voucher receipt status, neighborhood quality, and household composition for up to a six-year period for more than 350,000 households from all parts of Wisconsin. Our full-sample results indicate that voucher receipt has little short-term effect on the quality of the neighborhood in which voucher recipients reside, but some positive long-term effects. We also find that voucher receipt is tied to a higher probability of several types of changes in household composition in the year of voucher receipt, but greater stability of household composition in subsequent years. Finally, we find that these responses to voucher receipt differ significantly across subgroups.

## **II. THE SECTION 8 VOUCHER PROGRAM**

### **A. Program Overview and the Process of Voucher Assignment**

Operated by the Department of Housing and Urban Development (HUD) and administered by over 3,000 local public housing authorities (PHAs), the Section 8 voucher program is the primary tenant-based approach for providing housing assistance to low-income households in the United States.<sup>2</sup> The most recent HUD data indicate that over 2.2 million households—including more than one million households with minor children—are served by the program annually. The stated objectives of the program are to enable “very low-income

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<sup>2</sup> The Section 8 program has officially been titled the Housing Choice Voucher Program since 1999, but most researchers and administrators still refer to it as the “Section 8 voucher” program. The “Section 8” designation refers to the program’s statutory authorization under Section 8 of the United States Housing Act of 1937, as amended by the Housing and Community Development Act of 1974; we use the “Section 8” designation in this paper.

families, the elderly, and the disabled to afford decent, safe, and sanitary housing in the private market,” and to facilitate the relocation of recipients into better neighborhoods.<sup>3</sup>

Obtaining and using a Section 8 voucher is a multi-step process that routinely spans multiple years. Individuals begin the process by submitting an application to a PHA during a period when the PHA’s waiting list is open and accepting new applications. Upon receipt of the applications, the PHA assigns applicants to a place on the waiting list.<sup>4</sup> Each PHA has the autonomy to establish waiting list preferences for applicants with particular characteristics.<sup>5</sup> When an applicant’s name rises to the top of the waiting list—a process that typically takes several years—the PHA awards their voucher. Upon receipt of the voucher, the recipient begins to search for housing in the private market that meets the PHA’s minimum standard of health and safety and is owned by a landlord willing to rent under the terms of the Section 8 program. If the voucher recipient—whose income must, in general, be below 50 percent of the median income of the county or metropolitan area in which they live—is able to locate suitable housing, then the recipient unit generally contributes 30 percent of its income toward rent.<sup>6</sup> The Section 8 program subsidizes the difference between the tenant contribution and actual rent, up to a locally defined “fair market rent” payment standard.<sup>7</sup>

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<sup>3</sup> See [http://www.hud.gov/offices/pih/programs/hcv/about/fact\\_sheet.cfm#10](http://www.hud.gov/offices/pih/programs/hcv/about/fact_sheet.cfm#10). As the program has expanded over time, a number of constraints have partially interfered with the goal of geographic mobility for voucher recipients. One constraint has been the limited geographic span of many local PHAs that serve only parts of metropolitan areas. While some PHAs allow recipients to find housing in other jurisdictions, administrative burdens and the need to transfer supporting funds constrain this practice. Such transfers also impose additional costs on recipients in the form of duplicate application, orientation, and program criteria (Katz and Turner 2000).

<sup>4</sup> In 2008, voucher recipients in Wisconsin had spent an average of 27 months on the waiting list.

<sup>5</sup> For a comprehensive description of waiting list policies—including common examples of preferences instituted by PHAs—see <http://www.hud.gov/offices/adm/hudclips/guidebooks/7420.10G/7420g04GUID.pdf>.

<sup>6</sup> See [http://www.hud.gov/offices/pih/programs/hcv/about/fact\\_sheet.cfm](http://www.hud.gov/offices/pih/programs/hcv/about/fact_sheet.cfm). Each PHA must provide 75 percent of its vouchers to applicants whose incomes do not exceed 30 percent of the area median income.

<sup>7</sup> This standard is set by the Department of Housing and Urban Development (HUD) at the 40th percentile of the local rental market, as calculated by the monetary value of leases commenced in the previous year.

## B. Behavioral Responses to Voucher Receipt

The design of the Section 8 program generates a diverse set of opportunities and incentives that are likely to influence residential location and household composition decisions. However, as is the case with other outcomes, the intricate incentive structure makes it difficult to develop unambiguous predictions regarding the effects of the program on these choices—see Shroder 2002, Jacob and Ludwig 2012, and Carlson et al. 2012 for discussions of relevant theoretical considerations in the context of analyzing the effect of voucher receipt on labor market outcomes.

In theory, there are two ways that the quality of the neighborhood in which an individual resides can change. First, the individual could move to a neighborhood with a different set of characteristics. Second, the individual could remain in their original location, but the quality of the neighborhood could improve or deteriorate over time. As described in greater detail below, the 2000 U.S. Census serves as the source of data on neighborhood quality at the block group level in this study; it is the only source of such detailed information. Although this data source has several advantages, it also means that our measures of neighborhood quality are not dynamic in nature. Consequently, in this paper any observed changes in neighborhood quality are attributable to household relocation, rather than a change in neighborhood quality over time.

With that in mind, decisions regarding neighborhood quality are likely to be affected by the fact that voucher receipt alters the budget constraint for housing.<sup>8</sup> As a result of the program design, which requires voucher recipients to contribute 30 percent of their income toward rent and then subsidizes the difference between the tenant contribution toward rent and the market

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<sup>8</sup> It is important to note that Section 8 voucher receipt alters recipients' budget constraint for housing only when the counterfactual is specified as receipt of no housing assistance, as it is in this analysis. If the counterfactual is specified as receipt of public housing, as in the Moving to Opportunity (MTO) experiment, then voucher receipt does not alter recipients' budget constraint because residents of public housing, like voucher recipients, contribute 30 percent of their income toward rent, with the government subsidizing remaining rental costs.

rent for the unit up to a locally defined fair market rent, voucher recipients face a zero marginal price of housing up to the locally defined fair market rent.<sup>9</sup> Shroder (2002) defines housing as a “bundle of unit characteristics (square footage, appliances, locks and bolts, water pipes, wiring, heat source, insulation, ventilation...) and site factors (distance to services, population density, transportation infrastructure, noise and pollution exposure, neighbors’ behavior...).” If neighborhood quality represents an important site factor that households consider in choosing a housing option, standard economic theory predicts that voucher receipt would result in improved neighborhood quality. However, if households place the great majority of weight on unit characteristics or non-neighborhood site factors in selecting housing, voucher receipt may not result in improved neighborhood quality. Given these incentives, voucher receipt is not likely to lead to a decrease in neighborhood quality; whether the effect will be positive or null, however, is theoretically ambiguous and must be determined empirically.

Regarding household composition, three aspects of the Section 8 program design—the income gain, the increased marginal tax rate, and the income ceiling for benefits—are likely to influence recipients’ choices.

#### *Income Gain*

First, through the rent subsidy, the Section 8 program can result in an income boost for recipient households, which may enable a variety of changes in household composition that had previously been constrained by financial considerations. Recipients may be able to terminate multigenerational housing arrangements or cohabitation relationships with other adults that were necessary to meet financial obligations. Changes in these arrangements that reduce financial

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<sup>9</sup> Technically, recipients face a zero marginal price of housing for units between the minimum acceptable standards of health and safety and fair market rent. Beyond the level of fair market rent, voucher recipients are able to purchase additional housing (up to 40 percent of their income) by paying the incremental market rent, without loss of the voucher.

obligations would imply a reduction in the number of adult members in the household. On the other hand, the increase in income associated with voucher receipt may provide individuals with the ability to support adult children or other individuals experiencing hardship. This consideration implies that voucher receipt could result in the addition of adult members to the household. The additional income provided by a voucher also seems likely to provide recipients with the resources necessary to support additional children, especially because the value of a rental voucher can increase with larger housing units, which can be justified to accommodate additional children.

#### *Increase in Marginal Tax Rate*

Because the Section 8 program requires recipient households to contribute 30 percent of income toward rent, the program effectively increases the marginal tax rate on earnings of all program beneficiaries.<sup>10</sup> At the margin, this may discourage the addition of earning adults to the household, and encourage departure of earning adults who had previously been in the household primarily to meet financial obligations. Overall, this feature of the program design seems likely to reduce the number of able-bodied adults in voucher households.

#### *Income Ceiling for Benefits*

Third, the Section 8 program specifies an income ceiling that households must fall below in order to be eligible for voucher receipt. If a household has income above this eligibility ceiling, continued voucher receipt is jeopardized. Hence, after receipt, households—especially those whose income is near the program eligibility limit—may reduce the number of earning adults in order to ensure that the household will retain eligibility for voucher receipt.

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<sup>10</sup> Again, it is important to note that Section 8 voucher receipt increases household income and the marginal tax rate only given our counterfactual of no receipt of housing assistance; see note 8.

Taken as a whole, the Section 8 program design seems likely to create an incentive structure that would lead to a reduction in the number of adult members of a household and encourage the addition of children. Moreover, the relocation that often accompanies Section 8 voucher receipt is likely to affect the theoretical considerations identified above. Relocation provides a natural opportunity for households to alter their composition and represents the only mechanism for households to change their neighborhood surroundings. Because relocation often takes place soon after voucher receipt, significant change in household composition and neighborhood quality may occur in the first year of voucher receipt, with subsequent stability in household composition and locational characteristics after this re-optimization.<sup>11</sup> Our empirical analysis will assess the accuracy of these predictions and conjectures.

### C. Empirical Research on Neighborhood Quality and Household Composition

#### *Neighborhood Quality*

A relatively limited body of empirical research has examined the relationship between voucher receipt and neighborhood quality;<sup>12</sup> most of it is based on evidence from three experimental studies, especially the Moving to Opportunity (MTO) experiment. This study randomly assigned participating public housing residents in five large urban areas to one of three groups: a control group that remained in public housing (Control group), a group that received a voucher that could be used anywhere (Section 8 group), and a group that received a voucher that

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<sup>11</sup> Many of the households that we classify as voucher recipients do not continue to use their voucher during the full observation period. Indeed, the typical recipient household tends to use their Section 8 voucher for less than four years. Our primary analysis describes how the households that received and used a voucher in the treatment year revealed geographic area and household composition outcomes in subsequent years, whether or not they continued to use their voucher for the entire observation period. However, in a supplementary analysis, we examine outcomes separately for 1) Cases that retained their voucher throughout the observation period, and 2) Cases that received a voucher in the initial year but relinquished it at some point during the observation period.

<sup>12</sup> Additional discussion of the prior literature on the full range of effects of voucher receipt can be found in Carlson et al, 2012.

could be used only to secure housing in areas with low poverty rates (MTO group). The final evaluation of the program finds that, relative to the control group, families assigned to the MTO and Section 8 groups lived in neighborhoods with lower poverty rates (U.S. Department of Housing and Urban Development 2011). When averaged over the 10 to 15-year study period, families assigned to the MTO and Section 8 groups lived in census tracts with average poverty rates of 31 percent and 33 percent, respectively. This compares favorably to the average poverty rate of 40 percent in the census tracts in which families assigned to the control group lived over the study period. Because not all households assigned to the MTO and Section 8 groups used their voucher, the treatment-on-the-treated (TOT) results are larger than the intention-to-treat (ITT) results presented above. Specifically, relative to the control group, households assigned to the MTO group that were able to use their voucher lived in neighborhoods with poverty rates that were 18 percentage points lower, on average; the corresponding TOT estimate for the Section 8 group is about 11 percentage points.

A second source of experimental evidence on the effect of voucher receipt on neighborhood quality is Jacob's (2004) analysis of a natural experiment in Chicago. Jacob exploited the fact that the Chicago Housing Authority offered Section 8 vouchers to public housing residents whose units were scheduled for demolition. In his analysis, Jacob classified voucher households whose units were scheduled for demolition as treatment cases while a group of voucher recipients whose units were not scheduled for demolition served as the control group. Jacob finds that, three years after initially receiving notification that their public housing unit would close, treatment group members' average census tract poverty rate was 53 percent, whereas the average poverty rate for members of the control group was 67 percent.

The final source of experimental evidence on the relationship between voucher receipt and neighborhood quality is the Welfare to Work (WtW) evaluation. This study was initiated in

2000 and conducted across six cities—Atlanta, Augusta, Fresno, Houston, Los Angeles, and Spokane. In this study, approximately 8,700 families that were receiving or eligible to receive welfare benefits were randomly assigned to either a treatment group that received a Section 8 voucher or a control group that did not receive a voucher. Results of the study indicate that four years after random assignment, voucher recipients lived in neighborhoods with lower poverty rates, higher adult employment, and lower welfare participation rates than did the control group (Mills et al. 2006).<sup>13</sup> Although these differences are statistically significant, they are quite small in magnitude relative to the two experimental studies described above. For example, the average poverty rate in census tracts where members of the treatment group resided was only 0.6 percentage points lower than the average poverty rate in census tracts where members of the control group resided.<sup>14</sup>

Taken together, the existing literature suggests that Section 8 voucher receipt can result in households residing in higher-quality neighborhoods, at least as measured by the poverty rate of the census tract. However, estimates of the extent to which Section 8 recipients reside in higher-quality neighborhoods are quite inconsistent across the three experimental studies; estimates of the difference in the average neighborhood poverty rates for the treatment and control groups appear to be larger for the studies using public housing recipients (Jacob and MTO) than for those that test the effect of voucher receipt on a more general population of recipients (WtW).<sup>15</sup>

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<sup>13</sup> Notably, voucher receipt did not have a significant impact on census tract poverty rate until the fifth quarter after random assignment.

<sup>14</sup> The limited nonexperimental research on the effects of low-income housing vouchers also shows that Section 8 voucher recipients are less likely than public housing residents to live in high-poverty neighborhoods. For example, Newman and Schnare (1997) found that 54 percent of public housing residents lived in neighborhoods in which more than 30 percent of residents were poor, whereas only 15 percent of Section 8 voucher recipients lived in such neighborhoods.

<sup>15</sup> The discrepant magnitudes are likely due in part to contrasting counterfactuals. The counterfactual in the Jacob and MTO studies is residence in traditional public housing. The findings in these studies that voucher receipt results in households living in neighborhoods with significantly lower poverty rates may not be surprising, given that public housing complexes are often located in neighborhoods that are quite poor, particularly in the cities where

### *Household Composition*

Research on the effects of housing voucher receipt on household composition is far more limited. To our knowledge, the Welfare to Work experiment is the only study that has reported on these effects to a meaningful extent. About four years after random assignment, voucher receipt reduced the proportion of multigenerational households and average household size, but did not have an effect on the likelihood of residing with a spouse or partner or on the number of children living in the household (Mills et al. 2006). Given the limited existing empirical research on household composition, our analysis has the potential to yield insights into the effects of policy on this important social outcome.

### **III. OUR RESEARCH APPROACH**

This paper studies the effect of housing voucher receipt on geographic movement, neighborhood quality, and household composition among a broad sample of recipient households in Wisconsin. As noted above, we specify the counterfactual as receipt of no housing assistance, which is similar to that used in the WtW experiment. However, our analysis is based on a sample that is broader, more diverse, and more representative of voucher recipients nationwide than the WtW sample.<sup>16</sup> The breadth and size of our sample allows us to separately analyze the

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Jacob's study and MTO took place. The counterfactual in the WtW study, in contrast, was specified as no voucher receipt, and just 7 percent of the households in the experiment lived in public housing at the time of random assignment. Again perhaps not surprisingly, this study found voucher receipt to result in households living in areas with only slightly lower poverty rates. (The study finds that voucher recipients who lived in public and assisted housing at baseline were more likely to move to a different census tract and more likely to move to a tract with a lower poverty rate [ $p < .01$ ] than were control group members who resided in public or assisted housing at baseline [exhibits D.1 and D.3].) Because most housing voucher recipients do not transition from traditional public housing to Section 8 voucher receipt, but rather from no housing assistance to Section 8 receipt, residence in public housing is not always an ideal counterfactual in the study of housing voucher effects. Residence in public housing in large central cities may be an especially misleading counterfactual for some studies of housing vouchers, since the majority of voucher recipients do not reside in central cities. The most recent national data show that less than half (47 percent) of voucher recipients lived in central cities, 14 percent resided outside of metropolitan statistical areas and 39 percent resided in suburbs (HUD 2008).

<sup>16</sup> See Carlson et al. (2012) for a comparison of the characteristics of our sample to the characteristics of Section 8 recipients nationwide.

effects of voucher receipt for a variety of policy-relevant socioeconomic and geographic subgroups, including households in Milwaukee, rural areas, and non-Milwaukee urban areas, households headed by Blacks and Whites, and households headed by young, middle-aged, and older individuals.

A. Data

Our analysis is based on detailed administrative records from two large-scale databases maintained by the State of Wisconsin, supplemented with data from the U.S. Census Bureau. The primary source of data is the Wisconsin Client Assistance for Re-employment and Economic Support (CARES) database, containing detailed demographic, location, and public program participation information on several hundred thousand cases, with up to five years of longitudinal records on each case.<sup>17</sup> From this database we extracted annual records through 2006 for all cases that applied for or received Supplemental Nutrition Assistance Program (SNAP, formerly Food Stamp program) or Temporary Assistance for Needy Families (TANF) benefits in 2001, 2002, or 2003 and were not recorded as living in public housing. We pool the three calendar year cohorts and separate the sample into two groups—cases that were first observed receiving a Section 8 voucher between 2001 and 2003 and cases that did not receive a Section 8 voucher between 2001 and 2003, or in any of the follow-up years.<sup>18</sup> The data on receipt of a housing voucher is derived from questions asked of households applying for, or seeking

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<sup>17</sup> The definition of a “case” depends on the type of assistance sought or being received. A TANF case generally consists of a parental casehead and the casehead’s minor children. Food Stamp cases consist of an identified casehead, generally the adult who applies for assistance, and all members of the household who buy and prepare food with the casehead. A household receiving both TANF and Food Stamps would have the same case identification number in the two programs. Case identification numbers remain the same if the casehead leaves the case and another adult becomes the casehead.

<sup>18</sup> A family unit is defined as being in the voucher group if the CARES case file indicates that it first received a rental subsidy in a particular calendar year or if the case file indicates that the case received a rental subsidy after a minimum of two consecutive months of nonreceipt. Nonrecipient units are those cases that did not join the voucher group according to this criterion and were not receiving a rental subsidy.

continuation of, TANF or food assistance. The CARES database indicates whether households receive voucher-based housing subsidies, reside in public housing, or receive no housing assistance.<sup>19</sup>

We added earnings and employment information from 1996 to 2006 from the Wisconsin Unemployment Insurance (UI) database to all of the extracted observations. These earnings and employment records are used in the matching procedure that we describe below. In a final step, we matched each address in the address history of all cases in our database to a census block group, and then merged approximately 20 block group characteristics from the 2000 Census into the dataset.<sup>20</sup> From these 20 block group characteristics we selected four—the unemployment rate, the percentage of persons in poverty, the percentage of 16- to 19-year-olds in school, and the median gross rent—to serve as our measures of neighborhood quality. We selected these four measures in an effort to examine multiple aspects of neighborhood quality, specifically dimensions related to the labor market, education, income, and housing quality. Examining the bivariate correlations between these measures suggests that we were largely successful in

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<sup>19</sup> There are other forms of housing assistance in addition to Section 8 vouchers and public housing, the most common of which are assistance to housing projects offered by the Department of Housing and Urban Development and tax credit programs for developers. Respondents who live in housing opened by private developers with public support, either through tax credits or through HUD project assistance, may say either that they receive no assistance or that they reside in public housing, but they would be unlikely to say that they receive a housing voucher. The U.S. Department of Agriculture also operates a housing voucher program, but it is much smaller than Section 8; there are only about 100 USDA housing vouchers in Wisconsin (see [http://www.rurdev.usda.gov/Reports/WI\\_USDA\\_AnnualReport.pdf](http://www.rurdev.usda.gov/Reports/WI_USDA_AnnualReport.pdf)) compared to some 28,000 Section 8 vouchers. The number of Section 8 recipient households in our data conforms broadly to what we know about the number of Section 8 units in Wisconsin: There were, according to HUD, 27,942 vouchers in Wisconsin in 2004 (see [http://www.huduser.org/portal/download/Pict2004\\_655633.csv](http://www.huduser.org/portal/download/Pict2004_655633.csv)). Nationally, HUD data suggest that about 44 percent of Section 8 voucher households also receive some form of welfare. This would suggest that, in any given year, about 12,300 Section 8 households in Wisconsin (27,942 X .44) would also be receiving some form of welfare. Since the average length of stay on Section 8 is about 3 years, the number of entrants to the Section 8 program with welfare assistance should be about 4,100 (12,300/3). The number who had either applied for or were receiving welfare should be somewhat higher. Our data (Table 1) contain 5,383 Section 8 households that had either applied for or were receiving welfare assistance in 2003.

<sup>20</sup> As noted earlier, because the 2000 Census served as our data source on neighborhood quality at the block group level, our measures of neighborhood quality are not dynamic in nature. Consequently, any observed changes in neighborhood quality are attributable to household relocation, rather than a change in neighborhood quality over time.

identifying separate dimensions of neighborhood quality. Although the neighborhood unemployment rate and the percentage of persons in poverty correlate at approximately 0.7, all remaining correlations fall below 0.3, with most below 0.2.<sup>21</sup> Taken together, this suggests the existence of multiple dimensions of neighborhood quality and opens the possibility of heterogeneous effects of voucher receipt across these dimensions.

Our household composition analysis proceeds in two stages. In the first stage we estimate the effect of voucher receipt on the number of adults in the household and on the number of children in the household. However, because our first-stage analysis could mask offsetting household composition changes, we perform a second-stage analysis in which we separately estimate the effect of voucher receipt on the addition of an adult member and the loss of an adult member.

The full dataset contains complete information for 12,170 cases in the voucher group and over 342,000 nonvoucher, or potential comparison, cases for up to a six year period. This sample is broad and includes both urban and rural residents, households with a wide variety of racial and ethnic backgrounds, and cases with a variety of familial compositions, from single individuals to married couples with multiple children. Table 1 summarizes the demographic characteristics of the two groups for the three cohorts that comprise our dataset.<sup>22</sup>

[Insert Table 1 about here]

## B. Empirical Strategy

The fact that individuals self-select into voucher receipt, thus rendering it potentially endogenous, represents the most serious challenge to identifying the effect of voucher receipt on

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<sup>21</sup> The precise correlations are available from the authors upon request.

<sup>22</sup> Readers may note that the number of cases for which we have complete data (12,170 voucher cases and over 342,000 potential comparison cases) is not equal to the sum of rental subsidy and non-rental subsidy cases in Table 1. This is because Table 1 presents demographic characteristics for all cases extracted from the CARES database. Not all of these cases were able to be linked to UI earnings records or geocoded to a census block group.

neighborhood quality or household composition. The breadth and depth of our dataset allow us to pursue several strategies for addressing the possible endogeneity of voucher receipt. In our main analysis we use propensity score matching techniques to create a comparison group that is statistically indistinguishable our sample of voucher recipients on dozens of observable characteristics.<sup>23</sup> We then isolate the effect of voucher receipt on neighborhood quality and household composition in a regression framework.<sup>24</sup> Combining matching with regression has been found to generally be preferable to applying either method in isolation (Imbens and Wooldridge, 2008; Gelman and Hill, 2007). Taken as a whole, our sample and empirical approach result in estimation of the effect Section 8 voucher receipt on mobility, household composition, and neighborhood quality outcomes for a sample of recipient caseheads, relative to a counterfactual world in which no housing assistance is available.

### C. Propensity Score Matching Approach

Research has shown that propensity score matching techniques are most effective in eliminating bias due to endogenous treatment assignment when several conditions are met (see

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<sup>23</sup> The primary papers describing propensity score matching approaches include Rosenbaum and Rubin (1983); Heckman, Ichimura, Smith, and Todd (1996, 1998); Heckman, Ichimura, and Todd (1997); and Smith and Todd (2005). Applications of the method include Dehejia and Wahba (1999, 2002); Lechner (2002); and Dyke, Heinrich, Mueser, Troske, and Jeon (2006). The theoretical properties underlying propensity score matching guarantee only that the procedure has the ability to eliminate differences on all observed characteristics used in the propensity score estimation; this procedure does not have the ability to correct for bias stemming from unobserved variables. As we describe in greater detail below, propensity score matching procedures have been shown to be particularly effective in reducing bias stemming from nonrandom treatment assignment under a number of conditions that we are confident our procedure meets. Our belief that our approach produces unbiased estimates of the effect of voucher receipt on neighborhood quality and household composition outcomes is supported by the results of several sensitivity analyses later in this paper.

<sup>24</sup> A more complete discussion of the general empirical approach we have followed can be found in Carlson et al, 2012. The dataset and empirical approach we employ in this paper are similar to those we use in that study. We use a similar empirical approach to isolate the effects of voucher receipt on our outcomes of interest. While the analyses in Carlson et al. (2012) focus on estimating the effect of voucher receipt on earnings and employment, this paper estimates the effect of voucher receipt on two social outcomes—neighborhood quality and household composition. Consequently, this paper exploits the information from the 2000 U.S. Census—to examine neighborhood quality—and the CARES database—to analyze household composition—while Carlson et al. (2012) relies most heavily on the information from the UI database.

Heckman, Ichimura, and Todd 1997; Smith and Todd 2005; and Pirog, Bufardi, Chrisinger, Singh, and Briney 2009. First, propensity score matching procedures are most effective in eliminating bias when the ratio of treatment to potential comparison cases is large. The 12,170 voucher cases and over 342,000 potential comparison cases result in a ratio of potential comparison to treatment cases of nearly 30:1. Few propensity score applications have had a more desirable distribution of treatment and potential comparison cases. Second, the ability of propensity score matching techniques to eliminate bias is maximized when treatment cases—voucher recipients—can be matched to potential comparison cases that are similar on demographic, geographic, and contextual dimensions. The large number of potential comparison cases, coupled with the large amount of information we have on each case, provides us with the ability to achieve balance between the voucher and matched comparison groups on these important dimensions.<sup>25</sup> Finally, propensity score matching techniques are most effective at eliminating bias due to endogenous treatment assignment when the model used to estimate the propensity score contains pretreatment measures of the outcomes to be studied. Consequently, our matching model contains baseline measures of neighborhood quality and household composition. Taken as a whole, we believe our data provide an ideal context for isolating the effect of voucher receipt on neighborhood quality and household composition outcomes using a propensity score matching approach.

The model we use to estimate each case's propensity score, which we estimate separately for the full sample and each demographic subgroup we analyze, contains a wide variety of covariates. Specifically, and in line with the recommendations of previous research, it contains

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<sup>25</sup> Demographically, we include variables measuring race/ethnicity, age, sex, education, and several other characteristics. Geographically, all cases reside in Wisconsin and, in addition, we match on county of residence. Contextually, we match on approximately 20 census block group variables that measure important neighborhood characteristics.

numerous demographic, geographic, and contextual measures, as well as baseline measures of the outcomes to be studied—neighborhood quality and household composition—and dozens of other variables likely to be predictive of Section 8 voucher receipt.<sup>26</sup>

Upon estimation of each case’s propensity score, we used a nearest neighbor technique to match—with replacement—each voucher recipient to five nonrecipient cases.<sup>27</sup> We evaluated the quality of the match by performing a balance test, and by comparing baseline measures of neighborhood quality and household composition for the voucher and matched comparison groups. Results from the balance test indicate no statistically significant difference between the voucher and matched comparison groups on any of the dozens of covariates included in our model used to estimate the propensity score. Similarly, comparison of the baseline neighborhood quality and household composition measures reveal no differences between the voucher and matched comparison groups. Taken as a whole, these diagnostic procedures indicate that the matching procedure succeeded in generating a comparison group that is indistinguishable from the group of voucher recipients on dozens of observable characteristics, thus increasing the likelihood that our analyses return unbiased estimates of the effect of Section 8 voucher receipt on neighborhood quality and household composition.<sup>28</sup>

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<sup>26</sup> Additional detail regarding the propensity score approach, including a comprehensive listing of the variables that we include in the logit model used to estimate the propensity score and the results of the balance tests, can be found in Carlson et al (2012).

<sup>27</sup> Nearest neighbor matches were also performed with each treatment case matched to the 1, 3, and 10 nearest neighbors. The results, which are available from the authors, did not differ substantively. There are several matching strategies available in the propensity score literature—including “nearest neighbor,” “kernel,” and “local linear regression” methods. Discussions of various matching metrics and methods can be found in Mueser, Troske, and Gorislawsky (2007) and Smith and Todd (2005).

<sup>28</sup> We also performed balance tests for each of our subgroup matches. The results, which are available from the authors, show no statistically significant pre-receipt differences on any variable for any subgroup. See Carlson et al. (2012) for more detail on the matching strategy and diagnostic evaluations.

*D. Regression-adjusted Estimates of the Effect of Voucher Receipt on Neighborhood Quality and Household Composition*

After using the propensity score matching procedure to generate the comparison group for our sample of voucher recipients, we isolated the effect of voucher receipt on neighborhood quality and household composition in a regression framework. Specifically, we estimated the following model:

$$Y_{it} = \alpha + \beta_1 V_i + \beta_2 R_{it} + \beta_3 X_{it} + \beta_4 A_{it} + \beta_5 (V_i \times A_{it}) + \epsilon_{it} \quad (1)$$

where  $i$  and  $t$  index cases and time since initial voucher receipt, respectively;  $Y$  represents the neighborhood quality or household composition outcome;  $\alpha$  represents the intercept;  $V$  is a dummy variable indicating voucher receipt in the treatment year;  $R$  represents the calendar year;  $X$  is a vector of observed characteristics of the case and casehead;<sup>29</sup> and  $A$  represents the year of the observed outcome relative to the treatment. The model is estimated via OLS. For each year, the total estimated effect of voucher receipt on the case-specific outcomes is equal to the sum of  $\beta_1$  and  $\beta_5$ .

#### IV. ESTIMATION RESULTS

##### A. Geographic Movement

Changing residential location provides a natural opportunity for Section 8 voucher recipients to alter neighborhood quality; it may also be the basis for a change in household composition. Hence, we estimate the effect of housing voucher receipt on the probability that a household changes residence within one year and within four years after the month in which the

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<sup>29</sup> Specifically, the vector of observed characteristics includes the sex, education level, race/ethnicity, age, marital status, and baseline earnings of the casehead as well as baseline household composition.

case first received the housing voucher; we use the CARES database that includes information on the address history of each family.<sup>30</sup>

As shown in Table 2, the receipt of a housing voucher substantially increases the probability of changing residential location in both the full sample and for every demographic subgroup we examine. For the full sample, 58 percent of voucher recipients had moved within one year after voucher receipt, compared to 44 percent of matched non-recipient families. By four years after voucher receipt, 77 percent and 67 percent of the two groups, respectively, had moved.<sup>31</sup> When estimated in a regression framework, the marginal effect of voucher receipt on the probability of moving within one year of receipt is 0.131; the marginal effect on moving within four years of receipt is 0.107. Voucher receipt clearly induces relocation across census block groups.

[Insert table 2 about here]

## B. The Effect of Voucher Receipt on Neighborhood Quality

### *Full Sample Results*

Table 3 presents the estimated effect of voucher receipt on our four indicators of neighborhood quality—the unemployment rate, the percentage of persons in poverty, the percentage of 16- to 19-year-olds in school, and the median gross rent—for the full sample.

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<sup>30</sup> For this analysis, we define moving to a different Census block groups. We employ this definition of relocation, which is very similar to the one employed in the Welfare to Work experiment, because it is only by moving to a different block group that households can experience changes in neighborhood quality. That said, we also estimated the effect of voucher receipt on any residential relocation and the results, which are available from the author, are substantively similar.

<sup>31</sup> Our estimates of the effect of voucher receipt are very similar to those found in the Welfare to Work experiment. The four-year treatment-on-the-treated estimated marginal effect of voucher receipt on changing Census tracts in Welfare to Work—the estimate to which ours is most comparable— is 0.110 whereas our estimated marginal effect is 0.107. See Exhibit 3.5 in [http://www.huduser.org/portal/publications/pdf/hsgvouchers\\_1\\_2011.pdf](http://www.huduser.org/portal/publications/pdf/hsgvouchers_1_2011.pdf)

One year after voucher cases first received a housing subsidy, the differences in neighborhood quality between the voucher and matched comparison groups are slight. The neighborhood (average census block group) unemployment rate for the voucher group is about one-fifth of one percentage point lower than that for the matched comparison group, and this gain is statistically significant. Interestingly, one year after voucher receipt, recipients appear to live in neighborhoods that have slightly fewer (about one-half of one percentage point) youths in school than do the neighborhoods of the matched comparisons, and this result is also statistically significant. There are no statistically significant differences between the two groups on percentage of persons in poverty and median gross rent.

[Insert table 3 about here]

The neighborhood quality results measured four years after voucher receipt indicate that, relative to the matched comparison group, voucher recipients have moved to slightly higher quality neighborhoods. Four years after receipt, voucher recipients lived in census block groups with a significantly lower percentage of persons in poverty and continue to reside in neighborhoods with lower unemployment rates. The magnitude of these effects, however, is rather small—a 0.28 percentage point lower poverty rate and a 0.23 percentage point lower unemployment rate. In addition, the point estimates suggest that members of the voucher group live in areas with higher median rent and a greater proportion of 16- to 19-year-olds in school, but these estimates fail to reach statistical significance. Taken together, these results provide some evidence that receipt of a housing voucher leads to small improvements in neighborhood quality over a multi-year time period.

### *Subgroup Results*

The full sample results mask a number of interesting patterns occurring across geographic and demographic subgroups. In Table 4, we present our neighborhood quality results for a variety of subgroups.

Like previous work employing samples from large cities—MTO, WtW, and Jacobs (2004)—our results for Milwaukee households indicate that voucher receipt spurs movement to higher quality neighborhoods; one year after initial receipt, Milwaukee voucher recipients live in census block groups with a lower percentage of persons in poverty, a lower unemployment rate, and a higher percentage of 16- to 19-year-olds in school, relative to the matched comparison group. The magnitude of these estimates—1.3 percentage points fewer persons in poverty, a 0.6 percentage point lower unemployment rate, and 0.7 percentage points more 16- to 19-year-olds in school—is similar to those found in WtW. The positive effects of voucher receipt on neighborhood quality are slightly stronger four years after receipt for households in Milwaukee.

[Insert table 4 about here]

In contrast, our analysis of households in rural areas reveals that voucher receipt results in movement to lower quality neighborhoods, particularly within the first year of receipt. One year after receipt, voucher recipients in rural areas reside in neighborhoods with an average of 0.74 percentage points more individuals in poverty, 1.1 percentage points fewer 16- to 19-year-olds in school, and rents that are, on average, \$8 lower than the rents in block groups where matched comparison cases reside. Four years after receipt, however, the negative effects of voucher receipt on measures of the proportion of youths in school and the median gross rent fade to statistical insignificance; the negative effect on the percentage of individuals in poverty remains significant, however.

Results for urban households outside of Milwaukee are mixed. Our analysis indicates that, one year after receipt, voucher recipients reside in neighborhoods with a greater number of persons in poverty and a lower percentage of youths in school, relative to the group of matched comparison cases. However, the results also indicate that voucher recipients reside in neighborhoods with slightly lower unemployment rates. By four years after receipt, there are no statistically significant differences between the voucher and matched comparison groups on any of the neighborhood quality measures for households living in an urban area outside of Milwaukee.

In addition to separately analyzing the effects of voucher receipt by the urbanicity of households, we also track the results by the age and the race/ethnicity of the casehead.<sup>32</sup> These results, also shown in Table 4, indicate that for all of the age groups in the first year after voucher receipt, recipients moved to neighborhoods with statistically significantly lower unemployment rates. However, recipients aged 18-30 years tended to relocate to neighborhoods with a somewhat lower percentage of youths in school while older voucher holders moved to neighborhoods with statistically significantly lower rent—on average about \$9. By four years after voucher receipt, the pattern of relocation to neighborhoods with lower unemployment rates but lower rents persisted for voucher recipients aged less than 55 years, whereas households headed by a young person were living in neighborhoods with slightly higher average rent.

Examining the results by the race/ethnicity of the casehead indicates that, in the first year after voucher receipt, White voucher recipients reside in neighborhoods that are of lower quality on three of four dimensions—the percentage of persons in poverty, the percentage of youths

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<sup>32</sup> We also separately analyzed the effect of voucher receipt by household composition—single parents, couples with children, and cases with no children—but there were no systematic differences across these groups. We do not present these results in this paper, but they are available from the authors upon request.

enrolled in school, and the median gross rent—relative to matched comparison cases.<sup>33</sup> In contrast, Black voucher recipients are found to reside in neighborhoods with significantly lower proportions of individuals in poverty and lower unemployment rates. In addition, the point estimates on youth school enrollment and median gross rent are positive, but fail to reach statistical significance. By four years after receipt, Black voucher recipients reside in neighborhoods that are significantly better on all four measures of neighborhood quality, relative to the matched comparison group, while White recipients reside in neighborhoods that are not significantly different from those where the matched comparison cases reside on three of the neighborhood quality measures. However, White recipients continue to reside in neighborhoods with a slightly higher percentage of persons in poverty.<sup>34</sup> Given the overlap between race and urban location, the similarity of results on the effects of voucher receipt for Milwaukee residents and Blacks (relative to non-Milwaukee residents and Whites) are fully consistent. See footnote 34 for further detail on the overlap between race and urban location among our sample members.

### C. The Effect of Voucher Receipt on Household Size and Composition

In our estimation of the effect of voucher receipt on household composition, we first present results on the number of adults and number of children living in households. Then, we study the basis for these observed ‘count effects’ for adults by estimating the effect of voucher receipt on the addition and loss of adults.

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<sup>33</sup> White voucher recipients are found to move to neighborhoods with slightly lower unemployment rates, however.

<sup>34</sup> Given the parallels in the results for Milwaukee vs. rural households and Black vs. White households, it is instructive to consider the overlap in these subgroups. Analysis reveals that, among voucher recipients in Milwaukee, 75 percent were Black while 17 percent were White. In rural areas only 2 percent of recipients were Black while 87 percent were White. In urban areas outside of Milwaukee, 25 percent of recipients were Black and 64 percent were White. Analyzing the conditional distributions from the opposite perspective reveals that, among Black recipients, 60 percent resided in Milwaukee, 1 percent in rural areas, and 38 percent in urban areas outside of Milwaukee. Among White recipients, 8 percent resided in Milwaukee, 40 percent in rural areas, and 52 percent in urban areas outside of Milwaukee.

*Effects on Number of Adults and Number of Children*

Table 5 summarizes our findings concerning the effect of voucher receipt on the number of adults and the number of children in the household. Full sample results are presented in the first bank of the table; the remaining banks show effects on subgroups of the population. We analyze these outcomes for up to six years after initial voucher receipt.

[Insert table 5 about here]

Our estimates reveal that one year after receipt, voucher receipt led to sizable and statistically significant reductions in the number of adults. Voucher receipt is also estimated to result in a decrease in the number of children, but the estimate is substantively small. The reduced number of adults is observed for the subsequent five years, though the magnitude of the effect diminishes across time. Beginning two years after voucher receipt, effect of voucher receipt on the number of children became positive, and the magnitude of the estimated effect increased in each succeeding year. Five years after voucher receipt, the effect of voucher receipt on the reduction in the number of adults was nearly equal to its effect on the increase in the number of children.

This pattern persisted across the geographic areas distinguished, except that no statistically significant effect of voucher receipt is observed for the number of children in rural areas in any observation year. Similarly, the patterns observed for the full sample exist for both racial groups we analyze. For households headed by younger people (ages 18-31), the large, statistically significant, and negative treatment year impact on the number of adults is reduced in subsequent years, though it remains negative and statistically significant through the observation period. Five years after voucher receipt, both of the older household groups recorded decreases in the number of adults, but no significant effect on the number of children.

*Effects on Addition/Losses of Adults*

In this analysis, shown in Table 6, we separately estimate the effect of voucher receipt on adding and losing an adult member of the case. This analysis allows us to determine whether the reduction in the number of adults is primarily attributable to voucher recipients, relative to the comparison group, actively shedding adult members from the case or simply being less likely to add additional adult members. The top bank of the table presents the estimated marginal effects for the full sample while subsequent banks show the results by geographic, racial/ethnic, and age subgroups.

[Insert table 6 about here]

For the full sample, receipt of a housing voucher stimulates significant changes in household composition in the initial year of receipt. Consistent with the findings in Table 5, voucher receipt is estimated to increase the predicted probability of losing an adult by more than 5 percentage points in the treatment year. This effect is both statistically and substantively significant, given that the comparison group mean in the year of receipt is only 15.4 percent. This effect turns negative and statistically significant, albeit substantively small, for three of the next five years. Similarly, voucher recipients were also significantly less likely than cases in the matched comparison group to add an adult in the year of voucher receipt. Taken together, it appears that initial receipt of a voucher spurs recipients to reconsider, and generally decrease, the number of adults living in the household. Over the period of observation, the number of adults in the household appears to stabilize, but at a lower level.

The pattern of adult additions and losses among subgroups are shown in subsequent banks of Table 6. For households in Milwaukee, voucher recipients are significantly less likely to add an adult to their case in each of the five years of observation, relative to the matched comparison group. In addition, Milwaukee recipients are significantly more likely to lose an

adult from the case in the first year of receipt than are nonrecipients, but are significantly less likely to lose an adult from the case in each of the next four years. Again, with respect to adult members, we observe a brief period of change followed by a longer period of stability—both fewer additions and fewer losses.

Like households in Milwaukee, households in rural areas exhibit a substantial increase in the probability of losing an adult—a marginal effect of 7 percentage points on a sample mean of 15.7 percent—and a significant decrease in the probability of adding an adult in the initial year of receipt. The similarities, however, end there. Whereas the effects of voucher receipt on adult case membership persisted over time for households in Milwaukee, voucher receipt has virtually no marginal effect on adult case membership over the subsequent five years of observation. The effects of voucher receipt in urban areas outside of Milwaukee are mixed. Voucher receipt exerts a negative effect on the probability of adding an adult in the years immediately following receipt, but a small positive effect in subsequent years. Similarly, voucher receipt has a positive impact on the probability of losing an adult in the initial year of receipt, but mixed effects in later years.

White households show a substantively large and significant effect of losing an adult in the treatment year (marginal effect of 6.2 percentage points), but no further effects over the subsequent period. The reduced probability of adding an adult (-2.7 percent) in the year of receipt is almost totally offset by small increases in the probability of adding an adult over the remaining observation period. Black households also show a positive, large and statistically significant effect on the probability of losing an adult in the initial year followed by a decreased likelihood of losing an adult in subsequent years. Finally, Black households, like whites, show a sizable and significant negative effect on the probability of adding an adult in the initial year of

receipt. However, unlike whites, there is also a significant and negative marginal effect on adding an adult over four of the remaining five observation years.

In the treatment year, households with heads in the youngest age category (ages 18-30) have a sizeable and significantly positive marginal effect (6.9 percentage points) of voucher receipt on the probability of losing an adult, and a sizeable and significantly negative effect (4.6 percent) on the probability of adding an adult. Both effects work to decreasing the number of adults in these households in the year of voucher receipt, relative to the matched comparison group. The initial negative effect on adding an adult is followed by an additional negative effect in the first post-treatment year, and then a positive effect in the fifth year after voucher receipt. These patterns are consistent with the overall effect of voucher receipt in significantly reducing the number of adults in the households of those in the youngest age group over the observation period. For both of the older age groups, the large and significant positive treatment year effects on the probability of losing an adult and the large and significant negative effect on the probability of adding an adult are followed by generally small and statistically insignificant marginal effects on these outcomes in subsequent years.

Taken as a whole, the results indicate that, relative to the matched comparison group, the lower number of adults in voucher cases is primarily attributable to these cases actively dropping adults in the initial year of receipt. However, a reduced probability of adding adults among voucher cases is undoubtedly responsible for some portion of the observed lower number of adults, at least in the initial year of receipt.

## **V. ROBUSTNESS TESTS AND SUPPLEMENTAL ANALYSES**

The results of several diagnostic procedures provide confidence that our propensity score matching approach returns unbiased and reliable estimates of the effect of voucher receipt on

neighborhood quality and household composition outcomes. However, like all propensity score-based analyses, our results may be biased because of unobserved heterogeneity between the voucher and matched comparison groups. To evaluate the merits of such concerns, we developed and executed several sensitivity analyses and robustness tests. Taken as a whole, the results of all these analyses are similar to our propensity score-based results and provide confidence in our primary results.

A. Recipient Fixed Effects for Neighborhood Quality Analysis

Our first robustness test exploits the fact that we have measures of recipients' neighborhood quality at baseline—prior to voucher receipt—and at various points after receipt. As a result, we use over-time variation in receipt among cases in the voucher group to identify the effect of voucher receipt on neighborhood quality. Specifically, we constructed a two-period panel—baseline and one year after receipt—of all cases in our voucher group. Using this panel, we estimate the following model:

$$Y_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 \mathbf{R}_t + \beta_3 \mathbf{C}_i + \beta_4 \mathbf{X}_{it} + \gamma_i + \varepsilon_{it}. \quad (2)$$

where  $Y$  represents the respective neighborhood quality measure;  $\beta_0$  represents the intercept;  $V$  is a dummy variable indicating voucher receipt;  $\mathbf{R}$  is a vector of calendar year dummies;  $\mathbf{C}$  is a vector of cohort dummies;  $\mathbf{X}$  is a vector of time-varying observed case characteristics that includes demographics, earnings, and case composition; and  $\gamma$  represents a case-level fixed effect. Subscripts  $i$  and  $t$  index cases and time, respectively. Because all cases in the estimation sample receive a voucher, this analysis mitigates the critique that selection into the voucher group could be biasing the estimated effects of voucher receipt on neighborhood quality.<sup>35</sup>

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<sup>35</sup> This analysis can be conducted only for the neighborhood quality outcomes; we do not have pre-receipt measures of household composition changes.

For the full sample, the results of this model, presented in Table 7, are quite similar to those in the primary analysis, though there are a few important differences. As in our primary analysis, these results indicate that voucher receipt spurs a statistically significant movement to neighborhoods with lower unemployment rates. Also similar to our primary analysis, this analysis indicates that voucher receipt results in a movement of households to neighborhoods with lower proportions of individuals in poverty, a result that was not statistically significant in our primary analysis but reaches significance in this analysis.

While our primary analysis indicates that voucher receipt results in recipients residing in neighborhoods with a lower average proportion of 16- to 19-year-olds in school, the direction of this effect is the same, but the estimate is not statistically significant in this model. Our primary analysis found that voucher receipt results in a negative but statistically insignificant effect on the average median gross rent of recipients, but this analysis indicates that voucher receipt results in a significant increase in the median gross rent in recipient neighborhood. Finally, as in our primary results, the results of this analysis indicate that effects of voucher receipt on neighborhood quality are more positive for Blacks than for Whites and for recipients in Milwaukee County than for recipients in rural areas, a finding with important policy implications (subgroup results not tabled).

[Insert Table 7 about here]

Overall, the results of this test of robustness are consistent with the main conclusion that emerges from our primary results, namely that the effects of voucher receipt on neighborhood quality one year after receipt are substantively small. Also, in both our primary analysis and this sensitivity test, responses differ significantly across socioeconomic subgroups. On the whole, however, these results offer a slightly more positive picture of the effect of voucher receipt on neighborhood quality than our primary full sample results.

B. Using the 2002 Cohort as Comparison Group for the 2001 Cohort

To further assess whether our propensity score analysis accounts for unobserved factors that may drive selection into the voucher group, we constructed a sample that enables us to compare baseline neighborhood characteristics for the 2002 cohort of voucher recipients to the neighborhood characteristics of the 2001 cohort of recipients one year post-receipt. Because both the 2001 and 2002 cohorts ultimately applied for and received a Section 8 voucher, those unobserved characteristics that may select some families into voucher receipt are controlled for in this comparison. As a result, this analysis addresses the concern that unobserved heterogeneity between the voucher and matched comparison groups may affect our primary results reported above.

We use the following model to compare earnings patterns for the two groups:

$$Y_i = \beta_0 + \beta_1 V_i + \beta_2 X_i + \varepsilon_{it}, \quad (3)$$

where  $Y$  represents the neighborhood quality outcome;  $\beta_0$  represents the intercept;  $V$  is a dummy variable indicating voucher receipt (i.e. the 2001 cohort one year post-receipt);  $X$  represents a vector of demographic and earnings characteristics. Estimation of this model returns results—presented in Table 7 above—that are similar to those presented in our primary analysis.

Specifically, voucher receipt is estimated to result in movement to a neighborhood with slightly lower unemployment rates (0.14 percentage points lower), but is not found to have a statistically significant effect on any of the three other measures of neighborhood quality. These results provide further confidence in the main conclusion that emerges from our primary analysis, namely that the effects of voucher receipt on neighborhood quality one year after receipt are substantively small.<sup>36</sup>

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<sup>36</sup> Again, this analysis can only be conducted for the neighborhood quality outcomes one year post-receipt; we do not have pre-receipt measures of household composition changes.

C. Duration-Specific Neighborhood Quality and Family Composition Responses to Voucher Receipt

In addition to addressing the concern that unobserved heterogeneity between the voucher and matched comparison groups may bias our results, we also conducted an analysis designed to provide clues into the mechanism that may account for the changes in neighborhood quality and household composition effects over the post-receipt period. In particular, we analyzed whether response to voucher receipt differs by duration of voucher holding—whether a family that retained its subsidy for (say) four years after receipt exhibits a response that differs from that of a family that used and then relinquished its voucher at some point during the first four years.<sup>37</sup>

To perform this analysis, we estimate the following models:

$$Y_{it} = \beta_0 + \beta_1 V_i + \beta_2 R_{it} + \beta_3 X_{it} + \beta_4 A_{it} + \beta_5 (V_i \times D_{it} \times A_{it}) + \varepsilon_{it} \quad (4)$$

$$Y_{it} = \beta_0 + \beta_1 V_i + \beta_2 R_{it} + \beta_3 X_{it} + \beta_4 A_{it} + \beta_5 (V_i \times N_{it} \times A_{it}) + \varepsilon_{it} \quad (5)$$

In the model 4,  $D$  is a dummy variable indicating that the case continued to receive a voucher in the specified outcome year. In the model 5,  $N$  is a dummy variable indicating that the case is not verified as continuing to receive a voucher in the specified outcome year. All other components of the model have been described above. Estimation of this model allows us to compare the relationship between voucher receipt and neighborhood quality or household composition outcomes among (1) cases that received a voucher in the treatment year and remained on housing assistance in a given year, and (2) cases that received a rental subsidy in the initial year, but subsequently relinquished receipt of this subsidy.

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<sup>37</sup> We are unable to control for unobserved characteristics that distinguish those with long voucher spells from those with short spells. As a result, the analysis is purely descriptive in nature, but it provides some insight into the extent to which the over-time changes in neighborhood quality and household composition outcomes may be due to cases leaving assistance and returning to pre-voucher behavior.

*Neighborhood Quality Results*

Estimation of models 4 and 5 indicates little difference in the neighborhood quality of stayers and leavers one year post-receipt.<sup>38</sup> Four years after receipt, however, cases that had retained their voucher throughout this period exhibited better outcomes on all four indicators of neighborhood quality than cases that received a voucher in the initial year but subsequently gave up their voucher. For example, for leavers, voucher receipt has no effect on median gross monthly rent for the neighborhood (relative to the matched comparison group), but there was a difference in median monthly rent of about \$11 between stayers and the matched comparison group four years after receipt. Similarly, relative to the matched comparison group, stayers lived in a census block group that had, on average, about 0.75 percentage points fewer persons in poverty; there was no difference between leavers and the matched comparison group on this measure. A similar trend is observed with respect to the indicator measuring the percentage of youths in school. Both stayers and leavers experienced statistically significant improvements in the unemployment rate relative to the matched comparison group, but the gains were larger for those who received a voucher in the initial year and remained on assistance. Full results are presented in Table 8, below.

[Insert Table 8 about here]

These results suggest that improvements in neighborhood quality attributable to voucher receipt may not manifest themselves immediately. Low-income individuals and families generally have a limited choice set with respect to their neighborhood of residence. Receipt of a housing voucher likely expands this choice set, but time may elapse before recipients learn about

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<sup>38</sup> “Stayers” are cases that received a voucher in the treatment year and were verified as continuing to receive a voucher in the year in which neighborhood quality is analyzed. “Leavers” are cases that received a voucher in the treatment year, but could not be verified to still be receiving a voucher in the year analyzed. Estimation results are available upon request from the authors.

and evaluate the new options in their choice set. Once recipients have had the opportunity to assess their newly available options, the results suggest that many recipients use their voucher to relocate to a more desirable neighborhood.

### *Household Composition Results*

Estimation of models 4 and 5 reveals almost no effect on the four case composition change measures for leavers; upon leaving assistance, cases apparently quickly return to nonvoucher behavior with respect to household composition. In contrast, stayers are substantially more likely to add a child to the case, and this effect grows over time. Moreover, cases that remain on voucher assistance four and five years after initial receipt are significantly more likely to add adults to the case. Full results are presented in Table 9 below. Taken together, the results suggest that long-duration voucher receipt enables caseheads to make desired adjustments in adult coresidential arrangements and fertility that were not possible for short-duration recipients.

[Insert Table 9 about here]

## **VI. DISCUSSION AND CONCLUSION**

This paper uses a longitudinal dataset containing extensive information on more than 350,000 low-income households residing in a diverse, medium-sized state to study the effects of housing voucher receipt on geographic movement, neighborhood quality, and household composition. The research exploits the size and diversity of our sample to separately analyze the effect of voucher receipt on these outcomes for several policy-relevant geographic and demographic subgroups, including households in Milwaukee, rural areas, non-Milwaukee urban areas, among Black and White recipients, and among households headed by individuals of different ages. We tested the robustness of our results and distinguished the relationship between

voucher receipt and neighborhood quality or household composition outcomes by the duration for which the voucher is retained.

Four main results emerge from this analysis. First, voucher receipt stimulates geographic mobility in both the short- and long-term. Relative to the matched comparison group, voucher recipients were significantly more likely to have moved to a different block group both one and four years after initial receipt of the voucher. The changes in location spurred by voucher receipt likely provide recipients with the opportunity to make significant changes in several aspects of their lives, including neighborhood quality and case composition.

Second, for the full sample, voucher receipt leads to some small improvements in neighborhood quality in the long term, but appears to have little effect in the short term. Evaluated one year after initial receipt, voucher recipients exhibit no improvement on three of our four neighborhood quality indicators. However, observations made four years after initial receipt indicate statistically significant, but substantively small, gains on all four indicators of neighborhood quality for voucher recipients. These results are consistent with a scenario in which voucher recipients require some time to learn about the new housing options available to them, but once recipients have evaluated the new options, they make decisions to reside in slightly better neighborhoods.

Third, for the full sample, voucher receipt appears to generate household composition change in the year of receipt, but greater stability in subsequent years. The change that occurs in the initial year is mainly characterized by a reduction in the number of adult members of the household. For some, the voucher may allow recipients to leave unproductive relationships and to establish an independent household. For others, the voucher may entail leaving a parental residence and establishing their own living arrangement. Both of these changes suggest that

voucher receipt improves overall well-being, reflecting the additional resources that come with voucher receipt.

Fourth, the full sample results mask a number of interesting patterns occurring across the geographic and demographic subgroups we study. The effect of voucher receipt on neighborhood quality is substantially more positive for Blacks, relative to Whites, and for recipients in Milwaukee, relative to recipients in rural areas. The effect of voucher receipt on household composition differs significantly across subgroups as well.

These findings have several significant implications for future research. The paper illustrates the importance of clearly specifying the counterfactual and sample context when analyzing the effects of Section 8 voucher receipt. Like WTW, which specifies the counterfactual as receipt of no housing assistance, our study finds voucher receipt to have a statistically significant, but substantively small, positive effect on some dimensions of neighborhood quality. This finding stands in contrast to studies that specify the counterfactual as public housing receipt—MTO and Jacobs (2004)—which find voucher receipt to have a much larger impact on neighborhood quality. In addition, this analysis indicates that the characteristics of the analytic sample have an important influence on the effects of housing voucher receipt. A primary contribution of this analysis is the provision of clear evidence that the effects of voucher receipt on neighborhood quality and household composition are very different in large urban areas than in rural areas. The fact that all previous studies on this topic have been conducted in the context of medium to large urban areas has masked these important differences. Additional research on subgroup differences—both qualitative and quantitative—is necessary to improve our limited understanding of the effects of voucher receipt outside of large urban areas.

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**Table 1. Demographic Characteristics for Those Who Receive Rental Subsidies and Those Who Do Not Receive Rental Subsidies: 2001–2003 Cohorts**

Characteristic	2001		2002		2003	
	Receive Rent Subsidy	Do Not Receive Rent Subsidy	Receive Rent Subsidy	Do Not Receive Rent Subsidy	Receive Rent Subsidy	Do Not Receive Rent Subsidy
<b>Total Number of Cases</b>	6,159	163,391	6,080	187,276	5,383	216,064
<b>Sex</b>						
Male	15.6	24.8	15.2	26.7	15.3	28.0
Female	84.4	75.2	84.8	73.3	84.7	72.1
<b>Age</b>						
18–30	42.9	37.9	47.0	38.4	48.0	39.1
31–45	29.9	36.0	30.2	36.1	28.3	35.8
46–59	12.6	13.5	12.3	14.2	14.0	14.9
60+	14.2	12.1	10.3	10.8	9.4	9.7
<b>Race</b>						
White	59.3	48.2	58.7	48.9	60.4	50.9
Black	29.0	36.2	28.5	35.6	26.9	34.5
Hispanic	3.3	6.2	3.7	6.3	3.1	6.3
Other	8.5	9.4	9.2	9.2	9.6	8.4
<b>Education Level</b>						
No high school diploma	35.4	39.7	34.1	37.9	33.2	36.3
High school diploma	64.6	60.3	65.9	62.1	66.8	63.7
<b>Marital Status</b>						
Single, never married	50.5	50.2	52.0	51.4	52.0	52.7
Divorced or annulled	20.4	17.9	21.4	17.7	21.7	17.5
Separated	11.3	10.7	11.2	10.4	11.0	9.8
Married	10.7	15.1	10.3	15.3	10.7	15.5
Widowed	7.0	6.0	5.1	5.2	4.6	4.5
<b>County Urbanicity</b>						
Rural	28.0	21.6	26.9	21.6	30.6	22.2
Urban	45.9	31.0	51.8	32.0	51.3	33.7
Milwaukee	26.1	47.4	21.3	46.4	18.1	44.1
<b>Number of Children</b>						
0	39.8	44.9	36.1	45.9	35.9	48.1
1	25.6	21.2	27.6	21.3	27.2	21.1
2	19.1	16.5	19.6	16.3	20.1	15.6
3+	15.5	17.4	16.8	16.4	16.9	15.2

**Table 2. Effect of voucher receipt on residential relocation- bivariate and multivariate results**

Moved	Bivariate results		Multivariate results
	Voucher group mean	Matched comparison group mean	Marginal effect of voucher receipt
One year post-receipt	57.6 (0.45)	44.1 (0.22)	0.131*** (0.005)
Four years post-receipt	76.8 (0.43)	67.3 (0.22)	0.107*** (0.006)

Standard errors in parentheses below point estimates. \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ . For bivariate results, t-tests indicate all mean differences between voucher and matched comparison groups are statistically significant at  $p < 0.001$ . For multivariate results, marginal effects were calculated from a logistic regression model of residential relocation containing control variables measuring casehead sex, education, prior earnings, age, age squared, race/ethnicity, marital status, number of eligible children, number of eligible case members, county of residence, cohort, calendar year, and year relative to voucher receipt. Complete results are available from the authors upon request.

**Table 3. Coefficients and standard errors from OLS Regression Predicting Neighborhood Quality—Full Sample**

Neighborhood Quality Indicator	One Year Post-Receipt	Four Years Post-Receipt
Percent of persons in poverty	-0.042 (0.117)	-0.282** (0.133)
Unemployment rate	-0.209*** (0.035)	-0.212*** (0.039)
Percent of 16- to 19-year-olds in school	-0.564*** (0.203)	0.176 (0.222)
Median gross rent	-2.050 (1.249)	1.407 (1.465)

Standard errors in parentheses below point estimates. \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ . Several control variables were also included in the regression model, and are listed in the body of the paper. Complete results are available from the authors.

**Table 4. Coefficients and standard errors from OLS Regression Predicting Neighborhood Quality—  
Geographic Subgroups**

Neighborhood Quality Indicator	One Year Post-Receipt	Four Years Post-Receipt
	<i>Milwaukee</i>	
Percent of persons in poverty	-1.297*** (0.343)	-1.606*** (0.375)
Unemployment rate	-0.640*** (0.097)	-0.746*** (0.106)
Percent of 16- to 19-year-olds in school	0.710* (0.412)	1.660*** (0.459)
Median gross rent	1.353 (2.744)	3.739 (3.019)
	<i>Rural</i>	
Percent of persons in poverty	0.739*** (0.137)	0.480*** (0.163)
Unemployment rate	0.009 (0.042)	0.000 (0.049)
Percent of 16–19 year olds in school	-1.100*** (0.350)	0.027 (0.375)
Median gross rent	-8.119*** (2.149)	-0.416 (2.588)
	<i>Urban- Non-Milwaukee</i>	
Percent of persons in poverty	0.484*** (0.153)	0.257 (0.173)
Unemployment rate	-0.108** (0.047)	-0.069 (0.053)
Percent of 16–19 year olds in school	-0.614** (0.301)	-0.136 (0.333)
Median gross rent	-2.102 (1.806)	0.217 (2.164)

Standard errors in parentheses below point estimates. \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ . Several control variables were also included in the regression model, and are listed in the body of the paper. Complete results are available from the authors.

**Table 4 (cont.). Coefficients and standard errors from OLS Regression Predicting Neighborhood Quality—Racial/ethnic Subgroups**

Neighborhood Quality Indicator	One Year Post-Receipt	Four Years Post-Receipt
	<i>White</i>	
Percent of persons in poverty	0.595*** (0.120)	0.315** (0.133)
Unemployment rate	-0.108*** (0.035)	-0.056 (0.038)
Percent of 16- to 19-year-olds in school	-0.871*** (0.263)	-0.271 (0.286)
Median gross rent	-4.454*** (1.616)	-1.849 (1.910)
	<i>Black</i>	
Percent of persons in poverty	-0.935*** (0.280)	-0.933*** (0.313)
Unemployment rate	-0.429*** (0.084)	-0.450*** (0.093)
Percent of 16–19 year olds in school	0.421 (0.362)	1.377*** (0.401)
Median gross rent	0.578 (2.272)	5.056* (2.613)

Standard errors in parentheses below point estimates. \* $p < .10$ , \*\* $p < .05$ , \*\*\* $p < .01$ . Several control variables were also included in the regression model, and are listed in the body of the paper. Complete results are available from the authors.

**Table 4 (cont.). Coefficients and standard errors from OLS Regression Predicting Neighborhood Quality—Age Subgroups**

Neighborhood Quality Indicator	One Year Post-Receipt	Four Years Post-Receipt
	<i>Age 18-30</i>	
Percent of persons in poverty	0.033 (0.161)	0.016 (0.180)
Unemployment rate	-0.282*** (0.048)	-0.174*** (0.054)
Percent of 16-19 year olds in school	-0.594** (0.276)	0.008 (0.304)
Median gross rent	-1.788 (1.719)	3.466* (2.059)
	<i>Age 31-54</i>	
Percent of persons in poverty	-0.177 (0.194)	-0.344 (0.222)
Unemployment rate	-0.185*** (0.058)	-0.243*** (0.064)
Percent of 16-19 year olds in school	-0.530 (0.327)	0.384 (0.354)
Median gross rent	-0.222 (1.970)	0.903 (2.255)
	<i>Age 55+</i>	
Percent of persons in poverty	0.261 (0.353)	0.467 (0.388)
Unemployment rate	-0.213** (0.096)	-0.154 (0.108)
Percent of 16-19 year olds in school	-0.629 (0.678)	-0.051 (0.768)
Median gross rent	-9.283** (4.364)	-11.762** (5.109)

**Table 5. Effect of voucher receipt on number of adults and children in the case-Full sample & subgroups**

Case composition	Year of Receipt	One year post	Two years post	Three years post	Four years post	Five years post
<i>Full Sample</i>						
Number of adults	-0.102*** (0.007)	-0.104*** (0.007)	-0.085*** (0.007)	-0.077*** (0.007)	-0.064*** (0.007)	-0.049*** (0.009)
Number of children	-0.014** (0.007)	-0.006 (0.008)	0.014* (0.008)	0.024*** (0.009)	0.039*** (0.010)	0.053*** (0.013)
<i>Milwaukee</i>						
Number of adults	-0.133*** (0.012)	-0.139*** (0.012)	-0.127*** (0.013)	-0.123*** (0.013)	-0.101*** (0.014)	-0.107*** (0.016)
Number of children	-0.034** (0.014)	-0.010 (0.015)	0.023 (0.015)	0.047** (0.019)	0.060*** (0.020)	0.109*** (0.026)
<i>Rural</i>						
Number of adults	-0.072*** (0.013)	-0.079*** (0.013)	-0.067*** (0.013)	-0.071*** (0.013)	-0.049*** (0.014)	-0.030* (0.017)
Number of children	0.011 (0.011)	0.020 (0.014)	0.020 (0.015)	0.014 (0.016)	0.024 (0.018)	0.019 (0.024)
<i>Urban, non-Milwaukee</i>						
Number of adults	-0.115*** (0.010)	-0.116*** (0.010)	-0.093*** (0.011)	-0.075*** (0.011)	-0.068*** (0.011)	-0.046*** (0.014)
Number of children	-0.011 (0.010)	0.002 (0.011)	0.021* (0.012)	0.035*** (0.013)	0.046*** (0.014)	0.059*** (0.019)
<i>White</i>						
Number of adults	-0.084*** (0.009)	-0.086*** (0.009)	-0.071*** (0.009)	-0.065*** (0.009)	-0.059*** (0.009)	-0.038*** (0.011)
Number of children	-0.003 (0.007)	0.003 (0.009)	0.014 (0.010)	0.022** (0.010)	0.036*** (0.011)	0.065*** (0.015)
<i>Black</i>						
Number of adults	-0.101*** (0.011)	-0.101*** (0.012)	-0.079*** (0.012)	-0.076*** (0.012)	-0.062*** (0.013)	-0.058*** (0.016)
Number of children	-0.023 (0.014)	-0.005 (0.016)	0.022 (0.018)	0.034* (0.019)	0.047** (0.020)	0.069*** (0.026)

**Table 5. Effect of voucher receipt on number of adults and children in the case-Full sample & subgroups**

Case composition	Year of Receipt	One year post	Two years post	Three years post	Four years post	Five years post
<i>Age 18-30</i>						
Number of adults	-0.140*** (0.010)	-0.125*** (0.010)	-0.087*** (0.010)	-0.077*** (0.010)	-0.057*** (0.010)	-0.045*** (0.012)
Number of children	-0.021** (0.009)	-0.019* (0.011)	0.004 (0.012)	0.014 (0.014)	0.028* (0.014)	0.062 *** (0.019)
<i>Age 31-54</i>						
Number of adults	-0.079*** (0.010)	-0.083*** (0.011)	-0.089*** (0.011)	-0.086*** (0.012)	-0.077*** (0.012)	-0.064*** (0.016)
Number of children	0.036*** (0.011)	0.040*** (0.013)	0.033** (0.014)	0.021 (0.014)	0.025* (0.015)	0.021 (0.019)
<i>Age 55+</i>						
Number of adults	-0.052*** (0.012)	-0.054*** (0.012)	-0.040*** (0.013)	-0.039*** (0.013)	-0.037*** (0.012)	-0.050*** (0.014)
Number of children	-0.016* (0.009)	-0.008 (0.009)	-0.011 (0.010)	-0.012 (0.008)	-0.009 (0.009)	-0.010 (0.011)

**Note:** Standard errors in parentheses below point estimates. \*p<.10, \*\*p<.05, \*\*\*p<.01.

**Table 6. Marginal effect of voucher receipt on case composition change-Full sample and subgroups**

Case composition	Year of Receipt	One year post	Two years post	Three years post	Four years post	Five years post
<i>Full Sample</i>						
Add Adult	-0.027*** (0.003)	-0.012*** (0.003)	0.000 (0.003)	-0.001 (0.003)	0.005** (0.002)	0.008*** (0.003)
Lose Adult	0.053** (0.004)	-0.007** (0.003)	-0.014*** (0.003)	-0.008** (0.003)	-0.006** (0.003)	0.000 (0.004)
<i>Milwaukee</i>						
Add Adult	-0.037*** (0.005)	-0.034*** (0.005)	-0.027*** (0.005)	-0.014*** (0.005)	-0.009** (0.004)	-0.009** (0.004)
Lose Adult	0.034*** (0.007)	-0.024*** (0.007)	-0.044*** (0.006)	-0.029*** (0.006)	-0.021*** (0.006)	-0.018*** (0.007)
<i>Rural</i>						
Add Adult	-0.022*** (0.006)	0.000 (0.006)	0.010 (0.006)	-0.008 (0.005)	0.004 (0.005)	0.012* (0.006)
Lose Adult	0.070*** (0.008)	0.009 (0.007)	0.001 (0.007)	(0.002) (0.006)	(0.009) (0.006)	0.001 (0.007)
<i>Urban, non-Milwaukee</i>						
Add Adult	-0.034*** (0.005)	-0.012** (0.005)	0.004 (0.004)	0.008* (0.004)	0.007** (0.004)	0.014*** (0.004)
Lose Adult	0.057*** (0.006)	-0.008 (0.005)	-0.012*** (0.005)	-0.005 (0.005)	0.004 (0.005)	0.010* (0.005)
<i>White</i>						
Add Adult	-0.027*** (0.004)	-0.004 (0.004)	0.010** (0.004)	-0.001 (0.004)	0.006* (0.003)	0.014*** (0.004)
Lose Adult	0.062*** (0.005)	0.000 (0.005)	-0.006 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.002 (0.005)
<i>Black</i>						
Add Adult	-0.028*** (0.005)	-0.026*** (0.005)	-0.018*** (0.005)	-0.011** (0.004)	-0.007* (0.004)	-0.003 (0.004)
Lose Adult	0.045*** (0.007)	-0.020*** (0.006)	-0.034*** (0.006)	-0.021*** (0.006)	-0.015** (0.006)	-0.012* (0.007)

**Table 6. Marginal effect of voucher receipt on case composition change-Full sample and subgroups**

Case composition	Year of Receipt	One year post	Two years post	Three years post	Four years post	Five years post
<i>Age 18-30</i>						
Add Adult	-0.046*** (0.005)	-0.016*** (0.005)	0.001 (0.005)	-0.005 (0.004)	0.004 (0.004)	0.014*** (0.005)
Lose Adult	0.069*** (0.006)	-0.021*** (0.005)	-0.025*** (0.005)	-0.012** (0.005)	-0.010** (0.004)	0.002 (0.005)
<i>Age 31-54</i>						
Add Adult	-0.015*** (0.005)	-0.007 (0.004)	-0.007 (0.004)	-0.001 (0.004)	0.001 (0.004)	0.007 (0.004)
Lose Adult	0.038*** (0.006)	0.005 (0.006)	0.000 (0.005)	-0.002 (0.005)	0.000 (0.005)	-0.002 (0.006)
<i>Age 55+</i>						
Add Adult	-0.009* (0.005)	-0.003 (0.004)	0.002 (0.004)	-0.001 (0.003)	0.000 (0.003)	-0.005*** (0.002)
Lose Adult	0.027*** (0.007)	0.003 (0.006)	-0.007 (0.005)	-0.001 (0.005)	-0.004 (0.004)	-0.002 (0.005)

**Note:** Standard errors in parentheses below point estimates. \*p<.10, \*\*p<.05, \*\*\*p<.01.

**Table 7. Effect of voucher receipt on neighborhood quality indicators-Sensitivity analyses**

<b>Neighborhood quality indicator</b>	<b>One year post-receipt</b>
<i>Case FE</i>	
Percent of persons in poverty	-0.302** (0.119)
Unemployment rate	-0.151*** (0.037)
Percent of 16-19 year olds in school	0.073 (0.213)
Median gross rent	4.212*** (1.231)
<i>2001 vs. 2002 Cohort</i>	
Percent of persons in poverty	-0.182 (0.291)
Unemployment rate	-0.142* (0.085)
Percent of 16-19 year olds in school	0.370 (0.484)
Median gross rent	0.346 (2.947)

Standard errors in parentheses below point estimates. \*p<.10, \*\*p<.05, \*\*\*p<.01.

**Table 8. Effect of voucher receipt on neighborhood quality indicators-  
Stayers and leavers**

<b>Neighborhood quality indicator</b>	<b>One year post- receipt</b>	<b>Four years post- receipt</b>
<i>Stayers</i>		
Percent of persons in poverty	-0.014 (0.132)	-0.748*** (0.246)
Unemployment rate	-0.118*** (0.039)	-0.235*** (0.071)
Percent of 16-19 year olds in school	-0.477** (0.230)	0.598 (0.382)
Median gross rent	-1.827 (1.408)	9.271 (2.600)
<i>Leavers</i>		
Percent of persons in poverty	-0.289 (0.223)	0.065 (0.152)
Unemployment rate	-0.171*** (0.065)	-0.080* (0.044)
Percent of 16-19 year olds in school	0.130 (0.406)	-0.062 (0.261)
Median gross rent	2.828 (2.624)	-2.596 (1.710)

Standard errors in parentheses below point estimates. Estimates in bold indicate significance and .10 level.

**Table 9. Effect of voucher receipt on number of adults and children in the case-Stayers and leavers**

<b>Case composition</b>	<b>Year of Receipt</b>	<b>One year post</b>	<b>Two years post</b>	<b>Three years post</b>	<b>Four years post</b>	<b>Five years post</b>
<i>Stayers</i>						
Number of adults	-0.102*** (0.007)	-0.113*** (0.007)	-0.121*** (0.008)	-0.125*** (0.009)	-0.120*** (0.013)	-0.104*** (0.019)
Number of kids	-0.014** (0.007)	-0.001 (0.008)	0.036*** (0.010)	0.064*** (0.013)	0.102*** (0.017)	0.146*** (0.028)
Add Adult	-0.026*** (0.003)	-0.007** (0.003)	0.002 (0.004)	0.004 (0.004)	0.016*** (0.005)	0.028*** (0.007)
Lose Adult	0.053*** (0.004)	-0.009** (0.004)	-0.026*** (0.004)	-0.021*** (0.005)	-0.002 (0.006)	0.014* (0.009)
<i>Leavers</i>						
Number of adults	NA	-0.041***	-0.012	-0.028***	-0.035***	-0.032***
	NA	(0.013)	(0.010)	(0.009)	(0.008)	(0.010)
Number of kids	NA	-0.023	-0.020	-0.010	0.011	0.026
	NA	(0.015)	(0.012)	(0.011)	(0.011)	(0.014)
Add Adult	NA	-0.024***	-0.002	-0.005	0.001	0.003
	NA	(0.006)	(0.004)	(0.003)	(0.003)	(0.003)
Lose Adult	NA	-0.002	0.006	0.003	-0.007**	-0.003
	NA	(0.007)	(0.005)	(0.004)	(0.003)	(0.004)