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CREATING MOVES TO OPPORTUNITY: EXPERIMENTAL EVIDENCE ON BARRIERS TO NEIGHBORHOOD CHOICE

Peter Bergman
Raj Chetty
Stefanie DeLuca
Nathaniel Hendren
Lawrence F. Katz
Christopher Palmer

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ABSTRACT

Low-income families in the United States tend to live in neighborhoods that offer limited opportunities for upward income mobility. One potential explanation for this pattern is that families prefer such neighborhoods for other reasons, such as affordability or proximity to family and jobs. An alternative explanation is that they do not move to high-opportunity areas because of a lack of information or barriers that prevent them from making such moves. We test between these explanations using a two-phase randomized controlled trial with housing voucher recipients in Seattle and King County. We first provided a bundle of resources to facilitate moves to high-upward-mobility neighborhoods: information about high-opportunity areas, short-term financial assistance, customized assistance during the housing search process, and connections to landlords. This bundled intervention increased the fraction of families who moved to high-upward-mobility areas from 15% in the control group to 53% in the treatment group. To understand the mechanisms underlying this effect, we ran a second phase with three arms:(1) information about high-opportunity areas and financial assistance only; (2) reduced support services in addition to information and financial assistance; and (3) full support services, as in the original bundled intervention. The full services had five times as large a treatment effect as the information and financial incentives treatment and three times as large an effect as the reduced support intervention, showing that high-intensity, customized support enables moves to opportunity. Interviews with randomly selected families reveal that the program succeeded by relaxing families' bandwidth constraints and addressing their specific needs, from identifying suitable units to providing emotional support to brokering with landlords. Families induced to move to higher opportunity areas tend to stay in their new neighborhoods in subsequent years and report higher levels of neighborhood satisfaction after moving. Our findings imply that many low-income families do not have a strong preference to stay in low-opportunity areas and that barriers in the housing search process are a central driver of residential segregation by income.

Peter Bergman
Department of Economics
University of Texas at Austin
116 Inner Campus Drive
Austin, TX 78712
and NBER
peterbergman@utexas.edu

Raj Chetty
Department of Economics
Harvard University
Littauer 321
Cambridge, MA 02138
and NBER
chetty79@gmail.com

Stefanie DeLuca
Johns Hopkins University
Department of Sociology
sdeluca@jhu.edu

Nathaniel Hendren
Harvard University
Department of Economics
Littauer Center Room 235
Cambridge, MA 02138
and NBER
nhendren@gmail.com

Lawrence F. Katz
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
lkatz@harvard.edu

Christopher Palmer
MIT Sloan School of Management
100 Main Street, E62-639
Cambridge, MA 02142
and NBER
cjpalmer@mit.edu

A randomized controlled trials registry entry is available at
socialscienceregistry.org/trials/2807
A Video Summary of Study Findings is available at
https://www.youtube.com/watch?v=w8hHtk7oe1w&feature=youtu.be

I Introduction

Recent research has established that children's outcomes in adulthood vary substantially across neighborhoods and that moving to lower-poverty, higher opportunity neighborhoods earlier in childhood improves children's outcomes significantly (Chetty, Hendren, and Katz 2016; Chetty and Hendren 2018a; Chyn 2018; Deutscher 2020; Chyn, Collinson, and Sandler 2022). Yet the vast majority of low-income families in the United States, even those receiving rental assistance through housing vouchers from the government, live in low-opportunity neighborhoods (Metzger 2014; Mazzara and Knudsen 2019; Rosen 2020). This pattern prevails even though many families live near areas with similar or lower rental costs that historically have produced much better economic outcomes for children (Chetty et al. 2018). Why don't more low-income families take advantage of these options and move to opportunity? More broadly, what explains the segregation of low-income families into high-poverty, low-opportunity neighborhoods?

One potential explanation is that low-income families prefer to stay in low-opportunity areas because these neighborhoods have other valuable amenities, such as shorter commutes, proximity to family and community, or greater racial and ethnic diversity. An alternative explanation is that low-income families do not move to high-opportunity areas because of a lack of information about the benefits of moving to such areas. A third possibility is that barriers in the housing search process itself – such as a lack of liquidity, difficulties in finding suitable units in high-opportunity areas, or reluctance among landlords to rent to voucher holders in such areas – limit moves to opportunity. Distinguishing between these explanations is important for understanding the drivers of residential segregation as well as for designing affordable housing policies to address any barriers that limit moves to opportunity.

We test between these explanations using a two-phase randomized controlled trial with 712 low-income families receiving housing vouchers, implemented in collaboration with the Seattle and King County housing authorities. The first phase of the trial enrolled families from April 2018 to April 2019 and evaluated the impacts of a bundled intervention of information and support services to move to high-opportunity areas. The second phase enrolled families from July 2019 through March 2020 and unbundled the original treatment into multiple arms to shed light on mechanisms underlying the impacts of the bundled intervention. The sample for both phases consisted of low-income families with a child below age 15 issued a Housing Choice Voucher in the Seattle and King County area, which provided $1,540 per month in rental assistance on average.

In the first phase of the experiment, families who applied for housing vouchers were randomly assigned (with 50% probability) to a control group or treatment group. The value of the vouchers and the restrictions governing their use followed pre-existing regulations and did not differ between the treatment and control groups. Families in the control group received standard briefings on how to use their vouchers. Families in the treatment group were offered a supplementary program called Creating Moves to Opportunity (CMTO) that was designed to help them lease units in high-opportunity areas, defined as Census tracts that have historical rates of upward income mobility in approximately the top third of tracts in the Seattle and King County area.[1]

The CMTO program consisted of three components: customized housing search assistance, landlord engagement, and short-term financial assistance – all administered by staff employed by a non-profit group, whom we term housing "navigators." The housing navigators met with families individually and provided information about high-opportunity areas, assistance in preparing rental documents, guidance in addressing issues in a family's credit and rental history, and help in identifying available units and connecting with landlords in high-opportunity areas. On average, navigators spent about six hours working with each family. They also engaged directly with landlords in opportunity areas to encourage them to lease units to CMTO families and expedite the lease-up process. Landlords who leased to CMTO families were additionally offered an insurance fund for damages to the unit above and beyond the security deposit. Finally, navigators provided financial assistance for security deposits and application fees on a case-by-case basis depending upon each family's needs, averaging $1,060 per family. The total up-front cost of the program, including all services, was $2,670 per family.[2] All families in the treatment group had the option to use their housing voucher in *any* neighborhood within the housing authorities' jurisdictions (although the CMTO services were only provided to move to high-opportunity areas).[3]

The CMTO treatment increased the share of families who leased units in high-opportunity

1. Although we define "high opportunity" areas based on measures of upward mobility, our measures of high opportunity areas overlap to a significant degree with traditional measures of "good" neighborhoods, such as having lower poverty rates or better educational outcomes. As a result, our experimental findings are not sensitive to the particular way in which neighborhood quality is measured, as we discuss further below.

2. This $2,670 figure excludes downstream costs incurred in the form of higher housing voucher payments because treatment group families moved to more expensive neighborhoods with higher voucher payment standards. We discuss those costs in greater detail in Section V.D when evaluating the program's rate of return.

3. This element of neighborhood choice is the critical distinction between CMTO and the Moving to Opportunity (MTO) experiment implemented in the 1990s, which *required* that families in the experimental group move to low-poverty Census tracts to receive a voucher. Studies of the MTO experiment have shown that families who moved to higher-opportunity areas as required by the experimental treatment had improved mental health and well-being for the adults and better economic outcomes for their children (Kling, Liebman, and Katz 2007; Chetty, Hendren, and Katz 2016; Ludwig et al. 2012). The CMTO experiment asks why families receiving vouchers without such requirements typically do not live in such areas.

neighborhoods by 37.8 percentage points (s.e. = 4.2 pp, $p = < 0.001$), from 15.4% in the control group to 53.2% in the treatment group. We find similarly large treatment effects on moves to high-opportunity areas across several subgroups, including racial minorities, immigrant families, and the lowest-income households. Families in the treatment group moved to a variety of different Census tracts across the Seattle and King County area: the 118 families in the treatment group who moved to a high-opportunity area live in 46 different tracts, mitigating the concern that the program might simply re-concentrate low-income families in different neighborhoods (Clark 2008).

Treated families moved to better neighborhoods as measured not just by their rates of upward mobility, but also other more traditional indices of neighborhood quality, such as median household incomes, the share of college graduates, or indices of educational or environmental quality. In the process of moving to higher-opportunity areas, treated families did not have to make sacrifices on other neighborhood amenities, such as distance to their prior location or proximity to jobs, nor in the quality or size of the unit they rent.

Perhaps as a result of improvements in neighborhood quality, families in the CMTO treatment group tended to stay in high-opportunity areas when their leases came up for renewal. Three years after the initial lease-up, 58.6% of families in the treatment group lived in high-opportunity neighborhoods, compared with 22.4% in the control group. This represents a decline of only 4.9 pp relative to the treatment effect at lease-up. Furthermore, in a post-move survey of a randomly selected subset of families, families in the treatment group expressed higher rates of satisfaction with their new neighborhoods. For instance, 64.2% of families in the treatment group reported being "very satisfied" with their new neighborhood, compared with 45.5% in the control group.

To understand the mechanisms through which the CMTO program helped families move to high-opportunity areas, we implemented a second randomized trial with three treatment arms (and a control group). Families in the first treatment arm, "incentivized information," received information about opportunity neighborhoods and financial assistance for moving to an opportunity neighborhood. Because the financial support (worth $1,177 for the average opportunity move, equivalent to nearly a month of income for the typical family in our sample) was available only if one moved to a high-opportunity area, families had strong incentives to pay attention to the information provided about the location of high-opportunity areas. The second treatment arm, "reduced services," provided information and financial assistance along with a lower dosage version of the original treatment, with more limited housing search services (with less one-on-one assistance from navigators). The third treatment arm received the full CMTO program, as in the first phase.

The incentivized information increased the share of families who moved to high-opportunity areas (relative to control) by 8.9 pp, the reduced services had a treatment effect of 13.8 pp, and the full services had a treatment effect of 40.8 pp, similar to the impact of the full program in the first phase. The full services cost about three times as much as the reduced services and had three times as large a treatment effect, consistent with a linear dose-response to service intensity. We reject the hypothesis that the three treatment effects are equal to each other with $p < 0.01$. These findings – which are robust across subgroups and different measures of neighborhood quality – show that the CMTO program does not change neighborhood choice solely by providing financial liquidity or information about high-opportunity neighborhoods. Rather, the customized, high-intensity services provided by the housing navigators during the housing search process appear to be central to the program's success in changing where families choose to live. The results are consistent with other experimental studies that document small impacts of information provision and low-dosage support services on neighborhood choice in other settings (Bergman, Chan, and Kapor 2020; Schwartz, Mihaly, and Gala 2017). The finding that financial liquidity has small impacts is also consistent with supplementary quasi-experimental analyses we conduct showing that increases in payment standards in high-opportunity areas in Seattle and King County had positive impacts on the share of families who moved to high-opportunity areas (consistent with Collinson and Ganong 2018), but much smaller effects than the full CMTO services.

Having established that the services provided by navigators during the housing search process played a critical role in neighborhood choice, we next examine the barriers families face in moving to opportunity and how housing navigators are able to address them. To do so, we use a qualitative approach, conducting 251 in-depth (on average, two-hour) interviews with a stratified random sample of families in the treatment and control groups during and after their move. Many families reported that they had extremely limited time and resources to search for housing and were pessimistic about the prospect of finding housing in high-opportunity areas given histories of past unfruitful searches.

Families in the treatment group in the first phase of the experiment identified five key ways the CMTO program helped them overcome these bandwidth constraints, update their beliefs, and ultimately move to opportunity: providing emotional support and communication, increasing their motivation to move to a high-opportunity neighborhood by making such a move seem more attainable, streamlining the search process by helping to prepare rental applications and "rental resumes," providing brokerage services and representation with landlords, and deploying timely financial as-

sistance for fees and deposits that could prevent a lease from being signed. Data from interviews with families in the second phase of the experiment provide an out-of-sample validation of these mechanisms: the five mechanisms were mentioned frequently by families who received the full CMTO services but were mentioned at much lower rates by families in the reduced services and incentivized information groups.

The interviews also revealed that the navigators' ability to respond in a customized manner to each family's specific needs from a higher dosage of available services was critical to the full CMTO program's larger impact. Service utilization was highly heterogeneous across families, with some families relying heavily on search assistance, and others benefiting from representation in landlord negotiation or taking advantage of direct landlord referrals. In short, the CMTO program changed where many families lived by providing customized support at critical junctures of the housing search process that helped families overcome their tight bandwidth constraints and revise their beliefs about the feasibility of moving to high-opportunity areas.

We conclude that many low-income families do not have a strong preference to stay in low-opportunity areas; rather, barriers to moving to high-opportunity areas play a central role in explaining neighborhood choice and residential sorting patterns. This conclusion suggests that redesigning affordable housing programs and other policies (e.g., zoning laws and the location of affordable housing developments) to facilitate more moves to opportunity could have substantial impacts on residential segregation by race and socioeconomic status.

Such programs may also have the potential to increase intergenerational income mobility for the children in families that move to opportunity significantly. Using data from Chetty et al. (2018), we estimate that the moves from low- to high-opportunity Census tracts induced by CMTO will increase average undiscounted lifetime household incomes by $212,000 (8.3%) for children who move at birth and stay in their new neighborhoods throughout childhood. An important limitation of this partial equilibrium estimate is that it assumes that the causal effects of places on mobility will not change when voucher holders move to different neighborhoods – an assumption that may not hold particularly as the program is scaled up. As we discuss further below, in general equilibrium, changes in peer composition and provision of public goods across areas may dampen or increase total impacts on upward mobility. Understanding the effects of scaling up policies such as CMTO and other efforts to increase socioeconomic integration on economic mobility will ultimately require specifying and estimating an equilibrium model of neighborhood choice. Our empirical results provide new insights into the specification of such neighborhood choice models – in particular

identifying a new set of constraints that low-income families face in the housing search process – as we discuss in Section VIII.

Our analysis builds on a long literature in economics and sociology analyzing the sources of residential segregation (e.g., Schelling 1971; Kain and Quigley 1975; Massey and Denton 1987; Reardon and Bischoff 2011; Sampson 2012; Sharkey 2013; Turner et al. 2013; Lareau and Goyette 2014; Krysan and Crowder 2017). Our contributions to this literature are (1) establishing experimentally that barriers in the housing search process have substantial causal effects on neighborhood choice among low-income families; (2) showing that the barriers extend beyond racial discrimination by landlords, a lack of information, or a lack of financial liquidity and instead involve deeper psychological and social structural constraints; and (3) demonstrating that these barriers can be reduced through feasible modifications of existing government programs.

The paper is organized as follows. Section II summarizes the facts on the geography of opportunity in the Seattle metro area that motivate our intervention. Section III provides institutional background on the housing voucher program and describes our intervention and experimental design. Section IV describes the data we use. Sections V and VI presents the results from the first and second phases of the experiment, respectively. Section VII presents qualitative evidence on how the navigators helped overcome the barriers families face in moving to opportunity. Section VIII discusses the implications of our findings for models of neighborhood choice. Section IX concludes.

II The Geography of Opportunity in Seattle

In this section, we summarize three facts on the geography and price of opportunity that motivate our intervention.[4]

First, children's rates of upward income mobility vary substantially across nearby tracts. Figure 1a plots upward income mobility by Census tract in King County (which includes the city of Seattle and surrounding suburbs) using data from the Opportunity Atlas (Chetty et al. 2018), which is constructed using information from anonymized tax records. The map shows the average household income percentile rank at age 35 for children who grew up in low-income (25th percentile) families in the 1978-1983 birth cohorts.[5] There is substantial variation in upward mobility across tracts: the (population-weighted) standard deviation of children's mean income ranks in adulthood across

4. We establish these facts using data from Seattle and King County here, but the same three facts hold systematically in other metro areas across the country.

5. Children are assigned to tracts in proportion to the number of years they spent growing up in that tract until age 23; see Chetty et al. (2018) for further details.

tracts within King County is 4.7 percentiles (approximately $5,150, or 10.3% of mean annual income for children with parents at the 25th percentile).

Second, much of the variation in upward mobility across neighborhoods is driven by the *causal effects* of childhood exposure rather than sorting. Recent studies have established that moving to high-upward-mobility ("high-opportunity") neighborhoods improves children's outcomes in adulthood in proportion to the amount of time they spend growing up there. These studies, summarized in Appendix Figure 1, use research designs ranging from random assignment of vouchers (Chetty, Hendren, and Katz 2016) and quasi-experimental estimates based on variation in the age of children at the time of the move (Chetty et al. 2018; Laliberté 2018) to demolitions of public housing projects (Chyn 2018). They find that approximately two-thirds of the observational variation in upward mobility across tracts is due to causal effects of place.

Third, low-income families tend to live in lower-opportunity neighborhoods. Even among families that receive rental assistance from the government in the form of housing vouchers, 76.2% of families in Seattle and King County live in tracts with below-median levels of upward mobility.[6] Figure 1a illustrates this fact by showing the 25 most common locations where families with housing vouchers moved between 2015 and 2017 (as a percentage of the total population in each tract). Families are clustered in lower-opportunity tracts (red colors) even though there are many higher-opportunity tracts with comparable rents nearby, as shown in Appendix Figure 3b, which plots upward mobility vs. median rents by Census tracts in King County.

These facts motivate our central questions: Why don't more low-income families, especially those receiving housing vouchers, move to opportunity? Do families prefer lower-opportunity areas because they have other advantages (e.g., a shorter commute to work or proximity to family)? Or would they prefer higher-opportunity neighborhoods, but lack information about them or face barriers that limit access to such areas? If families face such barriers, how can we intervene to help families live where they would like to live?

III Intervention and Experimental Design

This section describes our intervention and experimental design. We begin by providing some institutional background on the Housing Choice Voucher (HCV) program. We then discuss the Creating Moves to Opportunity program and the design of the randomized controlled trial.

6. This result echoes evidence from Jacob and Ludwig (2012) and Jacob, Kapustin, and Ludwig (2015) showing that families who obtained housing vouchers in Chicago via a lottery continued to live in high poverty neighborhoods.

III.A Background on the Housing Choice Voucher Program

The HCV program provides rental assistance to 2.2 million families in the United States each year, with a total program cost of approximately $20 billion annually; see Collinson, Ellen, and Ludwig (2015) for a comprehensive description of the program. The program is overseen at the federal level by the U.S. Department of Housing and Urban Development (HUD), but is administered by local Public Housing Authorities (PHAs). In this study, we work with two PHAs: the Seattle Housing Authority (SHA), which issues vouchers that can be used in the city of Seattle, and the King County Housing Authority (KCHA), which issues vouchers that can be used in the rest of King County, excluding the cities of Seattle and Renton.[7] Both KCHA and SHA are among a small number of PHAs who participate in HUD's Moving to Work program, which gives them greater flexibility to implement policy pilots than other PHAs.

The HCV program is targeted at low-income families. To be eligible for a voucher from SHA and KCHA, families must have household income below 80% of Area Median Income (AMI).[8] In line with national patterns, more families meet this criteria than the number of vouchers available. The PHAs address this problem by using a lottery to assign families positions on a waiting list. Families who are homeless or who have incomes below 30% of AMI are given priority on the waitlist. In practice, virtually all families who actually receive vouchers fall well below the 30% AMI cutoff, which corresponds to $29,900 for a family of 3. In Seattle and King County, the typical family who received a voucher during our experiment had been on the waitlist for about 1.5 years.

Families eligible for the HCV program are required to contribute 30 to 40% of their annual household income toward rent and utilities. They then receive a housing subsidy that covers the difference between a unit's listed rent and the family's contribution, up to a maximum amount known as the Voucher Payment Standard. In SHA and KCHA, the maximum monthly voucher payments for a two-bedroom unit were $2,278 and $2,110, respectively.[9]

Once families are issued a voucher, they typically have 4 to 8 months to use the voucher to lease a unit; if the voucher is not used by that point, it is issued to another family. To use a voucher, families must find an interested landlord whose unit passes a quality inspection conducted by the

7. Vouchers from both SHA and KCHA may be ported out to use in other areas if they meet certain requirements; this occurs infrequently in practice.

8. Families must also meet certain additional requirements, such as having children or meeting certain age requirements. The full set of requirements are available here for SHA and here for KCHA.

9. Both housing authorities have tiered payment standards that offer higher payments in more expensive areas. For example, between July 1, 2018 and December 31, 2018, the King County Housing Authority permitted a maximum rent of $1,795 for a 3 bedroom unit in the lowest tier and $2,685 in the highest tier.

PHA using HUD-defined housing quality standards. After leasing, families remain eligible for the voucher they received indefinitely as long their income remains below eligibility thresholds.

III.B The Creating Moves to Opportunity Intervention

In collaboration with our research team, the Seattle and King County Housing Authorities developed a bundle of services and resources designed to facilitate moves to high-opportunity neighborhoods. This section provides a brief overview of the program; see Bigelow (2021) for a detailed description of program implementation and DeLuca, Katz, and Oppenheimer (2022) for further details on how the program worked based on qualitative interviews. We discuss the full bundle of services that we provided in the first phase of the experiment here and then discuss how we unbundle this treatment into components in the second phase of the experiment in the next subsection.

Identifying High-Opportunity Areas. We designated "high opportunity" areas as Census tracts that have historical rates of upward mobility in approximately the top third of the distribution across tracts within Seattle and King County based on a preliminary version of the Opportunity Atlas (Figure 1a). We adjusted these definitions to create contiguous areas and account for potential neighborhood change by examining more recent data on test scores (see Appendix A for details). Figure 1a shows the final set of Census tracts that were designated as "high opportunity" after this process. Historically, around 12% of voucher recipients in Seattle and King County leased units in the areas we define as high opportunity.

Our upward-mobility-based measures of opportunity are highly correlated with traditional measures of neighborhood quality, such as poverty rates, average test scores, the fraction of two-parent households, and the averages incomes of residents in the neighborhood (Chetty et al. 2018). These observables capture about 50% of the variance in upward mobility across Census tracts. Our measures of high opportunity areas thus overlap to a significant degree with traditional measures of "good" neighborhoods, although certain areas we identify as high-opportunity would not have been identified as such by traditional measures. Because families may not have been aware that some of the areas we define as high opportunity offer high rates of upward mobility, the CMTO intervention effectively includes an informational treatment. We therefore test, among other things, whether providing information about which areas are high opportunity has an impact on where families choose to move (see Section III.C). We also study the impact of the CMTO treatment on traditional measures of neighborhood quality to evaluate whether families moved to better neighborhoods in general or places that would have been identified as high-opportunity only in the

Opportunity Atlas data.

To facilitate moves to high-opportunity areas, the program provided three types of resources and services (summarized in Figure 2a): search assistance, landlord engagement, and short-term financial assistance.

Search Assistance. Search assistance services were provided by a non-profit group, InterIm CDA, which employed four housing navigators to contact families and provide resources via in-person meetings, phone calls, emails, and text messages. These staff spent 6 hours directly assisting each family on average, spread throughout the search process from an initial meeting shortly after the family was notified of eligibility for a voucher to the point of lease-up (Figure 2b). The resources provided included: (1) information about high-opportunity areas and the benefits of moving to such areas for families with young children; (2) help in making rental applications more competitive by preparing rental documents and addressing issues in their credit and rental history; and (3) search assistance to help families identify available units, connect with landlords in opportunity areas, and complete the application process. Importantly, these resources were tailored to address the specific issues each family faced: for some families, search assistance focused extensively on application preparation and issues such as credit history, while for others they spent much more time on the search process itself. The resources could be customized in this manner because the navigators worked one on one in collaboration with families to find housing, rather than providing resources through group workshops.

In their first meeting, navigators talked with families to develop rapport and understand their specific circumstances and goals. They also reviewed maps of opportunity areas with families and discussed which of those areas might best fit the family's needs. Navigators also described the various CMTO resources available for housing searches in opportunity areas, including the financial assistance available to offset moving costs and security deposits (discussed further below) and their availability to accompany families to visit units and meet with prospective landlords. Navigators encouraged families to set concrete housing search goals and provided rental application coaching. This coaching included screening for rental barriers (e.g., low or no credit scores, criminal or eviction histories) and providing resources or referrals to help families address these issues, as well as scripting to support families' conversations with landlords about these barriers, either in-person, on the phone or through a rental resume. The rental resume allowed families to explain any negative aspects of their applications (especially poor credit scores) and the steps they have taken since to remedy these issues in order to make a stronger case for tenancy.

Navigators provided tips on how to search for listings online, sent available unit listings to families, and helped to fill out rental applications when necessary. They also offered to step in during difficult moments in the lease-up process especially with landlords. Navigators remained in communication throughout the entire housing search and lease-up processes, reaching out frequently to check in with families about their search progress.

Landlord Engagement. In addition to their family-facing roles, navigators directly recruited prospective landlords, often by searching local online rental listings for units in opportunity areas. Navigators also educated landlords who were unfamiliar with the voucher program and pitched the benefits of the voucher and the CMTO program, not only for their prospective tenants, but also for owners and property management staff themselves. In particular, navigators described how the stability of the income stream could be attractive to landlords and discussed their ability to expedite the lease-up process by streamlining paperwork and quickly conducting inspections themselves (the navigators were certified as HUD Housing Quality Standards inspectors) – a factor identified in prior work as a key reason landlords are reluctant to take housing vouchers (e.g., Garboden et al. 2018; Aranda et al. 2018). Such staff outreach was an important source of listings for families: connections with landlords facilitated by CMTO navigators account for 47% of the moves to opportunity neighborhoods in the treatment group.

The navigators also acted as brokers between families and landlords for units families found themselves, giving landlords more information and context about specific families, usually around issues related to the rental barriers mentioned above or by meeting with them directly when accompanying families to a visit their unit. More generally, navigators served as a liaison between families, landlords and housing authority staff, available to answer any questions landlords might have throughout the process and adding a layer of customization for landlords.

Landlords were also offered a damage mitigation insurance fund for any damages not covered by the tenant's security deposit incurred within the first 18 months after the start of the lease (up to a limit of $2,000). Many landlords reported being reassured by the availability of these funds, although the funds were used to a very limited extent in practice: there were only two claims (of $2,000 each) filed as part of the program (out of 178 total units leased in high-opportunity areas during the two phases of the experiment).[10]

10. This number is the total number of units leased in high-opportunity areas by treated families in the first phase and the units leased in high-opportunity areas by families who received the second or third treatment arm in the second phase (see below). Families in the incentivized information arm in the second phase were ineligible for the damage mitigation benefits.

Financial Assistance. Finally, families were provided with various forms of short-term financial assistance to facilitate the rental process. This included funds for application screening fees, security deposits, and any other expenses that arose and were standing in the way of lease-up. These payments were customized by navigators to address the specific impediments families faced, such as hesitant landlords who could be persuaded to accept families with eviction histories or poor credit with a larger security deposit. Families were usually eligible for a maximum of $3,500 in such expenses; on average, families in the treatment group in the first phase of the experiment received $1,057 in such assistance.

Unlike other mobility programs, such as the Moving to Opportunity experiment, which required families to use their vouchers (at least initially) in low-poverty (high opportunity) areas, families in CMTO could use their housing voucher in *any* neighborhood within their housing authority's jurisdiction. However, the services and financial assistance described above were targeted specifically at supporting families to move to high-opportunity areas.

The total up-front cost of the services provided by the CMTO program was approximately $2,670 per family issued a voucher: $1,057 of financial assistance, $1,500 of labor costs for the services, and $111 in net additional PHA expenses to administer the program (Table 4).[11] Note that these up-front program costs do not include the downstream increase in housing voucher payments that resulted from treatment group families moving to more expensive neighborhoods, which we estimate and discuss in greater detail when analyzing the treatment effects of the intervention in Section V.D below.

III.C Experimental Design

The randomized trial was implemented by MDRC with J-PAL North America staff providing project management.[12] The trial was registered in the AEA RCT Registry in March 2018. The experiment was conducted in two phases. The first enrolled families from April 2018 to April 2019, while the second enrolled families from July 2019 through March 2020. In both phases, we limited the sample to families eligible for housing vouchers from either the Seattle or King County housing authorities who had at least one child below age 15, in light of prior evidence that the benefits of moving to high-opportunity neighborhoods are largest for young children. We describe the experimental design of each phase in turn.

11. We present a detailed description of these cost calculations, a further breakdown of cost components, and comparisons to the other mobility programs in Appendix B and Appendix Table 1.

12. From February-May 2018, KCHA and SHA piloted the CMTO program. During this pilot phase, all families with at least one child aged 15 or younger were invited to participate in this pilot and 41 families enrolled.

First Phase. Families who had been on a waitlist to receive a voucher were invited to an intake appointment, at which point they were offered the option to participate in the CMTO experimental study by consenting and completing a baseline survey. 90% of families who were identified as eligible on a preliminary basis consented to participate in the study.[13] These families were then randomized (with 50% probability, stratified by housing authority) into either the CMTO treatment or control groups. Control group families received the standard services provided by their housing authority, which included a group briefing about how to use the voucher but no specific information about opportunity areas or any search assistance. Treatment group families received the CMTO program described above in addition to the standard services. Overall, 497 families consented to participate in the first phase of the experiment, of whom 430 ultimately met the voucher eligibility requirements. Five families used their vouchers to move out of the Seattle/King County area and were dropped from our analyses, leaving 425 families in the final analysis sample for the first phase of the experiment.

Second Phase. In the second phase of the experiment, we conducted a multi-arm trial that unbundled the original CMTO intervention to better understand the mechanisms through which the treatment affected where families moved. We randomly assigned families to one of three treatment groups or a control group, with 25% probability each (stratified by housing authority). In total, 326 families consented to participate in the second phase, of whom 287 ultimately met the voucher eligibility requirements and were included in our final analysis sample. The control group received standard services provided by the housing authority without any additional resources or information about high-opportunity areas, as in the first phase.

The first treatment arm, "Incentivized Information," provided families with the full set of financial assistance and information about high-opportunity areas provided to families in the original CMTO treatment, but did not provide any search assistance or landlord engagement. Information about high-opportunity areas was provided via an information session that informed families about opportunity neighborhoods and their impacts on children's long run outcomes and through email reminders during their housing searches. As in the original treatment, financial assistance was conditioned on moving to a high-opportunity area, providing families incentives to pay attention to the information on which areas had been designated as "high opportunity."

The second treatment arm, "Reduced Services," was designed to evaluate the dose response to

13. Enrollment rates were approximately 90% across all the subgroups we examine, except that households who do not speak English as a primary language enrolled at a 77% rate.

treatment service intensity by providing families a subset of the search assistance offered in the original CMTO treatment (on top of the same information and financial assistance offered in the first treatment arm). Families had only one in-person meeting with the navigator (rather than at least two meetings in Phase 1) and a more limited set of interactions via text or phone compared to those in the original CMTO treatment. The reduction in service dosage was accomplished by increasing navigator caseloads and providing guidance on limiting time spent with families to manage those caseloads. Families in this group also did not receive direct customized unit referrals unless they had vouchers for units with three or more bedrooms.

The third treatment arm replicated the original comprehensive set of CMTO services and resources – in particular providing customized family-specific supports and connections to landlords in addition to the services offered in the second treatment arm.

The direct up-front costs of the Phase 2 treatment arms were $420 per voucher issuance for the financial assistance and information, $720 for the reduced support services, and $2,780 for the full treatment.

IV Data

This section describes the data we use for the experimental analysis and the quasi-experimental analysis of changes in payment standards. We draw information from several sources: the administrative records of SHA and KCHA, a baseline survey, a service delivery process management system, tract-level and housing-unit-level data from external sources, and post-move followup surveys and interviews that form the basis for our qualitative analysis. After describing these data sources and key variable definitions, we provide descriptive statistics and test for balance across the treatment and control groups.

IV.A Data Sources

Housing Authority Administrative Records. The core data we use comes from the PHAs' internal administrative records. We obtained data on all families issued vouchers from 2015-2022, including post-voucher-issuance outcomes and family characteristics. The key outcomes we study include whether a household issued a voucher successfully leases a unit using the voucher, in what Census tract this lease up occurred, and at what rent. Family characteristics obtained from voucher application forms include gender, race, ethnicity, homeless and disability status, household size, income, and address at time of application. Data on lease-ups were obtained up through February

7, 2022, by which point vouchers had either been taken up or had expired for all families who participated in the experiment.

Baseline Survey. We conducted a baseline survey for all families who enrolled in each phase of the experiment after providing informed consent. We collected information on characteristics including the head of household's primary language, birth country, years in the United States, tenure in the Seattle area, education, current housing status, employment status, employment location and commute length, moving and eviction history, receipt of social services, and child care utilization. In addition, we asked about self-reported assessments of current neighborhood satisfaction, motivations to move, opinions of various neighborhoods, and overall happiness. The baseline survey also included information on children, such as their ages, grade levels, school name, special education participation, school satisfaction, and participation in extracurricular activities. The full baseline survey instrument is available here.

Service Delivery. The service providers used a case management system built by MDRC to record data on interactions with households and landlords in real time. For households, the database includes information on the housing search process, contact with the navigators, and take-up of financial assistance. Data on the housing search process includes information on whether the household made goals and completed several tasks: visiting neighborhoods, looking for housing, contacting property owners, completing rental applications, and preparing to move. Data on contact with navigators include the date of each contact, the method of contact, who initiated the contact, the location of the contact, the reason for the contact, whether the contact included rental application coaching or visiting a prospective unit, and how long the meeting lasted. Records of financial assistance include the amount and type of financial assistance requested and received. Finally, we also collected information on credit, rental, and criminal histories, savings, childcare availability, smoking status, pet ownership, and neighborhood preferences and priorities.

For landlords, the database contains information on landlord characteristics, outreach efforts, and unit availability. We recorded information about each unit referred to a household by a housing locator, including the outcome of any such referrals.

Housing Unit and Tract Characteristics. We obtain information about the characteristics of the units that families rented from rent reasonableness reports (for KCHA), and Zillow, Redfin, Apartments.com, and King County Property records (for SHA). These data on unit characteristics were linked to CMTO households using a unique household identifier. We were able to obtain information on unit characteristics for 81% of the units rented by families in our sample. These

data include information on unit size, year built, and appliance availability.

We obtain data on the characteristics of the Census tracts to characterize the origin and destination neighborhoods for each family from several sources. We predict the effect of the treatment on children's outcomes in adulthood using three sets of outcome variables from the Opportunity Atlas (Chetty et al. 2018) for children with parents at the 25th percentile of the income distribution: mean household income rank, the incarceration rate, and (for women) the teen birth rate. We measure other Census characteristics such as the poverty rate and racial demographics using the 2013-2017 American Community Survey. Tract-level transit and environmental health indices are drawn from publicly available HUD Affirmatively Furthering Fair Housing (AFFH) data. Test score data by school district are obtained from the Stanford Education Data Archive (Fahle et al. 2017).

Follow-up Survey and Qualitative Interviews. We conducted in-person interviews with families from Phase 1 between June 3rd, 2019 and February 25, 2020. We contacted a randomly selected subset of participants in the first phase of the experiment, stratifying by housing authority (SHA, KCHA), treatment status (treatment, control), and lease up status (leased up, still searching). We overweighted families in the treatment group and those still searching for housing to maximize power to learn about mechanisms through which the treatment works during the search process (see Appendix C for details and further information on the design of the qualitative study). At the end of each interview, we asked families two questions about their satisfaction with their current neighborhood.

We conducted the Phase 2 interviews between September 21st, 2020 and June 30th, 2021. Because of COVID-19 restrictions, these interviews were conducted by Zoom, Facetime, or phone. We first contacted a random stratified subset of Phase 2 participants in the incentivized information and reduced services treatment arms to maximize power in comparisons of mechanisms with the Phase 1 full services treatment. We then contacted an additional set of Black families, including those in the Phase 2 full services treatment arm, motivated by the fact that Black families moved to high-opportunity areas at slightly lower rates in Phase 1.

We interviewed 161 Phase 1 families, out of 202 who were targeted for inclusion in the qualitative study, for an 80% response rate (Appendix Table 2). Of these 161 families, 130 had leased up at the point of interview and thus have post-move neighborhood satisfaction data. Among the families interviewed post-move, 97 are in the treatment group and 33 are in the control group. We interviewed 90 Phase 2 families out of the 130 we targeted across the three treatment arms, a 70%

response rate.[14]

IV.B Baseline Characteristics and Balance Tests

Table 1 presents summary statistics on the baseline characteristics of the 425 participants in the first phase of the experiment and their origin neighborhoods for the pooled sample and separately for the control and treatment groups. Analogous statistics for the second phase of the experiment, which exhibit very similar patterns to those discussed below, are shown in Appendix Table 3.

Baseline Characteristics. Families participating in the CMTO experiment are quite economically disadvantaged (Panel A of Table 1). The median household income of CMTO participants of around $19,000 falls just below the 15th percentile of the national household income distribution (based on data from the 2017 Current Population Survey) and less than one quarter of King County's median household income in 2017 of over $86,700. Only 5% of the CMTO household heads have a four-year college degree, and 13% were homeless or living in a group shelter at baseline. The vast majority (82%) of the household heads are female and 3% were married at baseline. About half of the CMTO participants (49%) are Black (non-Hispanic), 24% are White (non-Hispanic), about 8% are Hispanic, and 7% are Asian. A little more than a third (35%) of the household heads are immigrants, and about a fifth of the participants required a translator for the baseline survey and in-take services. 57% of participants were employed at baseline, and only 28% were working full-time (35 or more hours a week).[15]

Panel B of Table 1 provides information on CMTO participants' attitudes toward moves to higher-opportunity neighborhoods.[16] At baseline, CMTO participants expressed interest in moving to higher opportunity neighborhoods but were worried about the feasibility of making such moves. Around 80% of households indicated they were comfortable moving to a racially different neighborhood. Over 70% of families indicated that they were willing to move to at least one of three areas we named (Northwest Seattle, Northeast Seattle, and South of Ship Canal for SHA; North King County, East King County, and East Hill Kent for KCHA) that have many high-opportunity neighborhoods. However, only 29% of the CMTO families felt they would find it easy to pay moving

14. Phase 2 response rates were lower due to challenges associated with the COVID-19 pandemic

15. Although CMTO participants have low incomes relative to the median family, they are significantly better off than participants in the Moving to Opportunity experiment (Sanbonmatsu et al. 2011). For example, only 28% of MTO household heads were employed at baseline as compared to 57% of CMTO household heads. Only 3% of CMTO families were living in extremely high-poverty tracts (40% or higher poverty rate) at baseline, as compared to 100% of MTO families.

16. See Appendix Table 4 for the exact questions used to assess these attitudes and the way in which responses were coded.

expenses to move to a different neighborhood. The primary motivation expressed by CMTO participants for moving to a new neighborhood was better schools (42%), safer neighborhood (21%), and better or bigger home (16%).[17] Few CMTO participants list employment-related motivations for moving to a new neighborhood.

Panel C of Table 1 shows that CMTO families were living at baseline in relatively disadvantaged neighborhoods within King County on several dimensions. The mean poverty rate of the Census tracts in which CMTO families lived was 17% in 2016, as compared to 10.9% for King County. The mean predicted income rank in adulthood of children growing up in a low-income (25th percentile) family was 43.9 (about $35,000) in the baseline neighborhoods of CMTO families, which falls at approximately the 31st percentile of tracts across King County.

Balance Tests. The final column of Table 1 reports p-values for tests of the difference in the mean of each variable between the treatment and control groups.[18] The baseline characteristics are generally balanced between the treatment and control groups, as would be expected given random assignment. An F-test for balance across all the baseline variables shown in Table 1 yields a statistically insignificant p-value of 0.2. Analogous comparisons show that the four arms of the second phase of the experiment are balanced as well (Appendix Table 3).

The Phase 1 qualitative sample (the subset of households for whom we analyze post-move neighborhood satisfaction data) is representative of the full quantitative sample (Appendix Table 5), consistent with the sampling design. There is also no evidence of selective attrition from the qualitative sample: rates of response to the followup survey do not vary with treatment status and families who responded to the survey are balanced on observable baseline characteristics (Appendix Tables 2 and 6).

V Phase One Experimental Results

This section presents the experimental results from the first phase of the experiment. We divide our analysis into four parts. First, we analyze how the CMTO treatment affected the rate of moves to high-opportunity areas, the primary outcome specified in our pre-analysis plan, as well as various measures of neighborhood and unit quality. Second, we examine heterogeneity in treatment effects

17. These motivations contrast with the MTO families, where concerns about gangs and violence was the primary motivation to move for most families, and better schools was the primary motivation for a much smaller group.

18. Since randomization was stratified by PHA (Seattle vs. King County), we compute these p-values by regressing the outcome on indicators for treatment status and PHA and report the p-value on the treatment indicator. In practice, since randomization rates were essentially identical in the two PHAs, the resulting difference is very similar to the raw difference in means between the treatment and control group.

across subgroups. Third, we analyze rates of persistence in new neighborhoods and neighborhood satisfaction based on post-move surveys. Finally, we use our estimates to predict the impacts of the treatment on rates of upward income mobility and compare the earnings impacts of the intervention to its costs.

V.A Impacts on Neighborhood Choice

We estimate the treatment effect of the bundled CMTO intervention on an outcome y_i (e.g., an indicator for moving to a high-opportunity area) using an OLS regression specification of the form:

$$y_i = \alpha + \beta Treat_i + \delta KCHA_i + \gamma X_i + \epsilon_i \quad (1)$$

where Treat is an indicator variable for being randomly assigned to the treatment group, KCHA is an indicator for receiving a voucher from the King County Housing Authority (as opposed to the Seattle Housing Authority), and X is a vector of baseline covariates.

In our baseline specifications, we include the KCHA indicator (since randomization occurred within each housing authority) but no additional covariates X. In supplemental specifications, we evaluate the sensitivity of our estimates to the inclusion of the baseline covariates listed in Table 1. Including these additional covariates has little impact on the estimates, as expected given that the covariates are balanced across the treatment and control groups.

Figure 3a shows the effect of the CMTO program on the fraction of families who rent units in high-opportunity areas using their housing vouchers. To facilitate visualization, we plot the control group mean (pooling all control group families across the two housing authorities) and the control group mean plus the estimated treatment effect β from equation (1).

The CMTO intervention increased the share of families moving to high-upward-mobility (opportunity) areas by 37.8 percentage points (s.e. = 4.2, $p < 0.001$) from 15.4% in the control group to 53.2% in the treatment group.[19] The 15.4% rate of moves to high-opportunity areas in the control group is similar to historical rates (Figure 3a), suggesting that the high rate of opportunity moves in the treatment group did not crowd out moves to opportunity areas that control group families would have made.[20]

19. We find very similar treatment effects across the two housing authorities: 35.1 pp (s.e. = 6.0) for families receiving vouchers from KCHA and 40.9 pp (s.e. = 6.0) for those receiving vouchers from SHA.

20. In particular, if there are a small number of units available in high-opportunity neighborhoods, the increased success of CMTO treatment group families in leasing those units could come at the expense of other voucher holders who would have gotten the units. This does not appear to occur in practice, presumably because the marginal family competing for housing in a high-opportunity neighborhood is typically not a voucher holder.

Figure 3b replicates Figure 3a, changing the outcome to an indicator for leasing up anywhere (not just in a high-opportunity area). Lease-up rates are very similar across the treatment group (87.3%) and control group (86.8%).[21] The fact that lease-up rates were quite high even in the control group shows that CMTO's impacts are not simply driven by providing services that enable families to use their vouchers (e.g., landlord referrals) and steering them to certain areas as a condition for receiving these services. Rather, CMTO changed *where* families chose to live. This result implies that moves to high-opportunity areas are inhibited by informational limitations and/or barriers specific to high-opportunity areas – which the bundle of CMTO services were expressly designed to address – rather than barriers associated with finding *any* place to lease up.

Conditional on leasing up, 61% of families leased units in high-opportunity areas in the treatment group, compared with 17.8% in the control group (Figure 3c). Hence, if all families were to receive CMTO services and treatment effects remained stable, we would expect 61% (rather than the current 17.8%) of families using vouchers to live in high-opportunity areas in steady-state.

Figure 4a maps the neighborhoods to which treatment and control families moved (among those who leased a unit using their voucher). Control group families remain concentrated in lower-opportunity neighborhoods in the southern and western parts of the metro area, which is where most families lived at the point of voucher application (Appendix Figure 4). In contrast, treatment group families are widely dispersed across high-opportunity neighborhoods across the metro area. The 118 treatment group families in our sample who moved to an opportunity area spread out across 46 distinct Census tracts. The dispersion of treatment group families shows that the program did not simply enable families to move to a specific set of apartment buildings or neighborhoods but rather facilitated moves to a variety of different areas that may have best suited families' heterogeneous tastes and constraints.

The average distance between families' new neighborhoods and prior neighborhoods is similar for treatment and control families who leased up (Table 2). This finding suggests that the CMTO program helped families overcome barriers unique to moving to high-opportunity areas in particular, rather than simply enabling them to move farther away from their current locations.

Figure 4b plots the distribution of levels of upward mobility (the mean household income rank of

21. The lease-up rate in the control group in Seattle and King County is considerably higher than in other areas of the United States, perhaps because of the efforts these housing authorities make to help households use their vouchers even in the absence of CMTO. For example, roughly half of voucher recipients in Chicago use their vouchers (Jacob, Kapustin, and Ludwig 2015). In such settings, the CMTO intervention may increase overall lease-up rates as well. Indeed, we find that even in the Seattle area, the CMTO intervention increased overall lease-up rates in the second phase of the experiment, which occurred during the pandemic when housing search became more challenging (Appendix Figure 10a).

children who grew up in low-income families) in the neighborhoods to which families moved for the treatment and control groups. The distributions for the treatment group are shifted significantly to the right relative to that for the control group. Families who moved to opportunity did not simply gravitate to lower-opportunity areas within the set of neighborhoods designated as "high opportunity." Some treatment group families moved to the highest-upward-mobility neighborhoods in the county – areas where no one would have moved absent the services (as shown by the near-zero density in the control group in the upper right tail).

Impacts on Other Measures of Neighborhood Quality. Having established that the treatment induced families to move to areas that we designated as high opportunity, we now turn to examine treatment effects on other measures of neighborhood quality to characterize the types of areas to which families moved. Table 2 reports estimates of treatment effects on several traditional measures of neighborhood quality. We estimate these treatment effects using a specification analogous to (1), replacing the dependent variable with a characteristic of the Census tract to which the family moves (e.g., poverty rate). Treatment group families move to neighborhoods that have $12,919 higher median household incomes on average (based on the 2017 ACS), a 9.7 pp higher fraction of college graduates, and 3.75 pp more two parent families (all significantly different from 0 with $p < 0.01$). In addition, treatment group families move to areas with lower rates of incarceration for children who grow up there. Treatment group families also move to areas that score higher on other neighborhood-level indices of opportunity that have been used in prior work, such as Kirwan indices (Acevedo-Garcia et al. 2014).

These results show that families in the treatment group did not sort based on particular characteristics of high-opportunity neighborhoods as we defined them but rather moved to neighborhoods that would be judged to be "higher quality" across many different dimensions. The treatment leads families to move to neighborhoods scoring higher on these dimensions because areas with higher levels of upward income mobility tend to have higher average income levels, more two-parent families, college graduates, etc. (Appendix Table 7, Chetty et al. 2018).

Unit Quality. Families' outcomes and well-being may be affected not only by the quality of the neighborhoods to which they move but also the quality of the specific apartment or house they lease. This raises the question of whether families induced to move to higher-opportunity areas by the CMTO program had to make sacrifices on the quality of the units they leased. To answer this question, we estimate treatment effects on a variety of unit-level characteristics.

Table 2 shows that the treatment did not induce families to move to smaller housing units; if

anything, families in the treatment group lease slightly larger units than those in the control group (though the difference is not statistically significant). Housing units rented by treatment group families are also quite similar to those of the control group in terms of age, household appliances, and access to air conditioning (Table 2). In short, the moves to opportunity induced by the CMTO treatment did not require families to make sacrifices in terms of housing quality.[22]

V.B Subgroup Heterogeneity

The effectiveness of programs that seek to reduce barriers to moving could potentially vary significantly across subgroups that face different types of barriers (e.g., racial/ethnic minorities who may face discrimination). In Figure 5, we evaluate whether this is a concern by analyzing the heterogeneity in the CMTO treatment effect on the rate of moves to high-opportunity areas across subgroups.

Panel A of Figure 5 replicates Figure 3a separately for non-Hispanic Black head-of-households, non-Hispanic Whites, and all other racial and ethnic groups. The CMTO treatment generated large increases in moves to higher opportunity areas of at least 30 percentage points across all of these groups.[23] The significant gains among Black families show that the CMTO treatment has substantial effects even in the presence of any racial discrimination that may exist in the housing market (Kain and Quigley 1975). Conversely, the large treatment effects among White families show that the low rate of opportunity moves among voucher holders is not due solely to racial discrimination.

Panel B of Figure 5 splits the sample into families with household incomes below vs. above $19,000 per year (the median in the CMTO experimental sample). We find substantial treatment effects in both of these groups, demonstrating that the program yields benefits even for the most disadvantaged households.

In Table 3, we estimate analogous treatment effects for several other subgroups of the population by cutting the data on various baseline characteristics. In every one of the 35 subgroups considered in the table, we find a highly statistically significant treatment effect on the rate of opportunity

22. One reason this might be the case is that Seattle and King County offer higher payments for more expensive neighborhoods, allowing families to access more expensive units in high-opportunity areas. Understanding the trade-offs that would be induced by CMTO-type programs in a setting without tiered payment structures is an interesting direction for further work.

23. These changes in neighborhood choice are likely to improve long-term outcomes for all of these subgroups as well: for instance, Chetty et al. (2018) show that Black children who move to areas with higher levels of upward mobility on average have higher earnings in adulthood, even if the neighborhoods to which they move have relatively few Black families.

moves of at least 30 percentage points. These groups include immigrants vs. U.S. natives, those with or without English as their primary language, and families with more or less optimistic views at baseline of moving to an opportunity area. There are no significant changes in overall lease-up rates in any of the subgroups (Appendix Table 8), consistent with the patterns in Figure 3b for the full sample.

In sum, the CMTO intervention generates highly robust increases in moves to high-opportunity across subgroups of the population.

V.C Persistence and Neighborhood Satisfaction

A key concern with housing mobility programs is that the moves they induce to higher-opportunity areas may be short-lived, especially since many families have not experienced these areas before and could revise their preferences after living there. Given prior evidence that neighborhoods' impacts on children's outcomes depend upon the number of years for which children are exposed to the area (e.g., Chetty and Hendren 2018a; Deutscher 2020), it is important to understand whether CMTO led to long-lasting moves. In this section, we analyze whether families choose to stay in high-opportunity areas after moving and use survey data to directly assess neighborhood satisfaction after moving.

Persistence in New Neighborhoods. We begin by evaluating whether families who moved to high-opportunity neighborhoods in the first phase of the experiment stay there when their lease comes up for renewal. We have data on where families live up through February 7, 2022, roughly 3 years after participants in the first phase of the experiment received their vouchers. When analyzing persistence, we restrict attention to the 84% of families who continue to hold vouchers over the three years we analyze; we find no significant difference in the fraction of families who retain their vouchers over three years.

Figure 6 plots the fraction of families within this sample who initially leased a unit in a high-opportunity area (replicating Figure 3c) along with the fraction who live in a high-opportunity area in the three subsequent years (measured on February 7 of each year). The treatment effect of CMTO is highly persistent: families in the treatment group are 36 percentage points more likely to be living in a high-opportunity area after three years, as compared with 44 pp when they first leased up. Families induced to move to opportunity by the CMTO intervention do not exhibit a strong propensity to move back to the lower-opportunity neighborhoods they would otherwise have

chosen.[24]

Neighborhood Satisfaction. To gauge the preferences of infra-marginal households (i.e., those who are not close to the margin of moving again), we supplement the persistence measures with survey data on neighborhood satisfaction. We asked all individuals in the random sample used for the qualitative analysis to rate their levels of satisfaction with their new neighborhoods at the end of their interviews. On average, these surveys were conducted 6 months after families had moved. As discussed in Section VII, families who responded to these surveys are representative of the full sample on observable characteristics and there is no evidence of selective attrition by treatment status. Inferences drawn from this smaller subgroup of respondents are therefore likely to yield unbiased estimates of treatment effects in our broader experimental sample.

Families in the treatment group express much greater satisfaction with their new neighborhoods than control group families. At the end of their qualitative interviews, families were asked, "Which of the following statements best describes how satisfied you are with your current neighborhood?" with five potential answers ranging from "very satisfied" to "very dissatisfied." Figure 7a shows that the treatment increased the share of families who reported being "very satisfied" with their new neighborhoods by 18.7 percentage points (s.e. = 10.1, p = 0.066), from 45.5% in the control group to 64.2% in the treatment group (see Appendix Figure 6 for the full distribution of responses).[25]

Families were also asked, "Which of the following statements best describes how you feel about staying in your current neighborhood?" with five potential answers ranging from "very sure I want to stay" to "very sure I want to move to a different neighborhood." Treatment group families are 17.4 percentage points (s.e. = 9.8, p = 0.076) more likely to say they are "very sure" about wanting to stay in their new neighborhood (Figure 7b).

To further explore the mechanism underlying these improvements in neighborhood satisfaction, in Appendix Figure 7 we disaggregate the measures of satisfaction (Panel A) and likelihood of staying (Panel B) by whether families moved to high-opportunity areas. In both the treatment and control groups, families who moved to high-opportunity areas report much higher levels of satisfaction and likelihoods of staying.[26] These differences emerge only post-move: families in all four

24. These high rates of persistence may be driven by the fact that the families who moved to high-opportunity areas in CMTO chose such neighborhoods without being required to do so to use their vouchers (and hence are a selected subsample who exhibit a preference for such areas). In contrast, the families in the Moving to Opportunity experimental group were required to move to low-poverty areas to use their vouchers.

25. These treatment effects on satisfaction persist well after the initial move, mitigating potential concerns about a transitory "warm glow" effect right after moving. Among the 25% of families interviewed at least 280 days after their initial move, 71% of treated families reported being "very satisfied" with their new neighborhoods, compared with 42% of the control group.

26. The gains in satisfaction associated with moving to a high-opportunity area are slightly larger in the control

groups report similarly low levels of satisfaction (Panel C) and low probabilities of staying (Panel D) in their neighborhoods at the point of the baseline survey prior to randomization. Although the comparisons in Appendix Figure 7 are based on endogenous choices rather than experimental variation, they suggest that the key determinant of satisfaction is the neighborhoods in which families live rather than a direct effect of the CMTO services themselves. In particular, the treatment effect on the fraction of families who report being very satisfied (18.7%) is similar to what one would predict based on the difference in satisfaction between families who moved to high vs. low opportunity areas within the control group multiplied by the treatment effect on the fraction who move to high-opportunity areas ($58.5\% \times 43.2\% = 25.3\%$).[27]

In sum, the sharp increases in neighborhood satisfaction and high levels of persistence in the new neighborhoods allay the concern that the CMTO treatment may have steered families into new neighborhoods that end up being a poor fit after they arrive. Instead, these findings suggest that a lack of information about high-opportunity areas or barriers during the housing search process prevent low-income families with vouchers from moving to higher-opportunity areas that they actually prefer ex-post. We investigate the nature of the barriers that families face using a second phase of experiments in Section VI.

V.D Impacts on Upward Mobility

How do the changes in neighborhood choices induced by CMTO affect children's future outcomes? While children's earnings outcomes will not be directly observed for many years, the upward mobility measures from the Opportunity Atlas provide a way to predict the impacts of the CMTO treatment on children's subsequent earnings outcomes.

Impacts on Neighborhood-Level Upward Mobility. We begin by estimating treatment effects on average levels of upward mobility in the neighborhoods to which families move. We measure upward mobility in each Census tract as the predicted adult household income rank for children with parents at the 25th percentile, drawn directly from the publicly available Opportunity Atlas

group than the treatment group, perhaps reflecting the fact that the few families who moved to high-opportunity areas in the control group strongly preferred them to begin with, whereas the CMTO treatment induced families with slightly weaker preferences to move as well.

27. These findings also help address the concern that survey responses may be driven by social desirability bias, whereby families in the treatment group might feel obliged to say positive things about the program and their neighborhoods to the interviewers, especially right after moving. To mitigate such biases, interviewers stressed that they were independent from the PHAs and would not share their responses with the PHAs and sought to develop rapport with families at the beginning of the interviews – starting with an open invitation to "Tell us the story of your life" – before asking CMTO-specific questions.

data.[28] The treatment effect on this measure of upward mobility is an increase of 1.6 percentile ranks (s.e. $= 0.4$, $p < 0.001$), from 44.6 (roughly an income of \$36,000 at age 34) in the control group to 46.2 (\$37,800) in the treatment group (Table 2).[29]

The 1.6 estimated treatment effect on upward mobility might overstate the intervention's actual impact because of sampling error in the Opportunity Atlas estimates of upward mobility used to define high-opportunity areas (Andrews, Kitagawa, and McCloskey 2019). In particular, the tracts that have the highest *estimated* rates of upward mobility in the Opportunity Atlas may not in fact have the highest *true* levels of upward mobility because of noise in the estimates. Because tracts that got a positive noise draw as a result of sampling variation are more likely to be defined as "high opportunity," their true levels of upward mobility will generally be lower on average than estimated. We address these concerns using two approaches.

First, we construct optimal forecasts of upward mobility by shrinking the raw Opportunity Atlas estimates, as in the literature on selection of teachers based on value-added estimates (e.g., Chetty, Friedman, and Rockoff 2014). We use the same shrinkage procedure that we used to construct the forecasts we used to define high-opportunity areas (see Appendix A). Under the assumption that upward mobility across tracts is Normally distributed (conditional on the covariates), the shrunk forecasts yield an unbiased estimate of the gain from the intervention (see Appendix E of Andrews, Kitagawa, and McCloskey 2019). The treatment effect on the forecasts of upward mobility is 1.6 percentiles, similar to what we obtain with the raw estimates.[30]

Second, we use a split-sample approach, estimating impacts on upward mobility using separate data from that used to define high-opportunity neighborhoods. Sample splitting directly eliminates the upward bias caused by sampling error insofar as the errors in the two samples are independent. We estimate a treatment effect of 1.2 percentiles (s.e. $= 0.34$) using tract-level data on mean income ranks in 2014-15 from the 1984-89 cohorts, which were not directly used in defining high-

28. We use the final, publicly available version of the Opportunity Atlas when constructing these predictions rather than the preliminary measures that were used to define "high opportunity" areas to maximize precision. However, results are similar if we use the preliminary measures because they are highly correlated with the final measures (Appendix Figure 2).

29. For families who did not lease up using their vouchers, we use upward mobility in their origin Census tract as the outcome. A survey of these households suggests that most stay in their origin tract and those that do move on average move to areas with lower upward mobility.

30. The estimates do not change significantly because our designation of high opportunity areas was not based directly on the Opportunity Atlas measures themselves but rather a forecast of those estimates based on covariates, as discussed in Appendix A. Some of the tracts to which families in the treatment group moved have lower estimates in the raw Opportunity Atlas data than one would predict based on covariates. As a result, even though shrinkage reduces the predicted gains from moving to most high-opportunity tracts, it ends up not affecting the overall mean significantly.

opportunity areas.[31] This split-sample approach does not rely on any distributional assumptions but evaluates a slightly different hypothesis than the shrinkage approach discussed above because it tests for differences in upward mobility among more recent cohorts and thus measures income at earlier ages than in our baseline analysis (which may explain why it yields a slightly smaller point estimate).

Together, these two approaches confirm that the tracts to which families in the treatment group move are not merely classified as "high opportunity" due to sampling error and do in fact have higher levels of upward mobility on average – consistent with the systematic differences in other neighborhood-level characteristics documented above.[32]

Predicted Impacts on Earnings. We translate the treatment effect estimate of 1.6 percentiles on household income ranks at the neighborhood level into an estimated causal impact on income for a given child whose family is induced to move to a high-opportunity area by CMTO by making two adjustments. First, not all of the observational variation in upward mobility across areas is driven by the causal effects of place; some of it reflects selection that would not be captured by a child who moves. Chetty et al. (2018) estimate that 62% of the variation in upward mobility is due to causal effects, i.e., moving at birth to an area with 1 percentile higher predicted outcomes would increase a given child's rank in adulthood by 0.62 percentiles.[33] Second, the treatment effect in Table 2 understates the gains a given child would obtain by moving from a low to high-opportunity

31. The shrinkage algorithm we used to define high-opportunity areas uses some predictors from the 1984-89 cohorts, which could potentially be correlated with the 1984-89 earnings outcomes and create scope for upward bias. As an alternative approach that does not suffer from this concern, consider defining Census tracts as "high opportunity" based purely on estimates of upward mobility for the 1978-83 birth cohorts, the sample used to construct the baseline Opportunity Atlas estimates. Defining high-opportunity areas as the top 20% of the distribution within Seattle Housing Authority tracts or top 40% of the distribution within King County Housing Authority tracts (the same thresholds used in Appendix A), we find that high-opportunity tracts have 3.2 (s.e. = 0.004) percentile higher levels of upward mobility in the 1984-89 cohorts. Recalling that the CMTO treatment increased the share of families who moved to high-opportunity areas by 37.8%, this 3.2 percentile difference aligns with the 1.2 percentile point estimated treatment effect on earnings ranks for the 1984-89 cohorts: 37.8%.

32. A distinct concern arises if one wishes to guarantee that *every* tract classified as "high opportunity" has higher upward mobility than every tract that is not classified as high opportunity. Mogstad et al. (2022) develop methods to generate confidence intervals for such comparisons, which require making many comparisons across tracts. They apply their approach to Opportunity Atlas data for Seattle and show that one cannot reliably guarantee that every neighborhood with an upward mobility estimate in the top third of the distribution has higher mobility than, say, every neighborhood estimated to be in the bottom third of the distribution. We focus on a different question: whether tracts classified as "high-opportunity" have higher rates of upward mobility *on average* than those that are not. Answering this question requires testing a single hypothesis (comparing two means) and hence does not require adjustments for multiple comparisons. Our results show that we can be confident that families in the CMTO treatment group moved to higher-opportunity areas on average, even if we cannot guarantee that every neighborhood to which they were induced to move has a higher level of upward mobility than the counterfactual neighborhood to which they would otherwise have moved.

33. Chetty, Hendren, and Katz (2016) obtain a very similar estimate when focusing on the subset of families induced to move to low-poverty areas by receiving a housing voucher in the Moving to Opportunity experiment, supporting the application of this 62% figure in our study population.

area because only 37.8% of families were induced to move to high-opportunity neighborhoods by the CMTO treatment.

Adjusting for these two factors, we estimate that the causal effect of the moves induced by the CMTO treatment on household income ranks in adulthood is $1.6 \times \frac{0.62}{37.8} \approx 2.6$ percentiles for a child who moves at birth and stays in their new neighborhood throughout their childhood. This corresponds to an increase in annual household income of approximately $3,000 when children are in their mid-thirties, which is approximately 8.3% of the mean income of children growing up in families at the 25th percentile of the national income distribution in low-opportunity areas in Seattle and King County. Assuming that individuals obtain a 8.3% income gain throughout their lives and an annual income growth rate of 1% per year, we project an undiscounted total lifetime income gain of $212,000. This is equivalent to $84,000 in present value at birth with a 2% discount rate.[34]

As another benchmark, note that children growing up in 75th percentile families in Seattle end up 13.6 percentiles higher in the income distribution as adults than those growing up in 25th percentile families in Seattle. Moving to a high-opportunity area reduces this 13.6 percentile gap in outcomes by $\frac{2.6}{13.6} = 19.1\%$. That is, moving from the average low-opportunity to high-opportunity area within Seattle reduces the gap in income between children from low- and high-income families by about 20%.

An important limitation of these earnings impact estimates is that they assume that the causal effects of places on mobility will remain stable over time, and in particular will not change as a result of voucher holders moving into new neighborhoods. The fact that the CMTO treatment induces families to move to a very diffuse set of high-opportunity areas (Figure 4) may reduce the risk that the gains from moving to a higher-opportunity neighborhood will be diminished by changes in neighborhood composition in this particular case. However, further work is required to understand the impacts of such interventions in general equilibrium, particularly when they are scaled up. On the one hand, an influx of lower-income residents could diminish the positive causal impacts of what are currently high-upward-mobility areas for a given low-income child by reducing her exposure to and interaction with higher-income peers (Chetty et al. 2022) or by generating reductions in public goods provision (Derenoncourt 2022). Families leaving under-invested, low opportunity neighborhoods could also potentially further undermine opportunities in those areas.

34. See Appendix Table 9 for step-by-step details on these calculations. The corresponding estimates for individual earnings (excluding spousal income) are a 2 percentile gain, translating to approximately $1,700 (6.8%) per year in a lifetime earnings gain of $130,000.

On the other hand, enabling families to make choices more freely by removing barriers to moving may lead to more efficient provision of public goods and improved outcomes in equilibrium across all areas via the mechanism of Tiebout competition across jurisdictions. In future work, it would be useful to analyze the impacts of CMTO-style policies using equilibrium models (as in e.g., Davis et al. 2021), incorporating a behavioral model of neighborhood choice that matches our empirical findings here (see Section VIII).

Comparison to Program Costs. How does the lifetime earnings impact of the CMTO intervention compare to its cost? We estimate that the treatment effect of the program on the present value of income tax revenue for children who move at birth is $6,000 (discounted at 2%). This is larger than the average program service cost of $2,670 (Table 4). However, it is smaller than the present value of the downstream cost of higher voucher payments generated by families in the treatment group moving to more expensive neighborhoods that have higher voucher payment standards. Table 2 estimates that treatment group families move to units with monthly rents that are $183 higher on average than families in the control group. Given the structure of payment standards in Seattle and King County, this marginal increase in rents is entirely borne by the housing authority rather than the families themselves; the treatment had no significant impact on families' out-of-pocket rent payments (Table 2). Assuming that families use their vouchers for 7 years (the average duration for which vouchers are used in Seattle and King County), the average increase in voucher payments costs the government $17,633 per lease (Table 4).

Taking both forms of costs into account, every $1 of government spending induced by the CMTO program leads to an income increase of $1.35. Conservatively assuming that the increases in children's earnings are the only benefits of CMTO, this implies that the program has a marginal value of public funds (MVPF) of 1.35. If participants additionally value the CMTO services at their costs, the MVPF would rise to 2.68, comparing favorably to most other government programs (Hendren and Sprung-Keyser 2022).

The downstream costs of higher voucher payments could vary substantially across settings, depending upon the level of rents and the degree to which payment standards are increased in higher-rent neighborhoods. While we do not have experimental evidence on the treatment effects of CMTO in the absence of tiered payment standards, we find that 46% of the treatment group families who moved to high-opportunity areas rented units that they would have been able to afford even in the absence of the higher payment standards provided in certain neighborhoods. This finding suggests that CMTO mobility services would have substantial impacts even in the

absence of differential payment standards across areas.[35] The cost-effectiveness of CMTO-style programs could therefore potentially be increased going forward by limiting the degree to which voucher payment standards are increased in higher-rent neighborhoods.[36]

VI Mechanisms: Phase Two Experimental Results

Having established that the CMTO program significantly changed where low-income families chose to live, we now turn to examine the mechanisms underlying this treatment effect. The bundled CMTO program included many elements that could have influenced families' choices, including information about high-opportunity areas, financial assistance, and various forms of support during the housing search process itself. In this section, we present results from a multi-arm randomized trial designed to distinguish between these mechanisms. The goals of this follow-up trial were to understand the factors that shape the neighborhood choices made by low-income families at present and how one can most effectively reduce the barriers that families face when seeking to move to opportunity.

As discussed in greater detail in Section III.C, the second phase experiment consisted of four groups: (1) control, which received the housing voucher but no additional information or support; (2) *Incentivized Information* (Treatment Arm 1), which received information about high-opportunity areas along with essentially the same financial assistance provided to families in the first phase bundled intervention; (3) *Reduced Services* (Treatment Arm 2), which provided information and financial assistance along with a lower dosage version of the original treatment with a more limited set of housing search services (with less one-on-one assistance from navigators); and (4) *Full Customized Services* (Treatment Arm 3), which received the full bundle of resources and services provided to the treatment group in the first phase.

Main Estimates. We estimate the effects of the three treatments relative to the control group using specifications analogous to (1), estimated using three separate regressions. Figure 8 shows the effect of the treatments on the fraction of families who moved to high-opportunity areas, plotting the control group mean and the control group mean plus each of the estimated treatment effects. In

35. This 46% figure should be interpreted as a lower bound on the fraction of families one would be observe moving to a high-opportunity area with the CMTO treatment in the absence of the higher payment standards since at least some families would presumably still move to high-opportunity areas, but choose less expensive units than the ones they chose given current policies.

36. As another way to see this point, note that the estimates in Table 4 imply that one could implement the CMTO program while maintaining a balanced budget by reducing the total number of vouchers offered by 2.5% if one takes only the up-front program costs into account vs. 17.2% if one takes the increase in downstream voucher payment costs resulting from the current tiered payment standards into account.

the control group, 12.5% of families move to high-opportunity areas, similar to the share observed in the first phase. In the full customized services group, 53.3% of families move to high-opportunity areas. This rate is also very similar to the impacts of the bundled intervention in the first phase of the experiment, showing that those results replicate in a second trial.[37]

Turning to the two new arms introduced in the second phase trial, the incentivized information treatment increased the share of families who moved to high-opportunity areas by 8.9 pp – an effect that is not statistically distinguishable from 0 but is significantly smaller than the 40.8 pp treatment effect of the full customized services with $p < 0.001$. Because the financial support (worth $1,177 for the average opportunity move, equivalent to nearly a month of income for the typical family in our sample) was available only if one moved to a high-opportunity area, there was a significant incentive for individuals to pay attention to the information being provided about where the high-opportunity areas are. Despite having these incentives and the information in hand, most families in the first treatment arm did not end up moving to high-opportunity areas. This result indicates that the reason many low-income families do not currently live in high-opportunity areas is not purely a lack of information about such neighborhoods. Indeed, the areas we designate as high-opportunity based on the new Opportunity Atlas data on upward mobility tend to have characteristics that families already identify with "good neighborhoods," such as lower poverty rates and better educational outcomes (as shown in Table 2).

The small impacts of the first treatment arm also show that simply providing up-front financial assistance to families to help them move to higher-opportunity neighborhoods does not change their neighborhoods choices substantially. Hence, credit constraints are also unlikely to explain the segregation of low-income families in lower-opportunity areas.

The reduced support services treatment arm increased the share of families who moved to high-opportunity areas by 13.8 pp, an effect that is significantly different from 0 but is only one-third as large as the treatment effect of the full intervention. This result points to a dose-response relationship in the amount of services families receive: lower-intensity services that do not provide as much family-specific support (e.g., customized landlord referrals) appear to have a positive but

37. While the treatment had no effect on lease-up rates in Phase 1 of the experiment (Figure 3b), the treatments significantly increased overall lease-up rates relative to the control group in Phase 2 (Appendix Figure 10a). The impacts on lease-up rates were driven by the subset of families who received their vouchers towards the end of the Phase 2 experiment (early 2020), who were searching for housing after the pandemic began in March 2020. We find no statistically significant effect on lease-up rates in the months prior to the onset of the pandemic. We also find no significant heterogeneity in the treatment effects on rates of moves to high-opportunity areas pre- vs. post-pandemic. These findings suggest that the effect of mobility services on total lease-up rates may differ by economic and housing market conditions (even if their impacts on the share of high-opportunity moves do not); receiving additional support and financial assistance may be especially valuable for leasing a unit in a time of economic instability.

smaller impact on rates of moves to high-opportunity areas than higher-intensity fully customized services.[38]

Subgroup Heterogeneity and Neighborhood Quality. We examine heterogeneity in the treatment effects of the three Phase 2 interventions across subgroups in Appendix Table 10, which replicates Table 3 for the Phase 2 treatments. Although the estimates are imprecise in some subgroups due to small cell sizes, in nearly every subsample, the full customized services treatment has larger effects on the rate of moves to high-opportunity areas than the reduced support services treatment. The treatment effects of the reduced support services arm are in turn larger than those of the incentivized information treatment arm, mirroring the ordering of size of the treatment effects for the entire population.

We also examine the impacts of the three Phase 2 treatment arms on measures of neighborhood quality in Appendix Table 11, which replicates Table 2 for Phase 2. The incentivized information and reduced services treatments both had little impact on key measures of neighborhood quality, such as median household incomes, Kirwan neighborhood quality indices, or measures of upward mobility. In contrast, the full intervention led to substantial improvements on all of these measures, mirroring the findings for Phase 1. Examining the distribution of upward mobility in the neighborhoods to which families moved (Appendix Figure 11), we find that some families in the full services treatment group moved to the highest-upward-mobility neighborhoods in the county (as in Phase 1), but virtually none of the families in the other treatment arms did so (as shown by the near-zero density for those group in the upper right tail).

Evidence from Other Housing Mobility Programs. Our findings on the limited impacts of information and the dose response to counseling support intensity are consistent with the findings of other recent interventions to help families move to higher opportunity areas. Bergman, Chan, and Kapor (2020) randomized the provision of information to families about the quality of schools associated with rental units on GoSection8.com, a housing search platform widely used by voucher holders. Families who received the information treatment moved to neighborhoods with schools scoring 0.1 standard deviations (SD) better on state tests on average, considerably smaller than the 0.5 SD impact induced by the full CMTO intervention. Bergman, Chan, and Kapor (2020) also report that the effect of the information on upward mobility is 16% as large as the CMTO impact on upward mobility shown in Table 2.

38. The comprehensive services cost about three times as much as the reduced support services ($2,778 vs. $720 of up-front program service costs) and have three times as large an impact on the fraction of families who move to high-opportunity areas, suggesting a linear dose response to service intensity over the range we study.

Schwartz, Mihaly, and Gala (2017) report results from a randomized trial in Chicago in which families receiving housing vouchers were given $500 of financial assistance and light-touch mobility counseling services to move to a high-opportunity area (defined based on an index of poverty rates, job access, and other characteristics). The counseling services were client-initiated, with families opting-in to specific mobility services they wanted to use, whereas the CMTO service model was more collaborative and higher-intensity, with the program staff determining which services to emphasize based on the needs of the family. They find that these light-touch incentives and supports had no impact on the rate of high-opportunity moves: less than 12% of families in the treatment group moved to high-opportunity neighborhoods.

Another increasingly common approach to help families move to higher-opportunity neighborhoods is to offer higher voucher payments in higher-rent or higher-opportunity neighborhoods within a metro area. Collinson and Ganong (2018) analyze the impacts of such tiered payment standards on the fraction of families who move to higher-opportunity neighborhoods in Dallas using quasi-experimental difference-in-difference designs. In Appendix E, we implement analogous difference-in-difference designs in the Seattle metro area, exploiting differential changes in payment standards between the Seattle (SHA) and King County (KCHA) housing authorities. In particular, KCHA increased payment standards in neighborhoods that had higher rents and scored higher in Kirwan indices of opportunity in 2016. In April 2018, SHA increased payment standards in exactly the same areas we designate as "high opportunity" in CMTO. Using observational data obtained from the housing authorities, we find that both reforms increased the share of families who moved to high-opportunity areas, consistent with the findings of Collinson and Ganong (2018). However, they had significantly smaller effects than the CMTO program. For example, the financial subsidy to move to high-opportunity neighborhoods provided by SHA – which costs the housing authority about $12,100 in present value per household that moved to a high-opportunity area – increased the share of families who moved to high-opportunity areas by at most 13.8 pp, one-third the impact of the full CMTO intervention.

Based on the Phase 2 experimental findings and these related analyses, we conclude that the concentration of low-income housing voucher recipients in lower-opportunity neighborhoods is not driven solely by information about the benefits and locations of opportunity neighborhoods or financial barriers to such moves.[39] Rather, the key factor limiting moves to high-opportunity

39. These findings do not imply that information or financial assistance are not necessary to make such moves; they simply show that they are not sufficient. An intervention that provides support services without any information about high-opportunity areas or financial supports might not have large treatment effects on rates of moves to

areas appears to be barriers in the process of finding housing in those areas itself – barriers that can evidently be overcome through support provided by housing navigators at a sufficiently high dosage. In the next section, we dig deeper into exactly what these barriers are by investigating the types of support services that had the greatest impact on families' neighborhood choices.

VII Qualitative Evidence on Barriers in Neighborhood Choice

What are the difficulties faced by families seeking to move to opportunity and how do the housing navigators help to address them? In this section, we present qualitative evidence on these questions based on interviews with a randomly selected set of families who are representative of the overall sample, as discussed in Section IV.A. We interviewed participants using an in-depth narrative approach, following Darrah and DeLuca (2014) and DeLuca, Clampet-Lundquist, and Edin (2016). We asked families about their lives broadly, such as their residential history, family dynamics, and children's schooling. We also elicited information about the barriers that families faced in moving to high-opportunity areas and the components of CMTO that were most useful in addressing those barriers. We then systematically coded the nearly 12,000 pages of interview transcripts to measure the prevalence of various themes and identify recurring patterns. Details on the methods used to collect and code the data are given in Appendix C. We begin by characterizing the families in the sample to shed light on the challenges they face in searching for housing. We then describe five key mechanisms that emerge in families' descriptions of how CMTO helped them overcome these challenges. Finally, we show how the combination of these mechanisms and the ability to customize the treatment to each family's needs was central to the program's success.

VII.A Who are the Families Applying for Housing Vouchers?

Interviews with families revealed several dimensions of economic disadvantage and barriers to housing search beyond the measures in the baseline survey data summarized in Table 1. A substantial share of the families (45%) reported struggling with a major health problem, including children with significant physical, mental or emotional needs, and 29% had experienced domestic violence. Perhaps as a result of such factors, the families had histories of significant housing instability. Around 19% of the families we interviewed had been evicted, and 49% had been homeless at some point. Approximately 78% of household heads had been previously "doubled-up," living in the homes of family members or friends.

high-opportunity areas either.

Many families described repeated denials when applying for housing, largely arising from credit problems. For example, Sandra, a White mother, had not received her voucher when we first interviewed her, and told us she felt despondent about ever find housing in Seattle because of her poor credit history. She was frustrated and said, "I wish they'd do a *criminal* background check instead of a *credit* [check]—I have no crimes."[40] As a result of their history of challenges in finding housing, many families began the CMTO program anxious about their prospects for finding housing in the tight Seattle area housing market. Parents were generally interested in moves to high-opportunity areas and believed such moves would benefit their families. However, they were pessimistic about the prospect of landlords in such areas being willing to rent to them.

Overall, the interviews paint a picture of families that have little time and resources to devote to housing searches. Many families had also experienced a history of making "reactive moves" (Carrillo et al. 2016; DeLuca, Wood, and Rosenblatt 2019) in response to shocks such as evictions, family conflicts, or violence, resulting in rushed relocations to seek shelter and, thus had little or no experience in searching for housing deliberately, particularly in less familiar high-opportunity areas. These factors amplify the scope for seemingly small barriers to affect families' choices.

VII.B Five Mechanisms Underlying the CMTO Treatment Effects

We identify the mechanisms through which CMTO helped families move to high-opportunity areas by first reading the entire corpus of Phase 1 interview transcripts for families who moved to high-opportunity areas and observing which aspects of the CMTO program emerged as most salient from families' accounts of their experiences with CMTO. We then coded all Phase 1 transcripts for these mechanisms and recorded the frequency with which families mentioned various themes, following the systematic coding protocol described in Appendix C.

Based on this analysis of the Phase 1 data, we identified five mechanisms through which navigators helped families move to high-opportunity areas. After establishing these mechanisms, we then used the Phase 2 interview data to conduct an out-of-sample test of these hypotheses by quantifying the prevalence with which the mechanisms were mentioned by families in the three different treatment arms. Here, we first describe the five mechanisms by presenting examples from Phase 1 interviews, and then discuss the Phase 2 validation analysis.

Mechanism 1: Emotional Support and Communication. To learn about families' experiences

40. This and other quotes included below were selected because they are representative of the modal experience reported by treatment group families who leased up in opportunity areas with the program. To protect families' identities, all names are pseudonyms chosen by respondents.

with CMTO, we asked an open-ended question in our interviews ("Tell me about CMTO...") before probing about any of the program specific details. Many families responded by describing how emotionally supported they felt by the navigators; 61% of Phase 1 treatment group families who leased up in opportunity areas reported that they felt supported by CMTO navigators.

For example, Katie, a Black mother living in North Seattle, told us that CMTO helped her "get a voice" and feel more confident dealing with property managers and negotiating her needs. She said, "I kind of got to start speaking up and not being so scared... you can't lose your Section 8 for speaking out." Dee, another Black mother in Seattle, explained that without CMTO she would not have had "the courage to even apply for this house" she was living in when we met her given her credit history, and that "[the navigator] broke down the neighborhoods in ways that I never would have looked at." Similarly, Jackie, a White mother in Issaquah, told us how she felt when she realized what the CMTO program would provide: "it was this whole flood of relief... just the supportive nature of having lots of conversations with [housing navigator], that they could call the landlords. That saved me... personally, mentally, emotionally, and financially."

Given how unpredictable and reactive their previous housing searches had been, this was the first time many families had the bandwidth and guidance to think through neighborhood choices deliberately. Ashley, a Black mother who was homeless before finding housing with CMTO, explained:

> It was good because it gave you a breakdown of what you needed to do, questions you need to ask, things you need to think about like school district, grocery stores, public transportation... after that, I'm like, "Well, these are things that are really important to me." And you didn't think about – you don't think about how something so simple is so important... So, now, when I came into this [move], I knew what I wanted. I wanted something close for all these things and something for my daughter.

Many families noted that the CMTO navigators' consistent communication and support were critical for keeping them motivated throughout the search process. Mona, a Hispanic mother who moved to Bellevue, said "[the navigator] was on top of everything [for] me. If it wasn't for her, I honestly think I would have lost my Section 8 because nobody was willing to give us an opportunity." Tina, a Native Hawaiian mother who moved to North Seattle, noted excitedly, "wow this program, like they're with you at all times, they help you they're there to guide you."

These accounts differed starkly from what we heard from control group members, like Arya, a White mother who wished she had more support during her housing search. Arya described the help she wished she had during a recent visit to an apartment leasing office, "could I get somebody to meet me there that might just sit there with me... to explain the paperwork to me more or to

be a second ear also. Because... I have communication issues like understanding the person and I feel rushed... So, I wanted somebody to come with me and [the PHA] emailed me back that they don't provide that service."

Mechanism 2: Increased Motivation to Move to Opportunity. In addition to the support they felt from the CMTO navigators, some families reported that they became more motivated to move to a high-opportunity area as a result of the program because it made such a move seem more attainable. Families recalled learning about the benefits for their children's long-term success during the initial study intake process and throughout their meetings with CMTO navigators. Many reported feeling "excited" that they might be able to live somewhere that, as Hiba, a Black mother in Seattle, told us, "there is research they've shown... [there] are more opportunities, there are more graduations from school... That is what we are looking for." Melinda, a Black mother in King County, told us that she was "tired of living around chaos," and became quite emotional when she heard that the program was about more than just providing housing assistance. She explained, "She [navigator] made me cry when she kind of explained to me what the program does, like it's not just we pay your rent... it's for to make sure that not only you are in a good area but your kid can grow up in a good area and be successful it's like it made me so happy to think that my son is going to be in a area that can just help him be a good part of society." Among treated families who moved to high-opportunity areas, 31% reported that their motivation to move to a higher-opportunity area was amplified by the CMTO program.

While many families spoke of a motivation to move to high-opportunity areas – starting to realize that this might be an attainable goal – very few (<3%) framed their CMTO experience in terms of receiving more information about the existence of such areas, consistent with our experimental results that simply providing information has little impact on families' neighborhood choices. Indeed, several families pointed out that they were already well aware that some neighborhoods offered much better opportunities for their kids. Sami, a Black mother in King County, told us, "I always heard like [Bellevue] school is better than Seattle area... so I always wish to move here if I can afford it, so that's when I get the voucher and when CMTO told me that you have to do that [to get the additional assistance], that was my wish I was like, yeah."

Mechanism 3: Streamlining the Search Process. The complexity of the search process – from online searches to landlord calls, apartment visits, security deposit paperwork, background checks, applications, inspections, and voucher payment paperwork – was overwhelming for many parents who were facing many other challenges. As Lisa, a mixed race mother who moved to the Lake City

area of Seattle, said, "it was like me staring at my phone [to do online housing searches] like while he [her son] is playing around and the less I have... to do that takes away from like me focusing on him or the other things that I need to do is the better."

The CMTO navigators were able to reduce this stress and streamline the search process by giving families clear guidance on what to do. Among Phase 1 treatment group families who moved to opportunity areas, 73% mentioned that their housing search and lease-up processes were made simpler, quicker and less overwhelming by the assistance they received from CMTO navigators. Stive, a Russian immigrant who moved to Bellevue, explained that CMTO was helpful because, "every time it's hard to communicate with many different organizations and explain to them what I need and working on paperwork and everything, and [CMTO] resources which will help me manage big circle of issues."

The program also reduced the tax of fruitless and demoralizing housing searches by directly providing listings of rental units that were owned by landlords and property management companies with whom the navigators had built relationships. Navigators built trust with property owners and managers and increased the information these housing providers had about families, thus reducing the influence of "Section 8" stereotypes (see Appendix D for details on the strategies used by navigators to do this). Melinda, a Black mother in King County, summarized how the referrals she received from her housing locator made it easier to find the place she moved into as follows:

> She gave me a list of apartments that CMTO worked with and I just based my search off of that list, so, cuz I was nervous about my credit and I just didn't wanna go through a whole bunch of denials if, you know, they're familiar with this program, then it'll be easier for me to get in... I don't think I would've tried out here honestly without them giving me like the areas that they feel like are more opportunities.

Mechanism 4: Landlord Brokering. In addition to providing initial referrals, the CMTO navigators helped form relationships between prospective tenants and landlords, both in preparing the tenants before they met landlords and in participating in conversations with landlords themselves. Among Phase 1 treatment group families who moved to high-opportunity areas, 61% reported that navigators helped negotiate directly with landlords on their behalf during some part of the process.

One key element of housing search preparation was the creation of a "rental resume," a document that families could use to present themselves to landlords. These essays helped families explain the circumstances surrounding barriers to housing, like poor credit histories, evictions or unemployment. Some families felt empowered by creating their rental resumes to help move beyond past barriers and achieve their hoped-for future through opportunity moves. The resumes also allowed the navigators to better describe families in their conversations with prospective landlords.

Nicole, a Black mother, described how the rental resume made a big difference to the leasing company she ended up working with in Seattle, despite her spotty credit history:

> Some landlords, you know, your credit could get denied like here like mine did [but] because I had that credit resume explaining the four derogatory marks on my credit, how they got there, how long they've been there, what I'm doing to dispute them, how I'm getting them off if I'm on a payment plan like... because of that, staff was just like, "Well, I mean, you seem smart, you seem like you're prepared, these things on your credit don't seem like a big deal..." And sure enough, she was like, "Just give her a chance, just higher deposit. " So, that, it helped.

Other families mentioned how valuable it was to have the navigators directly speak with landlords on their behalf. The navigators lent families additional credibility during difficult conversations or when landlords seemed reluctant to accept families. Lakeisha, a Black mother in Seattle, noted that having the CMTO navigator represent her when talking with landlords "felt like it's a reference." Dee's navigator helped her move into a unit with a landlord who had never rented to a voucher holder before. She recounted the sales pitch the navigator used to explain how the program worked and ended up benefiting both the landlord and the family:

> She did the inspection, she did a lot of talking to the landlord and getting them to understand the program helping him figure out how to get started with the program or Section 8 and all, that was her. She... did very good with helping a first time ever landlord, this is his first time even hearing about Section 8... an opportunity for him to help us in a sideline kind of way, he doesn't really have to do anything except for say yes and we're glad that we can help with this people move into this neighborhood to better resources and stuff for their kids, that was his contribution to my kids' future.

Although we did not conduct a systematic qualitative study of landlords themselves, we were able to glean some insight into landlords' perspectives on the benefits of the CMTO program from conversations with the housing navigators and selected landlords (see Appendix D for further details). In general, landlords appreciated that the CMTO navigators were easy to contact (compared to other housing agencies they previously dealt with), quickly answered their questions, or directed them to an appropriate contact at the housing authority to complete the leasing process. Some landlords became more open to the CMTO program after the navigators explained benefits such as direct rent payments and expedited inspections. As with families, CMTO's success with landlords appears to have stemmed not primarily from financial incentives but from one-on-one relationship building, clearer communication, and the provision of relevant resources when needed on a case-by-case basis (Aliprantis, Martin, and Phillips 2022).

Mechanism 5: Short-Term Financial Assistance. Finally, many families remarked that the customized financial assistance they received from CMTO mattered for removing upfront roadblocks.

81% of the families we interviewed mentioned receiving financial assistance as part of the CMTO program. Lou, a Black mother in Seattle, explained how CMTO financial assistance simplified things by covering upfront expenses, "CMTO, they help with the deposit, and you know, moving costs, if you have to bring stuff out of storage and things like that, and Section 8 pays for your first and last month rent... You can move in without any hassle, so it really makes, makes it a lot easier to just focus on finding a place."

Importantly, the interviews suggest that it is not just providing uniform lump-sum short-term financial assistance – as in a more standardized program – that makes the program effective. Instead, interviewees emphasize the value of navigators deploying funds strategically at key junctures of the search process. Such timely financial assistance included paying rental application fees, paying "holding" fees so families don't lose their units while applications are being processed, clearing up old utility bills or paying for new ones, and providing more generous security deposits for families with a past eviction or poor credit record. For example, Stive, mentioned above, explained:

> She [the CMTO navigator] paid security deposit, I gave her the access to my personal page in the [website] of the home, of this apartment complex. And yes, it was really helpful it was quick, because I was so afraid [of losing the place] when I find it out that I have to make a decision about [taking the apartment], and in the same time I have to pay security deposits and a couple fees [when] I don't have resources.

Out-of-Sample Tests Using Phase 2 Data. Given the relatively small sample of interviews used to identify the mechanisms in Phase 1, one may be concerned about overfitting (i.e., identifying spurious mechanisms by chance). An additional concern is that interview coders must sometimes make subjective judgments when classifying statements. To address these concerns, we use the Phase 2 data to conduct at out-of-sample test of the prevalence of the five mechanisms (which were reported in our working paper before the Phase 2 interview data were collected). The Phase 2 interviews were coded based on the same protocol used to code the Phase 1 interviews (described in Appendix C) but by a different team of reviewers in a blinded manner (i.e., without ex-ante knowledge of treatment group assignment). We first examine the frequency with which the five mechanisms are mentioned by Phase 2 families who received the full CMTO services, as in Phase 1. We find that this independent set of families frequently mentions all five mechanisms, with high prevalence rates similar to those observed in the Phase 1 sample used to identify the mechanisms (Table 5). For example, 68% of Phase 2 families report receiving emotional support and communication, similar to the 61% who report receiving such support in the Phase 1 sample.[41]

41. The one exception to this is the prevalence with which landlord brokering was mentioned in Phase 2, which may be partly driven by the challenges of such brokering during the COVID-19 pandemic.

Second, we find a gradation in the prevalence of these mechanisms across the three treatment arms in Phase 2 that is consistent with their importance in explaining why the full bundled intervention is effective. In particular, families assigned to the incentivized information and reduced services arms identify these mechanisms as helpful features of the CMTO program with much lower frequency than those in the other groups. For example, only 5% of the families in the incentivized information group discussed receiving emotional support and communication when asked about CMTO. Families in the reduced services group discussed the five mechanisms at higher rates on average than those in the information group (e.g., 38% mention receiving emotional support), but at lower rates than the full services group.[42]

What is perhaps most telling from the Phase 2 interviews are discussions with families in the first and second treatment arms about why the version of the program they received did *not* work for them. When asked, "What do you feel like was missing or might have been helpful [in your housing search]?" the features families identify as being lacking often coincided with what the full CMTO intervention provided. For example, Sara, a White mother in Seattle also assigned to the incentivized information arm, responded: "Guidance, support, help with the process. They just throw you out there, give you a bunch of information to begin with, and see if you can swim within the timeframe that you're given." Claire, a Black mother in King County also assigned to the Incentivized Information arm told us, "It would be nice if there was a middle connection between the people who are accepting it [landlords] with the CMTO neighborhoods... Because searching for those area codes and stuff was sometimes hard."

Families in the reduced services arm reported receiving some support and guidance but ultimately feeling overwhelmed being left on their own. Tasha in Shoreline said she would have liked it if the information she received in the "huge packet" was better connected for her: "I did look through all of it... so it would be like one page would have a map and then the other page would have the amount of the number and then the next page would have the properties or something like that. So, I guess there was a lot of flipping back and forth through things to connect it all together." Similarly, Joquin and Jolene, a Black couple, described "searching probably five months... I mean we've dumped between $300 and $500, just in application fees so far... not even to mention the time and gas and everything to do to look." When asked if their CMTO navigator was able to help, Joquin said, "She sent me some like informational things about that and talked about how people

42. The one exception to this pattern is that families mention the motivation to move to high-opportunity areas at equal rates in all three treatment arms. We believe this is because that motivation was instilled partly during the initial briefing about high-opportunity areas that families in all three treatment arms received.

have written letters and this and this... [but landlords] just don't seem to want to budge." They had still not found a unit to lease up when we last spoke to them.

VII.C Customization of Services to Families' Needs

The customization of CMTO services – with nonprofit staff being able to flexibly respond to each family's specific situation and needs – appears to be crucial to its success. Although many families mentioned several of the five mechanisms described above in their interviews, the intensity with which they used each component of the CMTO program varied greatly. This is borne out by data on service utilization from our case management system, which tracked the duration and nature of each of the contacts between CMTO navigators and families.

We report statistics on rates of service utilization in Appendix Table 12a. CMTO treatment group families who moved to a high-opportunity area received 7.1 hours of staff time on average, but there was substantial heterogeneity in the utilization of these services, with an interquartile range of about 4 hours to 9 hours. Similarly, mean financial assistance for treatment group families using financial assistance and leasing up in opportunity areas was $1,992 dollars, with an interquartile range of $967 to $3018. 47% of these families found the unit they moved into through a direct referral to a landlord found by navigators. Different families also used different subsets of these services: for instance, the correlation between the number of hours of staff time used and the amount of financial assistance used is 0.19 (Appendix Table 12d).

Consistent with these data as well as accounts from the navigators themselves (Bigelow 2021), several families reported that the CMTO program was about finding out what families wanted for themselves from the moves rather than following fixed protocols. For instance, Jennifer, a Black mother, noted that the CMTO navigators "understood the situation that I was in" and helped her accordingly.

In contrast, virtually none of the families in the control group mentioned such customized assistance, although several mentioned that they wished they had it. As Christina, a Black mother in Seattle, describes, she wished she had had personalized help during her search:

> Nobody really helps you find an apartment. I found this place [on my own]. I have sent emails back and forth begging to get in here... my application was sitting downstairs approved for like two days while I'm still in cars and outside with my daughter trying to figure it out. [Local non-profit housing provider] ended up paying for the move in fees and stuff like that which was a blessing but I feel like maybe if they could be more personal with their clients that they're accepting and taking on that I feel like that would help with the homeless situation a lot.

In sum, the CMTO program appears to have had large impacts through navigator staff who customized a combination of resources to address each family's specific challenges while also negotiating with landlords who might not otherwise rent to a family with a voucher. In light of the findings on scarcity of bandwidth and initial pessimism about the feasibility of moving to high-opportunity areas in Section VII.A, one way to summarize the program's theory of change is that it provides support to enable highly bandwidth-constrained families to optimize over neighborhood choice and updates their beliefs about the feasibility of moving to high-opportunity areas, ultimately allowing them to realize their inherent preferences for living in such areas (Harvey et al. 2019; DeLuca and Jang 2020).

That the intervention cannot be easily codified into a standardized set of protocols applied to all families, but must be administered through high-quality customized interactions with navigators, seems to underlie its efficacy. The customization of services may also have been beneficial in reducing program costs, as families who did not need certain components of the services (e.g., help with landlords or security deposit assistance) relied less on navigators for those resources. The general lesson may be that having a highly motivated case worker support each family in overcoming the barriers they face can help them make much more effective use of housing assistance programs (and perhaps other public programs).

VIII Implications for Models of Neighborhood Choice

Our findings have several implications for models of neighborhood choice and spatial equilibrium. At the simplest level, our findings are inconsistent with canonical economic models used to describe neighborhood choices in steady state (e.g., Rosen 1979; Roback 1982), in which residential sorting patterns are determined primarily by families' preferences and budget constraints. To rationalize our experimental findings, such models would require that a large mass of families happen to be nearly indifferent between high- and low-opportunity neighborhoods (even when fully informed about these areas), and end up being tipped into high-opportunity areas when they get assistance from the CMTO program (see Appendix F for a model formalizing this argument). But such a distribution of tastes is inconsistent with the evidence that financial incentives to move to high-opportunity areas have small impacts on the share of families who move to such areas, as well as our finding that the marginal families induced to move to high-opportunity areas by the full CMTO intervention report much higher levels of neighborhood satisfaction after moving.

Our experimental results thus imply that even in steady state, many low-income families may be

segregated into higher-poverty, lower-opportunity neighborhoods because of barriers that prevent them from moving to higher-opportunity neighborhoods rather than preferences to live in such areas. This conclusion contrasts with results obtained from structural models of neighborhood choice that do not directly incorporate such barriers, which imply that low-SES families have strong preferences to live in lower-SES areas (e.g., Bayer, Ferreira, and McMillan 2007).

The modern economics literature on neighborhood choice and migration (e.g., Wheaton 1990; Kennan and Walker 2011; Galiani, Murphy, and Pantano 2015) incorporates search frictions and moving costs to explain patterns observed in the data, such as the limited response of households to wage changes across areas. Our findings shed light on the nature of search frictions needed to fit the data. In particular, the search costs needed to rationalize our results must be quite large – large enough to explain why households forego substantial gains for their children from moving to different neighborhoods. They must also be neighborhood-specific (i.e., larger in high-opportunity areas in particular), persistent over time (as opposed to falling to zero in certain time periods, as in a Calvo (1983) style model), and independent of distance moved (since high-opportunity areas no farther from families' original locations than low-opportunity areas). These features differ from common parametrizations of search frictions in economic models of housing choice.

Our finding that the provision of liquidity or financial incentives is not in itself sufficient to induce many families to move to high-opportunity areas suggests that the search costs that families faces in moving to high-opportunity areas are not pure monetary costs. Uncertain or biased beliefs about neighborhood quality are also unlikely to explain why families do not move to high-opportunity areas, as providing information about these areas has modest impacts on families' choices. Instead, the qualitative evidence points to other types of barriers – such as scarcity of mental bandwidth, costs of engaging with landlords, pessimism about the likelihood of succeeding in finding housing in desirable neighborhoods, and the lack of a network of contacts to provide the support and confidence needed to find housing in unfamiliar areas. Developing economic models that explicitly incorporate such factors – which are more common in some sociological models (e.g., Charles 2000; Sampson and Sharkey 2008; Havekes, Bader, and Krysan 2016; Rosen 2020) – may yield a richer understanding of neighborhood choice. Such models would allow researchers and policy makers to go beyond the partial-equilibrium evidence presented here and better understand the impacts of policies like CMTO and other affordable housing initiatives in general equilibrium.[43]

43. These conclusions echo those of Krysan and Crowder (2017) regarding the interaction between preferences and structural barriers and potential policies to break the cycle of segregation. The patterns of choice inertia observed here are also consistent with inertia observed in other domains such as health insurance (Handel 2013; Abaluck and

IX Conclusion

Low-income families tend to live in neighborhoods that offer limited prospects for upward income mobility, amplifying the persistence of poverty across generations. This paper has shown that this pattern of segregation is not simply driven by deep-rooted preferences among tenants or landlords. Rather, many low-income families live in such areas because of housing search barriers that prevent them from moving to higher-opportunity neighborhoods.

The primary barriers families face are not a lack of liquidity or information about high-opportunity areas but rather challenges in the housing search process itself that make it difficult to locate suitable units, negotiate with landlords, and navigate the complexities of leasing up a unit with scarce bandwidth. High-intensity, customized support from housing navigators appears to be adequate to overcome these barriers for many families and results in many families moving to (and staying in) higher-opportunity areas.

The importance of interpersonal support provided by case workers for increasing moves to opportunity is consistent with recent research showing the effectiveness of high-touch support interventions in other settings, ranging from job training programs to outcomes at community colleges (Scrivener et al. 2015; Evans et al. 2020; Katz et al. 2022). Together, these findings call for greater focus on programs that go beyond providing financial resources and offer personalized social support to promote economic mobility.

One challenge with such programs is replicability and scalability: it is unclear whether CMTO-like programs will have similar impacts when implemented in other settings, with a different set of housing navigator staff under different market conditions.[44] The recently established Community Choice Demonstration, which was motivated in part to evaluate the generalizability of the results reported here, promises to shed light on this important issue by replicating CMTO-style mobility programs in nine other cities. In parallel, recognizing that not all families can or wish to move to opportunity, it would also be valuable to identify place-based investments that can improve outcomes for families who remain in lower-opportunity areas.

Adams-Prassl 2021). Insights from choice models in those domains may be applicable to neighborhood choice as well.

44. On one hand, Seattle and King County are tight housing markets in which high-opportunity areas have little affordable housing, which may permit even larger treatment effects elsewhere. On the other hand, Seattle bans source-of-payment discrimination, has housing authorities that achieve higher-than-average lease-up rates even absent CMTO, and offers high payment standards in many neighborhoods – factors that may make it easier for lower-income families to find housing in higher-opportunity areas.

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Online Appendix

A Defining High-Opportunity Areas

This Appendix describes how we define the high-opportunity areas shown in Figure 1b.

Constructing Predictions of Upward Mobility by Census Tract. We begin from a preliminary version of the measures of upward mobility later published in the Opportunity Atlas (at the time the CMTO experiment began, the final Opportunity Atlas estimates had not yet been released). In particular, using data provided in Chetty et al. (2013), we define upward mobility as the average household income rank in 2015 at age 30-35 for children who grew up in the 1980-1985 birth cohorts. To construct these measures, we focus on children who did not move across Census tracts before age 23 during our sample window and assign these children to the childhood Census tracts in which they grew up. For each tract in Seattle and King County, we then regress children's income ranks on their parents' income ranks. Finally, we construct the predicted value from the OLS regression at the 25th percentile, which we denote by $\widehat{y}_t$ in tract t; $\widehat{y}_t$ represents a raw estimate of upward mobility for children who grow up in tract t. Let se_t denote the estimated standard error of $\widehat{y}_t$.

The estimated upward mobility in each tract, $\widehat{y}_t = y_t + e_t$ is the sum of the (latent) true rate of upward mobility in each tract, y_t, and a realization of sampling variation, e_t. Hence, variation in y_t reflects both variation in true upward mobility and random sampling variation: $Var\left(\widehat{y}_t\right) = Var\left(y_t\right) + Var\left(e_t\right)$. To reduce the influence of sampling variation in our definition of opportunity neighborhoods, we construct forecasts of upward mobility in each tract that incorporate additional information, and use these estimates to define high-opportunity neighborhoods.

We form our forecasts using (a) additional observable characteristics of each tract and (b) the point estimate and standard error of the measured upward mobility. To begin, we regress $\widehat{y}_t$ on a vector of tract characteristics, X_t:

$$\widehat{y}_t = \beta X_t + \epsilon_t \tag{2}$$

where X_t consists of the following variables: poverty rates in 2010; average family income at age 22 for children in the 1986-93 cohorts who grew up in families with incomes at the 25th percentile (i.e., upward mobility measured at an earlier age for later non-overlapping cohorts); average college "quality" (the average earnings of the children who attended the college attended by the child in question) for children in the 1986-91 cohorts who grew up in families with incomes at the 25th percentile; mean 4th grade average math and reading test scores for children who received free or reduced-price lunches averaged from 2015 to 2016; and an indicator for whether the tract is within the city of Seattle. We weight the regression by the precision of the raw upward mobility estimates, $1/se_t^2$. Using this estimate $\hat{\beta}$ of β, we form predicted values $\hat{\beta}X_t$. These predicted values provide an unbiased estimate of the true upward mobility given our tract-level observables, X_t.[45]

We can form more informative predictions of y_t by incorporating the residual information contained in $\widehat{y}_t$ after accounting for the covariate-based predictions $\hat{\beta}X_t$. Let $\hat{\epsilon}_t = \widehat{y}_t - \hat{\beta}X_t$ denote the estimated residuals from the regression in equation (2). The ratio of the signal variance in the residual to the total variance in the residual is given by $\hat{\kappa}_t = \frac{var(y_t) - var\left(\hat{\beta}X_t\right)}{var(y_t) - var\left(\hat{\beta}X_t\right) + se_t^2}$ (treating the covariates as known). The numerator is the remaining variation in y_t after accounting for the variance captured by observables, X_t; the denominator includes the extra noise coming from sampling error in the estimate $\widehat{y}_t$, se_t.

45. Mathematically, $E\left[y_t|X_t\right] = E\left[\widehat{y}_t|X_t\right] + E\left[e_t|X_t\right] = \hat{\beta}X_t$. Note that $E\left[e_t|X_t\right] = 0$) because X_t contains information from separate samples than those used to estimate $\widehat{y}_t$.

The best (mean-squared-error-minimizing) linear predictor of upward mobility given, X_t, y_t, and se_t, is given by:

$$y_t^f = \hat{\beta} X_t + \hat{\kappa}_t \epsilon_t^x \tag{3}$$

when constraining the coefficient vector β to be constant across tracts, as discussed in Section VI of Chetty and Hendren (2018b). Intuitively, the forecasts shrink $\widehat{y}_t$ toward the predicted value based on the covariates, with the optimal shrinkage rate depending upon the degree of noise in the estimate of $\widehat{y}_t$. In places with large standard errors, se_t, there is little information in the residuals; but if $\widehat{y}_t$ is estimated with zero error, the estimate of $\widehat{y}_t$ is pure signal and hence the optimal forecast is based purely on $\widehat{y}_t$.

Defining High-Opportunity Areas. Using our predictions of upward mobility, we define opportunity neighborhoods as the set of tracts whose forecasted upward mobility y_t^f falls in approximately the top 20% of tracts in the city of Seattle (for the Seattle Housing Authority) and the top 40% of tracts in King County excluding Seattle (for the King County Housing Authority). We use different thresholds across the jurisdictions because there are more neighborhoods that have high levels of predicted upward mobility outside the city of Seattle than within the city boundaries. We then make adjustments to this initial definition to account for three issues: (1) geographic discontinuities, and (2) the existence of tracts that already have large concentrations of voucher holders, and (3) changes in neighborhoods over time.

For (1), the algorithmic definition of high-opportunity neighborhoods occasionally produces "holes" where a given tract is classified as low-opportunity while those surrounding it are classified as high-opportunity (or vice versa). In collaboration with the housing authorities, we fill these holes and create geographic continuity using qualitative assessments of how people perceived "neighborhoods" on the ground and how sharply upward mobility varied across the areas in question.

For (2), we exclude a few tracts that already had a large concentration of voucher holders, based on the idea that additional services were not necessary to facilitate moves to such areas.

For (3), we begin by evaluating whether the historical measures of upward mobility in the Opportunity Atlas – which are constructed using data for children who grew up in these areas in the 1980s and 1990s – are good predictors of opportunity for children growing up in those areas today. Chetty et al. (2018) examine the serial correlation of upward mobility measures across cohorts. They find that rates of upward mobility are generally quite stable over time and that historical mobility is more predictive of future mobility than typical contemporaneous proxies for opportunity, such as poverty rates.

That said, there are certain parts of Seattle, especially near the center of the city, which have gentrified dramatically in the past ten years and could potentially have very different outcomes today. To evaluate the impacts of this change, we obtain publicly available school-level test-score data for children in each tract for recent cohorts from the state of Washington. We evaluate trends in both average test scores and test scores for children on free and reduced price lunch. Although some rapidly gentrifying neighborhoods (particularly in central Seattle) experienced rapid growth in mean test scores overall, the average test scores conditional on free and reduced price lunch status changed much less. Hence, although neighborhood compositions are changing over time, there is little clear evidence that neighborhood effects on upward mobility of low-income children have changed systematically even in rapidly gentrifying areas. We therefore chose to proceed with our original forecasts, y_t^f, without making any further adjustments to account for neighborhood change.[46]

46. Of course, we note that there is no guarantee that this will be the case in other areas where neighborhoods have changed substantially. The Opportunity Atlas data provide a good starting point for predicting upward mobility

Comparison to Opportunity Atlas. As shown in Appendix Figure 2, our estimates of upward mobility across tracts differ slightly from what is measured in the Opportunity Atlas. This is for two reasons. First, the samples differ slightly between Chetty et al. (2013), which used tax data housed at the IRS, and Chetty et al. (2018), which uses tax and Census data housed at the Census. While both datasets are quite similar, there are differences in the years of tax data available to measure parental income and in the geocoding procedure for assigning taxpayers to locations. Second, we use covariate-based forecasts y_t^f to define opportunity neighborhoods based on tract-level observables as in equation (3).

Appendix Figure 2 compares the preliminary estimates to the final Opportunity Atlas estimates shown in Figure 1a (which were released in October 2018) and shows that they are quite similar in practice, with a correlation of 0.74 across tracts in King County.

B Program Costs

This appendix describes how we estimate the cost of the CMTO program and compares the cost of CMTO to the costs of other housing mobility programs. There are several important contextual factors that may affect how transferable the cost estimates below are to other housing markets and settings. In particular, both the Housing Assistance Payments (HAP) and financial assistance (e.g., security deposits) are in part driven by high housing costs in the Seattle metropolitan area. In contrast to some other mobility programs, we provided no post-move services to families in CMTO. Finally, CMTO services were implemented by a local non-profit who provided services at a regional level across both housing authorities; the availability of similar non-profits in other areas may differ.

B.A Costs of the CMTO Program

In Panel A of Table 4, we estimate the average up-front cost of CMTO services per voucher issued at $2,668. This cost figure sums three components, detailed in Panel B and discussed in further detail below: financial assistance, the cost of program services, and costs associated with administering CMTO incurred by the public housing authorities. When characterizing the services offered to the CMTO treatment group, we find the per-issuance cost to be the most natural measure of the cost of the program as it reflects the actual outlay of funds for each family and is not driven by outcomes that may be affected by the experiment itself (e.g., lease-up rates). However, when estimating total expenditures for a projected number of lease-ups (and when comparing to other interventions that report only this metric), practitioners may find it useful to consider the per leased-up voucher cost, which divides average cost per issuance by the lease-up rate. For the CMTO treatment group, the lease-up rate was 87%, resulting in a per-lease cost of CMTO of $3,056. A third cost metric that may be useful is the average cost per move to a high-opportunity neighborhood. We calculate this cost measure by inflating cost-per-lease-up by the fraction of leased-up households who moved to a high-opportunity neighborhood.[47] In CMTO, 61% of treatment-group families who leased up moved to a high-opportunity area, resulting in a cost per opportunity move of $4,997.

To put these costs into context, we calculate the average lifetime housing assistance payment (HAP) expenditure for an average control-group family ($1,431/month) over seven years (a typical

(which is inherently unobservable) for the current generation of children but should ideally be complemented with more recent data and qualitative judgment on a case-by-case basis to settle on final definitions of opportunity neighborhoods.

47. Note that this approach does not use average costs conditional on moving to an opportunity neighborhood because some service costs are incurred for all families issued vouchers, regardless of whether they ultimately move to opportunity.

voucher duration for families with children at KCHA and SHA historically). The up-front CMTO program cost of $3,056 per lease is 2.5% of this seven-year HAP cost per lease.

Panel B of Table 4 reports mean costs for each of the three components that are reflected in the total cost estimates discussed above. In what follows, we explain how each of these estimates are constructed.

Financial Assistance Costs. Using the case-management database described in Section IV.A, we estimate an average financial assistance payment of $1,057 (across all treatment group households issued vouchers). The standard deviation is $1,254 and the maximum payment is $4,639. These expenses include security deposits (average $815/voucher issued), pro-rated rent ($72/voucher), renter's insurance ($40/voucher), screening fees ($46/voucher), administrative fees ($44/voucher), holding fees ($23/voucher), damage mitigation insurance claims ($9/voucher), and a miscellaneous category of expenses ($8/voucher). As some of the financial assistance components are contingent on leasing up in an opportunity area, costs for the average family leasing up in an opportunity area are significantly higher (approximately $1,908).

The housing authorities provide some security deposit assistance to all families issued vouchers, even those in the control group. To account for control-group security deposit usage, we estimate the fraction of the control group that uses security deposit assistance by PHA (76% for KCHA and 9% for SHA) along with the average security deposit expense by PHA. We estimate that the PHAs spend an average of $281 more on security-deposit assistance per voucher issued to control group families than treatment group families – a cost that would have been paid even in the absence of the CMTO program. Therefore, when calculating the incremental CMTO program costs, we subtract $281 from the mean gross financial assistance of $1,057.

Program Service Costs. We estimate program services costs per issuance to be $1,500. We arrive at this estimate by calculating the (fixed) annual cost to administer the program and dividing by the number of vouchers we estimate to be a feasible annual load for that staffing level (264). We estimate the feasible annual load based on the PHAs' estimation that the program staff were operating at steady-state peak capacity from September to November 2018. Their workload during these months reflected an average of 22 issuances per month in the months prior, leading to an annual load of 264 issuances per year. The fixed program costs include salary and benefits for four full-time staffers, half of one full-time manager, and one full-time administrative assistant, as well as various costs incurred by the program contractors: mileage and training costs ($2,000/month), materials and supplies ($1,000/month), overhead such as utilities ($2,500/month), interpreter costs ($600/month), and other miscellaneous costs ($1,000/month) including cell phones, postage, and insurance. The total annual fixed cost is $396,092, which we divide by 264 families to arrive at a per-family cost of $1,500.[48]

PHA Administrative Costs. We estimate the marginal costs for administration of the CMTO program per issuance to be $392. This category consists of salary and benefits for two PHA project managers spending 50% of their time managing CMTO service implementation divided by 264 annual voucher issuances. Although many other PHA staff worked on CMTO (including an estimated 5% of a senior manager's time), we follow standard capital budgeting practices by not including their time as a CMTO cost because these PHA labor costs would likely have been incurred by the PHAs anyway even without the CMTO project. We exclude start-up costs (PHA staff development time, piloting, grant writing time, etc.) from PHA administration costs to estimate the cost of administering a similar program going forward.

48. Some of the staff time was spent on research-specific asks, such as entering data into the MIS system. We have been conservative and included this time in our cost estimates, noting that a similar program without a research component would probably still have an administrative burden and possibly face other costs the staff did not happen to incur, such as paid family leave, etc.

Incremental Housing Voucher Costs. Since SHA and KCHA offer families tiered payment standards based on neighborhood rental costs and many high-opportunity areas fall in higher tiers, the CMTO program increases the annual voucher payments made by the housing authorities by inducing more families to move to high-opportunity areas. In Panel C of Table 4, we estimate this incremental cost as the difference between average treatment-group HAP expenditures ($1,641/month) and average control-group HAP expenditures ($1,431/month) among households who leased up. This results in a monthly difference of $210 additional HAP expenditure on the treatment group over that of the control group ($2,519/year). Including the up-front CMTO program cost per lease ($3,056) and this additional HAP expenditure ($17,633) over the average voucher duration (7 years) results in a total incremental cost per lease of 17.2% of the seven-year HAP cost.

Phase 2 Treatment Costs. Panel D of Table 4 reports the average up-front cost of each of the Phase 2 treatment arms. These numbers are analogous to the $2,668 cost of CMTO services per issuance reported in the first row of Panel A and are calculated the same way, summing the financial costs, the program service costs, and the PHA administrative costs. For the incentivized information (T1) arm, these costs were on average $235 in financial assistance, $253 for program service costs, and $217 in PHA administrative costs. For the reduced services (T2) arm, the costs were $208 in financial assistance, $538 for program service costs, and $255 in PHA administrative costs. For the full services (T3) arm, the costs were $1,067 in financial assistance, $1,645 for program service costs, and $348 in PHA administrative costs.[49]

B.B Comparison with Costs of Other Mobility Programs

Appendix Table 1 compares the cost of the CMTO program with the costs of other mobility programs. Overall, the cost of the CMTO program is similar to that of other mobility programs (many of which either required moves to high-opportunity neighborhoods or had much smaller impacts on the fraction of families moving to opportunity). Below, we provide details on our sources of these estimates.

Feins, McInnis, and Popkin (1997) estimate the average cost of the counseling provided to the original MTO experimental group per opportunity move to be $3,077. Assuming their estimates are in 1997 dollars, adjusting for inflation with the CPI implies an MTO program cost of $4,814 in 2018 dollars. Cunningham and Popkin (2002) evaluate the Housing Opportunity Program (HOP), a mobility program funded by the Chicago Public Housing Authority. While Cunningham and Popkin (2002) do not provide cost estimates, Schwartz, Mihaly, and Gala (2017) report a nominal cost per opportunity move for HOP of $3,528 ($4,925 in 2018 dollars, assuming the original estimates are in 2002 dollars).

Rinzler et al. (2015) use cost data from the Baltimore Housing Mobility Program (BHMP) to model costs per opportunity move for a hypothetical housing mobility pay-for-success program of $3,235 in 2015 dollars ($3,427 in 2018 dollars). Program costs as defined in their model consist of mobility program services, including counseling, housing search assistance, and landlord engagement. BHMP resulted from a court order desegregating Baltimore public housing and has several programmatic differences from CMTO, such as not offering financial assistance but offering post-move support and requiring families to move to an opportunity neighborhood. Administrative costs for administering the HCV program are not included in cost estimates. Costs estimates are calcu-

49. The financial benefits available to families differed depending on the treatment arm. T1 and T2 families were not eligible to receive pro-rated rent or renter's insurance, and T1 families were not eligible for damage mitigation insurance. The change in use of security deposits of $281 (Panel B) is assumed to be the same in Phase 2 as in Phase 1 since we do not have data from the housing authorities on these services for Phase 2. As such, we subtract $281 from the mean gross financial assistance cost for each treatment arm.

lated as BHMP's total expenditure divided by their total number of lease-ups. One complication in comparing this estimate to CMTO's cost per lease-up is that differences in cost per lease could be driven by differences in lease-up rates.

Schwartz, Mihaly, and Gala (2017) evaluate a mobility program by the Chicago Regional Housing Choice Initiative intended to provide light-touch counseling (and no financial assistance) using a randomized controlled trial. In 2017 dollars, they estimate a counseling cost per opportunity move of $2,869 ($2,939 in 2018 dollars).

Sard, Cunningham, and Greenstein (2018) propose a hypothetical HCV program that would include mobility services and a home-visiting program. The mobility services would include housing search assistance, credit repair, opportunity area education, and landlord-tenant mediation. They estimate a cost of $4,500 per issuance for such a program.

C Qualitative Study: Methods

This appendix provides further information on the methods used in the qualitative study.

Sample Definition. To create the sample for the Phase 1 qualitative interviews, we stratified by housing authority (SHA, KCHA), treatment status (treatment, control), and lease-up status (leased up, still searching as of March 2019). If the participant had not yet received a voucher or received a voucher but was still searching for housing, we categorized them as "still searching." We then randomly selected participants from each stratum. Appendix Table 2 shows the number and percentage of participants we selected from each category.

The sampling frame heavily weighted treatment group participants and participants who were still searching for housing to ensure that we would be able to collect data about the housing search process. In all, we sampled 149 treatment households (67% of the treatment group) and 53 control households (26% of the control group). Of these targeted families, 80% responded and were successfully interviewed.

The Phase 2 qualitative sample was created by stratifying treatment group participants by housing authority and treatment arm, and then randomly selecting families from the incentivized information arm and the reduced support services arm (to compare with Phase 1 full services arm and the control group). We then added a supplemental oversample of all Black households in all three arms. Further, there were two Phase 2 families whom we interviewed but who did not complete the baseline survey, so we exculded them from the main Phase 2 analyses. Because recruitment was delayed by restrictions on research activities during the first year of the COVID-19 pandemic, we did not attempt to sample by search and lease-up status in Phase 2.

Recruitment. The qualitative research team was led by Stefanie DeLuca and comprised eight graduate students and 28 undergraduate students from Johns Hopkins University. Many of the students had previous qualitative research experience, and several had experience working on housing mobility programs specifically. Eight graduate students from the University of Washington were also hired to help with data collection. We also employed a local research firm, MEF Associates, to assist with ongoing data collection. In all, 50 people conducted interviews.

The majority of interview respondents were recruited through phone calls, although some responded to recruitment letters we sent through mail and email. Once we made contact, most people (91% in Phase 1 and 83.5% in Phase 2) agreed to an interview immediately or agreed to schedule one at a more convenient time. We achieved an 80% response rate in Phase 1, and 70% in Phase 2. The biggest barriers to recruitment were disconnected phone numbers and incorrect addresses, reflecting the financial and housing precarity of program participants. In Phase 1 we were able to recruit onsite by doorknocking, but in Phase 2 all in-person research was suspended,

which explained some of the lower response rate during that data collection period.

Our sample included some families with limited English proficiency, reflecting the diversity of program participants. To address language barriers, families chose one of three translation options to complete an interview, whichever they felt most comfortable with: a neighbor, friend, or family member; a third-party in-person language interpretation service; or a third-party phone interpretation service.

Most interviews were conducted in respondents' homes. If the respondent was not comfortable meeting with our interviewers at home, interviews were conducted at other locations they chose, such as local libraries or McDonald's restaurants. All Phase 2 interviews were conducted by Zoom or by phone. The semi-structured interviews lasted anywhere between one and four hours, with most interviews lasting approximately two hours. Respondents were asked about their personal life – residential history, children's schools, employment and education history, and health – as well as their experiences working with the PHAs and (if in the treatment group) the CMTO program. All interviews were recorded and transcribed. The respondents were paid $50 for their time.

Narrative Interviewing. Our methods are derived in part from a long tradition in the social sciences, especially the work of urban sociologists who developed methods of observing social life and the ways individuals make meaning of their everyday routines (Anderson 1990; Becker et al. 1961; Burawoy 1979; Edin and Lein 1997; Liebow 1967). Specifically, we used narrative interviewing techniques, a semi-structured approach to interviewing that uses open-ended questions to allow a wide range of responses to emerge, with targeted follow-up questions to ensure all interviews covered the same material (see DeLuca, Clampet-Lundquist, and Edin (2016) and Boyd and DeLuca (2017) for more on this method). These interviews create a natural, in-depth conversation, rather than a clinical series of questions and short answers.

Interviews are conducted without copies of the interview guide visible. Interviewers instead memorize a detailed interview protocol (with a shorthand notecard nearby for review of interview topics if needed), and the interviews are recorded. This allows the interviewers to focus on the respondent, making eye contact and not causing distraction by flipping through paper and writing notes. The approach communicates to respondents that we are focused entirely on hearing their story and perspective, rather than on simply going through a list of specific questions by rote. Previous work has shown that more detailed stories and unexpected answers are more likely to emerge from this approach, especially issues unanticipated by the researchers (Becker 1998) (in sharp contrast to forced choice response survey questions).

We start our interviews with a broad question: "Tell me the story of your life." This gives the respondents the sense that we are interested in the whole story of who they are. Further, the opening directive signals to them that we want them to talk—a lot—and that this is not a survey. Rather than merely documenting the events of our research participants' lives, the interviewing approach provides a setting in which respondents reveal how they see things, what they feel is important, how they make decisions, how they have made sense of their past and imagine their future. Respondents can then answer in their own words, without worrying about giving a "wrong" answer or saying too much. The protocol not only enriches the study findings by allowing for a broad range of answers, but it also reduces stress and the chances that respondents will feel coerced to say particular things.

In-depth interviewing can be especially effective for creating rapport and developing trust for stigmatized groups, such as low-income families receiving housing vouchers. By conducting interviews with empathy and non-leading, non-judgmental questions, respondents are often put at ease, and may feel less scrutinized. If respondents have some control over the way they can answer questions, and feel that the interviewer is truly interested in them and lets them speak at length, they may feel comfortable to open up more candidly.

Coding Protocols. The research team used themes from previous research, fieldnotes, and transcripts of the interviews to create a codebook that was used to quantify the prevalence of the five mechanisms discussed in the text. Descriptions of the codes for the five mechanisms are as follows:

Mechanism 1: Communication and Emotional Support. This code covers the experiences that treatment respondents have with the CMTO staff that foster a sense of psychological or emotional support, often as a result of what they describe as frequent and encouraging communication and check-ins from the staff. These communications foster a sense that the staff are accessible, responsive and able to help when and how respondents need to be helped so that they can find housing. This code also describes instances in which families report that the services CMTO provided for them gave them a sense of emotional support, "boost" of confidence, happiness, relief, reduced stress (the last component overlaps at times with Mechanisms 3-5). Segments include instances when families tell us that they feel like someone has "your back," that they aren't doing this alone, that someone can vouch for them, and that their housing search and lease-up process would not have been possible without the CMTO staff's help. Some of this includes reports that CMTO staff had catered to families' individual needs, and that CMTO staff asked them what they "wanted" what "their vision" was for their family. For some respondents, this includes the process of creating a rental resume to feel confident and better positioned to communicate with landlords, and for others this includes mentions of how well the CMTO staff explained everything so that they could understand the process and feel capable of searching in opportunity areas. In sum, this code reflects the work that CMTO staff do that keeps families feeling optimistic about their chances of leasing up, and prevents families from dropping out of the CMTO program when things get difficult or take longer than expected.

Mechanism 2: Opportunity Area Motivation. This code covers specific language that respondents use to describe their personal desire to move to and live in an opportunity area and excitement about the fact that the CMTO program is focused on making such moves possible. This code is more specific than just mentions of opportunity areas and includes respondents' discussing the benefits of living in an opportunity area as an important part of their residential decision-making and housing search processes. These discussions were also sometimes tied to an increased confidence about the feasibility of moving to an opportunity area through CMTO.

Mechanism 3: Streamlining. This code covers any discussion of how the CMTO navigators streamlined the search process for respondents to make finding a home with the voucher easier, especially at difficult points in the housing search and lease-up process. This code may include segments on how respondents had very little bandwidth to do the kind of housing search they would have liked and that CMTO made doing this search possible. In these cases, not having enough bandwidth means that because there are so many things to attend to and not enough time, money or support, it is very difficult to focus on the housing search, applications and other paperwork, or contacting landlords (because parents are searching for work, juggling child care, going to work, coping with health problems, transportation issues, etc.). This code includes concrete actions that CMTO navigators took that simplified/reduced the overwhelming aspects of the process of getting housing and can include housing unit referrals, neighborhood tours, and discussion of advice/guidance that CMTO navigators provided on how to search for housing (that then actually made their searches more effective). This code also includes discussions of how CMTO navigators accelerated the process for landlords as well by expediting inspections, filling out paperwork, calling landlords for unit visits, signing onto the tenant portal for an apartment complex on behalf of a tenant. This code might include respondents expressing sentiments such as: "I just handed it over to them after I said yes/landlord said yes and they did everything else!" (This code can overlap with Mechanisms #4 and #5).

Mechanism 4: Landlord Brokering. This code covers respondents' reports of CMTO navigators

serving as a broker between them and landlords/property managers during the housing search, application, or lease-up process. Examples of this include CMTO navigators communicating directly with landlords and other institutional representatives and/or customizing the financial assistance for each family's circumstances based specifically on their communication with landlords to get them moved in (examples include utility bills, rental insurance, bigger security deposits for those with eviction/credit issues, holding fees, etc.) It also includes CMTO navigators talking on behalf of respondents to landlords during a point in the process that can sometimes be demoralizing and/or a point of exit for landlords (when landlords waver about renting to a family with a history of poor credit). Families might mention that the navigators "vouched" for them or served as actual references. This code also includes people talking about finding their own units, but then CMTO navigators stepping in and taking care of the next steps to make it happen on the landlord or property managers' side (some of this overlaps with Mechanism #3, to the extent that activities that streamline also make landlords happier and more likely to agree to rent the unit to the CMTO family).

Mechanism 5: Short-Term Financial Assistance. This code covers any description of the financial assistance given by CMTO navigators that helps respondents move into their units. This assistance may be used for security deposits, application/holding fees, moving costs, previous rent balances, or renter's insurance. The code includes not only what the financial assistance was used for, but also when, and why it worked in that instance (likely to overlap with Mechanisms #3 and #4), to indicate how it was strategically deployed by CMTO navigators.

A team of coders then used this codebook to identify the prevalence of the five themes described above in individual interviews with treatment group families who had moved to high-opportunity areas. For Phase 1 coding, this team consisted of 13 members, 9 from Johns Hopkins University who did the initial coding and 4 from the University of Washington who also coded the same interviews so that we could estimate inter-coder reliability. For Phase 2 coding, the team consisted of 7 students from Johns Hopkins University. Due to the smaller team, a randomly selected half of these transcripts were coded twice (by different coders on the team) for a reliability check. Across all qualitative interviews in both phase, incidents of discrepancy between the coders' judgments – which occurred in fewer than 25% of the cases – resulted in another review of the transcript and consultation with DeLuca to make a determination as to whether a mechanism or mechanisms were indeed present or absent for particular respondents and/or whether the code definitions themselves needed to be clarified or refined.

Ethnographic Observations. Although we focus in Section VII on information obtained directly from our family interviews, our fieldwork also included other elements of observation that support our conclusions. Every time we interviewed families, we spent hours in their homes, talking to other household members and friends as they came and went, playing with children, meeting neighbors, and watching neighborhood activities. During recruiting, we drove repeatedly up and down neighborhood streets, knocking on doors, and eating at local fast-food places during breaks. We gave people rides so that they could run errands, dropped people off at social service agencies so they could apply for utility assistance, and we took them to lunch or dinner, sometimes with other family members. In other words, the interviews are part of a larger set of fieldwork practices, and we took detailed notes on all of those as well.

Researchers digitally recorded initial impressions of the interviews immediately after the interviews occurred and wrote fieldnotes for each interview. Fieldnotes describe everything that happened during an interview visit, including: the setting (usually the housing unit and neighborhood blocks surrounding the house); what participants were like (e.g., attire, demeanor); interactions with other family members; any other information that was not recorded (warm-up and exiting conversations); and conversations that took place over the course of the interview itself. The post-

interview fieldnotes also provide a summary of the interview, with a focus on central research questions.

The formulation of the five mechanisms discussed in Section VII were also informed by the following ethnographic data from Phase 1: three in-person observations of families with CMTO staff at their initial one on one meetings; attendance at two CMTO navigator meetings; four informational meetings with all of the CMTO family and housing search assistance team members (two by phone and two in person); four in-person meetings with CMTO study intake staff at both SHA and KCHA; one informational meeting with staff from the KCHA voucher program; and over two years of weekly phone meetings with PHA and CMTO research partners, MDRC implementation researchers, and J-PAL staff.

D Qualitative Evidence on Landlord Responses to CMTO

This appendix provides further details on how the CMTO program impacted the supply-side actors in the housing market, including landlords and property managers.

We attempted to interview a sample of landlords from December 2020 through February 2022, but it became difficult to get enough responses to our recruitment letters and phone calls to constitute a representative sample of landlords who did vs. did not participate in the CMTO program. We ultimately completed a total of ten landlord interviews. To characterize landlord responses to CMTO, we therefore drew on our these ten landlord interviews, a small number of landlord interviews conducted by MDRC during Phase 1, navigator interviews, and DeLuca's attendance at weekly meetings with MDRC and the PHAs throughout the implementation of both Phase 1 and Phase 2.

Landlords appear to have participated in the CMTO program because, like families, they appreciated the one on one assistance that they received from the navigators (which was sometimes also customized to their specific needs, like occupancy rates and timing of unit availability), reducing the administrative burdens they typically perceived as arduous when participating in the HCV program and working with PHAs (see also Cossyleon, Garboden, and DeLuca 2020; Garboden et al. 2018; Aranda et al. 2018). Navigators expedited the HCV leasing process through increased communication with landlords, quickly processing paperwork, and conducting housing quality inspections. The ability of the navigators to personally conduct inspections and hasten unit turnover was particularly appealing for landlords, who typically, while waiting for the HCV inspection, were at risk of losing revenue. In some cases, navigators pre-inspected units and informed the landlord in advance about what minor fixes were likely needed for the unit to pass the housing quality inspection. These pre-inspections also meant that navigators could refer families to such HCV-eligible units, and see if they were interested, before connecting them to the landlord, so that all sides felt that their needs were met and could proceed with leasing up.

While some of the housing units CMTO families moved into were owned by small to medium sized private owners, many other properties were owned by larger companies, who outsourced the day to day operations to property management staff. Navigators built sustained relationships with property management staff (alongside their regular communication with private landlords) through effective communication and active engagement. This communication encouraged initially reluctant property managers to eventually participate, and, over time, let navigators know when units became available in their developments.

Navigators reported that some of the hesitation they encountered from landlords and property managers was related to concerns about poor communication – that they "don't know who to talk to" once they lease a voucher holder. In contrast, CMTO was attractive to them because navigators

made themselves available to landlords for regular contact, responding quickly to their questions and directing them to the correct contacts at the PHAs to complete necessary paperwork. Even after a housing application was submitted, landlords sometimes contacted the navigators to seek updated information about when families might decide to rent their unit. On occasion, navigators went a step further to make personal connections to the landlords, trying to understand their requirements and payment preferences. Overall, navigators remarked that face-to-face conversations with landlords and property management staff during inspections were important for maintaining their connections.

When families struggled to find landlords to accept them because of poor credit history or eviction records, navigators stepped in to interact directly with landlords on behalf of their clients as brokers and advocates, explaining a client's background and vouching for their reputation. At the same time, the navigators educated landlords about the mission of CMTO and their role as a liaison between landlords and the PHA. While many landlords were enthusiastic about working with CMTO, navigators encountered some landlords who were initially against accepting housing vouchers. The navigators informed these landlords that discriminating against voucher recipients was against the law. Through persistent education, the navigators were able to convince some of these landlords to be more open-minded to CMTO's services and eventually accept some of their clients. One of the PHAs also employed landlord liaisons on staff to educate property owners about the source-of-income discrimination (SOI) law in the state of Washington. Some of the recruitment effort was dedicated to educating landlords not only about the SOI but also the benefits of the voucher program, since many were unfamiliar with housing assistance programs. For example, they emphasized that owners did not have to "chase" families for rent, because the program paid landlords directly each month, and they also mentioned the damage guaranty fund to compensate landlords in the (rare) event that their units were damaged by a CMTO renter.

Recruiting Landlords and Streamlining the Search Process. Our conversations with navigators also shed further light on the methods that were effective in connecting prospective tenants to landlords to begin with. Navigators used a number of strategies to recruit property owners. First, they used online rental housing websites like HotPads and Zillow to find available listings in opportunity areas and encouraged their clients to identify potential units and landlords. Second, they relied on already participating landlords and managed properties developments and periodically followed up to see whether they had any new vacancies or listings. With landlords who already expressed interest or had connections with navigators, they would sometimes set up potential matches, letting landlords know ahead of time which clients they would send their unit referral to. Third, navigators waited for clients to identify units they were interested in pursuing and then contacted the landlord to pitch CMTO. They emphasized the importance of letting their clients market themselves (with their rental resumes and landlord scripts the navigators helped them prepare) before they talked to the landlord. Fourth, some advertising through fliers and some initial meetings at area real estate groups was also attempted early on in the program implementation. Finally, some landlords reached out directly to the CMTO office to see if they could work with CMTO clients based on word of mouth.

The navigators also reported that marketability coaching was a crucial step in preparing CMTO families for a successful housing search, helping them learn how to advocate for themselves when inquiring about rental units, especially during conversations when landlords brought up concerns about some of their housing histories, including poor credit or evictions. Navigators also reported that it was important for families to build their skills by talking directly about their stories and goals with landlords, to make a better connection and impression, especially in the face of their housing histories and other barriers. Navigators mentioned that it was sometimes difficult to match voucher holders to a home because they had to negotiate the rent in order to make it more affordable;

in these situations, any connections that the family made with the landlord went a long way in facilitating the lease-up process.

E Effects of Changes in Voucher Payment Standards: Quasi-Experimental Evidence

In this appendix, we analyze the impacts of reforms implemented in Seattle and King County that increased voucher payment standards in high-rent, high-opportunity neighborhoods (commonly termed Small Area Fair Market Rents) on the share of families who move to high-opportunity areas. The first reform, implemented by KCHA in March 2016, increased payment standards in selected neighborhoods that had higher rents and scored higher in Kirwan indices of opportunity. The second, implemented by SHA in April 2018, effectively increased payment standards in exactly the same areas that we designated as "high opportunity" in CMTO. We analyze the impacts of these reforms using difference-in-difference designs, as in Collinson and Ganong (2018).

KCHA Increase in Payment Standards in High-Rent Areas. King County moved from a two-tier to a five-tier payment standard system in March 2016. The reform increased voucher payments in areas with higher rents. Appendix Figure 8 shows the resulting changes in payment standards across King County, which ranged from reductions of $220 per month in a few neighborhoods up to increases of $595 in the most expensive areas.

We use the PHAs' historical administrative data to analyze how the neighborhood location choices of families in KCHA changed around the reform relative to families in SHA. SHA did not enact any changes in its policies at the same time and hence serves as a natural counterfactual.

Appendix Figure 9a plots the fraction of families who move to high-opportunity areas (as defined based on our CMTO designation in Section III.B) by the month in which families were issued their vouchers. To reduce noise, we group months into pairs of two in this and subsequent figures. The fraction of families who leased up in high-opportunity areas fluctuates around 20% both before and after the reform, which is marked by the dashed vertical line. In particular, there is no evidence of an increase in the rate of moves to high-opportunity neighborhoods in KCHA (the "treatment" group for the purposes of this quasi-experiment) relative to SHA (the "control" group).

Under the identification assumption that trends in KCHA and SHA would have remained similar absent the reform, we can estimate the causal effect of the KCHA payment standard reform on the rate of moves to high-opportunity areas using a standard difference-in-difference regression specification. We compare the rate of moves to high-opportunity areas in KCHA and SHA in the eight months before vs. after the policy change by running OLS regressions of the form:

$$y_i = \alpha + \beta_1 KCHA_i + \beta_2 Post_i + \beta_3 KCHA_i \times Post_i + \varepsilon_i, \tag{4}$$

where y_i is an indicator for moving to a high-opportunity neighborhood, $KCHA_i$ is an indicator for receiving a voucher from KCHA (rather than SHA), and $Post_i$ is an indicator for being issued a voucher in or after March 2016. We estimate that the causal effect of the reform on the rate of moves to high-opportunity areas is a statistically insignificant β_3 =-3.6% (s.e. = 5.8), as shown in Column 1 of Appendix Table 13. Controlling for family size and other covariates does not affect this estimate significantly (Column 2).[50] Hence, the KCHA reform increased the rate of opportunity moves by at most 7.7 pp at the top of the 95% confidence interval – substantially smaller than the CMTO treatment effect of 37.8%, shown by the dashed line in Appendix Figure 9a as a reference.

50. Analogous DD specifications using median rents as the dependent variable suggest that the SAFMR reform induced families to move to more expensive areas (Columns 3 and 4 of Appendix Table 13), consistent with Collinson and Ganong (2018), although the estimates are somewhat imprecise and hence not statistically significant.

Indeed, only 17.5% of KCHA families with children moved to high-opportunity areas in the eight months after the payment standard increase, far below the 53.2% rate achieved through the CMTO program in King County.

Our analysis of the KCHA reform shows that raising payment standards in more expensive neighborhoods – as is typically done in SAFMR policies – does not necessarily induce families to move to higher-opportunity areas.[51] One interpretation of this result is that financial incentives have smaller impacts on neighborhood choice than the customized services offered through CMTO. An alternative interpretation is that incentivizing families to move to more expensive neighborhoods does not induce moves to opportunity because rents are not very highly correlated with upward mobility in King County (Figure 1b). To distinguish between these explanations, we now turn to a second quasi-experiment.

SHA Increase in Payment Standards in High-Opportunity Areas. In March 2018, SHA introduced a Family Access Supplement (FAS) that effectively increased payment standards in areas that were designated as "high opportunity" in the CMTO study. If a family moved to an opportunity area and the unit rent exceeded the voucher payment standard by an amount that would cause the household to pay more than 40% of their income, the FAS paid for the unit's rent minus 40% of the family's income (subject to a maximum, which was $400 for 2 bedroom units). For families who moved to an opportunity area, this additional rental support amounted to $144 per month on average.

The FAS was initiated at the same time as a pilot phase of the CMTO intervention prior to the CMTO experiment. It continued throughout the pilot and the experiment, effectively providing families in the control group higher payments to move to high-opportunity areas than they would have received had they gotten their vouchers before March 2018. The FAS was restricted to families with at least one child under 18. We therefore estimate the impact of the FAS by comparing families with children to families without children in SHA.[52]

Appendix Figure 9b plots the fraction of families moving to high-opportunity areas before and after the introduction of the FAS (shown by the dashed line) for households with vs. without children. During the CMTO pilot phase (shown in the shaded region), all families with children received CMTO services. The fraction of families moving to high-opportunity areas trended similarly prior to the CMTO pilot and the FAS payment standard reform. During the pilot, the rate of moves to opportunity for those with children spiked up to 80%, while the rate of such moves for the those without children (who were untreated) remained steady. After the pilot, the rate of opportunity moves (based on data for the CMTO control group) fell precipitously for families with children.

Under the identification assumption that the rate of opportunity moves for families with vs. without children would have remained similar after March 2018 in the absence of the FAS, we can

51. In contrast with this finding, Collinson and Ganong (2018) find that SAFMRs induced moves to higher-quality neighborhoods in Dallas, where quality is defined as an index of tract-level poverty rate, test scores, unemployment rate, the share of children with single mothers, and the violent crime rate. By contrast, we find that SAFMRs in King County had no impact on either an index of neighborhood quality similar to that used by Collinson and Ganong or the Opportunity Atlas measures of upward mobility. One explanation for the different results is that the correlation between rents and upward mobility is 0.56 in Dallas, significantly higher than the 0.18 correlation in King County. The tighter link between rents and opportunity in Dallas might increase the impacts of SAFMRs on opportunity moves there. That said, Collinson and Ganong kindly replicated their analysis using the Opportunity Atlas measure of upward mobility and found an impact on the mean predicted rank of children with parents at the 25th percentile of 0.86 percentiles. Although this is a significant gain, it is still considerably smaller than the impact of CMTO, supporting the view that financial incentives have much smaller effects than customized mobility services.

52. We do not use KCHA as a counterfactual here because KCHA itself was implementing its CMTO pilot at the same time that SHA introduced the FAS.

infer that the SHA reform caused a small increase in the rate of moves to high-opportunity areas. Using a standard difference-in-differences specification comparing the rate of high-opportunity moves among families with vs. without children in SHA in the six months before March 2018 vs. the six months after May 2018 (after the CMTO pilot ended, using only families in the CMTO control), we estimate that the FAS increased the rate of opportunity moves by 13.8 pp (s.e. = 5.1), as shown in Column 5 of Appendix Table 13. This is about one-third the size of the Phase 1 CMTO treatment effect.[53]

F Frictionless Model of Neighborhood Choice

In this appendix, we formalize why a canonical frictionless model of the housing market in which all households are fully informed, live in the neighborhoods that maximize their utilities, and could purchase the services offered by CMTO in the market is inconsistent with our experimental findings. We first discuss the intuition underlying our argument using a simple graphical approach and then present formal algebraic derivations.

In Appendix Figure 12, the x-axis plots a family's net willingness to pay (WTP) for a *non-opportunity* neighborhood. The WTP is the indirect utility of moving to a non-opportunity neighborhood minus the indirect utility of moving to an opportunity neighborhood, taking into account rental costs as well as the baseline subsidies provided by the HCV program. Larger values on the x-axis correspond to stronger preferences for non-opportunity neighborhoods (e.g., because of other amenities or proximity to family).

What is the distribution of WTP to move to a non-opportunity area in the population of CMTO participants? Given that 17.8% of the control group that leased up moved to an opportunity neighborhood (Figure 3c), a frictionless model in which we can directly infer preferences from choices would imply that only 17.8% of families leasing up with vouchers prefer living in opportunity neighborhoods. This value is depicted by the open circle on the figure, where the y-axis shows the fraction of families with WTP below a given level x (i.e., the CDF of the WTP distribution).

If the services provided by CMTO could be purchased in the market at marginal cost, they would be valued at most at \$2,670 – the estimated marginal cost of the full CMTO program.[54] Hence, the fact that 61% of families who lease up in the treatment group move to high-opportunity areas would imply that 61% of households prefer living in opportunity neighborhoods when provided the equivalent of a \$2,670 subsidy to move to such areas. Put differently, 61% of families have a WTP for low-opportunity areas below \$2,670 – i.e., most families do not have a strong distaste for high-opportunity areas. This value is depicted by the solid circle in Appendix Figure 12.

Connecting these two points, as shown by the solid portion of CDF plotted in Appendix Figure 12, a frictionless model would imply that 43.2% of families who apply for housing vouchers have a WTP for low-opportunity areas between \$0 and \$2,670. That is, the only way to rationalize our findings in a model where fully-informed families live in their preferred neighborhoods is that a large group of families happen to be close to indifferent between high- and low-opportunity areas and thus are swayed by the relatively low-cost CMTO intervention.

53. Although small area fair market rents have smaller effects on the share of families who move to high-opportunity areas, they may have other benefits; for instance, they may reduce voucher program costs in less-expensive neighborhoods (Collinson and Ganong 2018).

54. Some of the average \$2,670 in CMTO services were available to treatment-group families even if they did not lease up in a high-opportunity neighborhood (e.g., family and housing navigator advice and training). This implies that the relevant cost of the marginal services provided to families that moved to a high-opportunity neighborhood is actually less than \$2,670. In practice, however, families who did not lease up in a high-opportunity neighborhood used CMTO services much less intensively; we therefore take the more conservative approach of using the \$2,670 figure.

This explanation, however, runs counter to two other sets of experimental results documented above. First, the second phase experiment shows that simply providing financial incentives to high-opportunity areas has a small, statistically insignificant effect on the share of families who move to high opportunity areas, which would not be the case if many families were indeed close to indifference between the two types of areas as in Appendix Figure 12. Second, families who are induced to move to opportunity areas by the full CMTO treatment experience large increases in neighborhood satisfaction (Figure 7a), contradicting the view that these families are close to indifference across neighborhoods. Our experimental findings thus challenge classical economic models of residential sorting and spatial equilibrium in which households are indifferent between locations given costs and amenities (e.g., Rosen 1979; Roback 1982).

Although we focus on tenant preferences here, the same logic would hold in a generalized model that permits heterogeneity in landlord preferences over tenants. In particular, any landlord preference to rent to non-voucher holders in high-opportunity areas must be small enough to be overcome by the CMTO treatment for 43% of families. Hence, strong preferences among landlords over tenants' backgrounds are also unlikely to explain the segregation of low-income families into lower-opportunity areas, consistent with Garboden et al. (2018).

Formal Derivation. To formalize the argument sketched above, we use a discrete choice framework in which family i chooses neighborhood type $j \in \{H, L\}$ corresponding to high-opportunity and low-opportunity neighborhoods, respectively, to maximize their indirect utility of living in neighborhood j. The indirect utility of living in neighborhood j for family i is

$$u_{ij} = \varepsilon_{ij} - P_j \tag{5}$$

where ε_{ij} is the idiosyncratic preference that household i has for neighborhood j and P_j is the cost of living in neighborhood j. We normalize the coefficient on costs to one so that preferences ε are interpretable in dollar terms.

Families choose the neighborhood type that maximizes their indirect utility and therefore move to an opportunity neighborhood whenever

$$u_{iH} > u_{iL} \tag{6}$$

$$\underbrace{\varepsilon_{iH} - \varepsilon_{iL}}_{\text{marginal benefit of } H} > \underbrace{P}_{\text{marginal cost of } H} \tag{7}$$

where $P = P_H - P_L$ denotes the marginal cost of moving to neighborhood H.

Note that this simple model abstracts away from risk aversion that could arise from uncertainty about ε. While such uncertainty would decrease the fraction of families that would be willing to move to a high-opportunity neighborhood for a given moving cost P, the Phase 2 experimental results indicate that the even when people are well informed about neighborhood quality (as in the first treatment arm), the provision of further services (as in the third treatment arm) has a significant impact on their neighborhood choices. Hence, uncertainty about neighborhood quality (ε) itself is unlikely to explain our empirical findings; however, risk aversion over the event of not successfully leasing up in a high opportunity neighborhood could be one component of the search barriers faced by families.

Absent any additional resources, the share of families moving to an opportunity neighborhood s_H is

$$s_H = \Pr(j^* = H) = \Pr(\varepsilon_{iH} - \varepsilon_{iL} > P). \tag{8}$$

The fact that 17.8% of families in the control group who lease up move to high-opportunity areas implies that $\hat{s}_H = 0.178$. That is, 82.2% of families have utility of living in the high-opportunity

neighborhood that is less than the cost of living in a high-opportunity neighborhood, i.e., have a net willingness-to-pay for low-opportunity areas that is positive: $WTP_i = \varepsilon_{iL} - \varepsilon_{iH} + P > 0$.

Now consider the CMTO treatment group. For this group, the indirect utility of moving to neighborhood j is

$$u_{ij}^T = \delta_i S_j - P_j + \varepsilon_{ij}, \tag{9}$$

where S_j is a variable representing the cost of the moving assistance services offered by the public housing authority for households moving to neighborhood j, including security-deposits and search assistance services. In the CMTO experiment, $S_L = 0$ and, as discussed above, conservatively set $S_H = \$2{,}670$.

The coefficient δ_i governs the translation of the dollar value of these services to utility. In an environment with no frictions where these services can be purchased in the market for their average cost, we would expect $\delta_i \leq 1$: families should value the services at most at their marginal cost, as they would have already purchased them otherwise.

Treatment-group families choose to move to a high-opportunity neighborhood when

$$u_{iH}^T > u_{iL}^T \tag{10}$$

$$\varepsilon_{iH} - \varepsilon_{iL} > P - \delta_i S_H \tag{11}$$

and hence the share of treatment-group families that lease up who move to an opportunity neighborhood is

$$s_H^T = \Pr(\varepsilon_{iH} - \varepsilon_{iL} > P - \delta_i S_H). \tag{12}$$

For the CMTO treatment group, $\hat{s}_H^T = 0.61$, meaning that 61% of families preferred high-opportunity neighborhoods after they were provided with the services targeted at high-opportunity areas. Given $\delta_i \leq 1$, we can infer these 61% of families have a net willingness to pay (WTP) for low-opportunity areas that is less than \$2,670, i.e., $WTP_i = \varepsilon_{iL} - \varepsilon_{iH} + P < \$2{,}670$.

Of course, not everyone in the treatment group received exactly \$2,670 in services. Appendix B discusses heterogeneity in services take-up and notes that the maximum cost of financial services taken up was \$4,639. A conservative upper bound for the cost of CMTO services (replacing \$1,057 with \$4,639 in Table 4) would therefore be \$6,250. However, we focus on the average cost of around \$2,670 as it better represents the actual expense required to generate the treatment effects we observe.

Putting together these two bounds, we infer that

$$\Pr(WTP_i \in [0, S_H]) = \Pr(\varepsilon_{iH} - \varepsilon_{iL} - P \in [-S_H, 0]) > s_H^T - s_H = 0.432, \tag{13}$$

if $\delta_i \leq 1$. That is, the frictionless model implies that 43.2% of families have net WTP for a low-opportunity area between \$0 and \$2,670, i.e., a large mass of families must happen to be nearly indifferent between high- and low-opportunity neighborhoods, as shown in Appendix Figure 12. As discussed above, the existence of such a mass is inconsistent with the limited impacts of financial incentives on the share of families who move to opportunity as well as the large changes in ex-post neighborhood satisfaction for families induced to make such moves by the CMTO program.

It follows that a canonical frictionless model in which families value CMTO services at or below their marginal cost ($\delta_i \leq 1$) does not fit our experimental findings. The experimental findings can potentially be explained by incorporating additional costs of moving to high-opportunity areas and/or by assuming that families cannot purchase services analogous to those provided by CMTO on the market to overcome the barriers they face, in which case $\delta_i > 1$. In either of these cases,

choices can no longer be directly translated into preferences (WTP). In particular, some families may have very high WTP for high-opportunity areas yet are prevented from moving to such areas (absent CMTO-type services) due to frictions in the housing search process.

Table 1

Summary Statistics and Balance Tests for Households in Experimental Sample - Phase 1

	Pooled	Control			Treatment			P-Value of T-C Difference
	Mean (1)	Mean (2)	SD (3)	N (4)	Mean (5)	SD (6)	N (7)	(8)
A. Head of Household Demographics								
Age (years)	34.2	34.2	8.8	204	34.2	7.7	221	0.989
Annual Household Income ($)	20,275	20,223	13,144	193	20,321	13,524	215	0.984
% Speak English (w/o Translator)	81.4	79.9	40.2	204	82.8	37.8	221	0.468
% Born Outside the U.S.	35.1	35.0	47.8	203	35.3	47.9	221	0.908
% Black Non-Hispanic	49.1	49.8	50.1	203	48.4	50.1	219	0.852
% White Non-Hispanic	24.4	22.7	42.0	203	26.0	44.0	219	0.442
% Hispanic	8.3	8.9	28.5	203	7.8	26.8	219	0.739
% Asian Non-Hispanic	6.9	6.9	25.4	203	6.8	25.3	219	0.962
% Female Head of Household	81.8	78.3	41.3	203	85.0	35.8	220	0.082*
% Married Head of Household	2.8	3.0	17.0	203	2.7	16.3	220	0.774
% Less than High School Grad	21.6	27.9	44.9	201	15.9	36.7	220	0.004***
% High School Degree	31.8	32.8	47.1	201	30.9	46.3	220	0.587
% Attended Some College	41.6	32.8	47.1	201	49.5	50.1	220	0.000***
% BA or more	5.0	6.5	24.7	201	3.6	18.8	220	0.172
% Homeless	13.4	14.8	35.6	203	12.2	32.8	221	0.458
% Currently Working	56.6	60.6	49.0	203	52.9	50.0	221	0.100*
% Works Full-Time (Over 35 Hours/Week)	28.3	31.0	46.4	203	25.8	43.8	221	0.193
% Commute > 30 min to Work	34.0	35.0	47.9	123	33.0	47.2	115	0.725
% with Car and Driver's License	63.4	59.1	49.3	203	67.3	47.0	220	0.079*
Number of Children	2.2	2.3	1.4	204	2.2	1.4	221	0.715
Children's Average Age	6.6	6.6	3.9	196	6.7	3.8	216	0.692
B. Neighborhood-Related Questions								
% Starting in High-Opportunity Tract	12.6	12.4	33.1	161	12.7	33.4	173	0.932
% Satisfied with Current Neighborhood	50.8	47.9	50.1	190	53.4	50.0	206	0.280
% Would Leave Neighborhood if Got Voucher	53.2	56.6	49.7	189	50.0	50.1	206	0.214
% Feel They Could Find Place in New Neighborhood	54.8	57.5	49.6	181	52.3	50.1	197	0.324
% Could Pay for a Move	28.8	32.5	47.0	203	25.3	43.6	221	0.121
% Good with Moving to Racially Diff Neighborhood	78.4	83.2	37.5	202	74.1	43.9	220	0.020**
% Good with Moving to Specific Neighborhood in Opportunity Area	71.7	72.4	44.8	203	71.0	45.5	221	0.673
% Considering Different School for Any Child	58.4	60.9	49.0	156	56.1	49.8	173	0.433
% Unsatisfied with Any Child's Current School	14.6	15.4	36.2	156	13.9	34.7	173	0.736
% Primary Motivation to Move is Schools	42.5	42.4	49.5	203	42.5	49.6	221	0.971
% Primary Motivation to Move is Safety	21.5	20.2	40.2	203	22.6	41.9	221	0.509
% Primary Motivation to Move is Bigger/Better Home	15.8	15.3	36.1	203	16.3	37.0	221	0.779
C. Characteristics of Origin Neighborhood (Census Tract)								
Predicted Mean Household Income Rank (p=25)	43.9	44.1	4.0	201	43.7	4.2	218	0.354
Incarceration Rate (p=25)	2.1	2.1	1.4	201	2.2	1.4	218	0.225
Teen Birth Rate (Women; p=25)	23.1	23.1	8.1	201	23.1	7.8	218	0.944
% in Poverty (2016 ACS)	16.6	15.9	10.2	201	17.2	9.8	218	0.156
% Black (ACS 2013-2017)	11.4	11.3	9.5	201	11.5	10.1	218	0.778
% Low-Inc. 3rd Graders Proficient in Math (2015)	41.4	41.8	11.4	197	41.0	11.9	213	0.481
% in Extreme Poverty (Rate > 40%) Tract (2016 ACS)	2.6	3.0	17.1	201	2.3	15.0	218	0.728

F-Test	F-Statistic	P-Value	N
	1.200	0.197	425

Notes: This table presents baseline summary statistics for the 425 households who were issued a voucher in Phase 1 of the CMTO experiment and are included in our analysis. We present means for the full sample and means, standard deviations, and counts for the treatment and control groups separately. In Column 8, we show the p-value for a test of the difference between treatment and control group means, estimated by regressing the relevant outcome variable on the treatment group indicator and an indicator for being in the Seattle or King County housing authority (since randomization was within PHA). The outcomes in Panels A and B come from the baseline survey administered as part of this study, complemented with administrative data from the PHAs at the time of voucher issuance (in particular, annual household income, race and ethnicity, head of household marital status and gender come from PHA administrative data); see Appendix Table 4 for definitions of these variables. The first three variables of Panel C show Census tract-level measures of mean household income rank, incarceration rates and teen birth rates for children whose parents were at the 25th percentile of the national household income distribution drawn from the Opportunity Atlas (Chetty, Friedman, Hendren, Jones, and Porter 2018). The remaining rows of Panel C are obtained from publicly available ACS data and the Stanford Education Data Archive (for the math proficiency variable). The number of observations varies across outcomes because of non-response. We report an omnibus test of balance by regressing treatment status on all baseline variables in the table, controlling for PHA, and compute the F-statistic from a test of the variables' joint significance. To preserve the full sample in that regression, we replace missing values in each variable with a constant and add an indicator variable for an outcome being missing. The resulting F-statistic and p-value are shown at the bottom of the table. We exclude 5 households whose voucher was transferred to a different PHA in this table. All regressions use robust standard errors. *** *p<0.01, ** p<0.05, * p<0.1*

Table 2
Treatment Effects on Neighborhood and Housing Unit Characteristics - Phase 1

A. Neighborhood Characteristics	Control Mean	Control Standard Deviation	Treatment Mean	Treatment Effect	Standard Error of Treatment Effect	Treatment Effect in Standard Deviations	Standard Error of Treatment Effect in Standard Deviations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tract Income and Other Characteristics							
Median HH Income (2017)	66,970.06	22,121.28	79,889.38	12919.32***	2,679.76	0.58	0.12
% Labor Force Participation (2010)	0.70	0.06	0.70	0.00	0.01	-0.03	0.10
% Poverty (2017)	14.87	8.00	13.39	-1.48*	0.80	-0.19	0.10
Median Home Value (2010)	342,428.50	103,755.15	403,180.34	60751.84***	12,352.30	0.59	0.12
Census Mail Response Rate	76.33	4.53	77.28	0.95**	0.44	0.21	0.10
Theil Index of Racial Segregation	0.12	0.05	0.12	-0.01*	0.00	-0.16	0.09
# Jobs For No HS Degree, 1 Mile Radius	164.25	384.23	185.39	21.14	34.46	0.06	0.09
Mean Commute Time in 2000 (Minutes)	29.58	3.31	28.34	-1.24***	0.32	-0.38	0.10
% Commute < 15 Mins	16.28	5.87	17.52	1.24**	0.61	0.21	0.10
Distance to City Hall of Largest City in CZ (Miles)	11.59	7.47	10.69	-0.89*	0.53	-0.12	0.07
Distance from Origin Neighborhood (Miles)	10.77	11.89	11.36	0.59	1.16	0.05	0.10
Resident Demographics							
% White (2017)	49.06	18.42	56.15	7.10***	1.70	0.39	0.09
% Black (2017)	11.40	9.21	8.28	-3.12***	0.80	-0.34	0.09
% Foreign-Born (2016)	24.79	10.18	24.46	-0.34	0.97	-0.03	0.10
% Married (2010)	46.26	9.56	49.08	2.83***	0.95	0.30	0.10
% of Children with Single Parents (2013-2017)	33.37	12.74	29.62	-3.75***	1.32	-0.29	0.10
% >= College Education (2017)	36.72	17.50	46.41	9.70***	1.76	0.55	0.10
Population Density (2010, # People per Square Mile)	2,496.17	1,298.80	2,388.31	-107.86	126.16	-0.08	0.10
Children's Long-Term Outcomes							
Predicted Mean Individual Income Rank (p=25)	46.51	3.04	47.75	1.24***	0.34	0.41	0.11
Predicted Mean Household Income Rank (p=25)	44.55	3.62	46.14	1.59***	0.39	0.44	0.11
Predicted Mean Household Income Rank for White Children (p=25)	47.04	4.46	47.83	0.79	0.49	0.18	0.11
Teenage Birth Rate for Women (p=25)	21.02	7.79	16.51	-4.51***	0.79	-0.58	0.10
Incarceration Rate (p=25)	2.06	1.30	1.61	-0.45***	0.13	-0.35	0.10
Other Indices of Opportunity							
Kirwan Overall Child Opportunity Score	-0.13	0.39	0.10	0.22***	0.04	0.57	0.10
Kirwan Educational Subscore	-0.24	0.57	0.11	0.35***	0.06	0.61	0.11
Kirwan Health/Environment Subscore	0.00	0.32	0.10	0.10***	0.03	0.31	0.09
Kirwan Social/Economic Opportunity Subscore	-0.14	0.55	0.07	0.22***	0.05	0.39	0.10
HUD Transit Index	82.34	8.62	82.01	-0.33	0.77	-0.04	0.09
Environmental Health Index	9.68	12.94	11.26	1.58	1.27	0.12	0.10
B. Unit Characteristics							
Square Feet	1,257.17	651.88	1,298.99	41.82	80.75	0.06	0.12
Year Built	1,985.18	22.71	1,980.99	-4.19	3.17	-0.18	0.14
Household Appliance Index	0.63	0.36	0.63	0.00	0.03	0.00	0.09
Baths	1.97	0.71	2.04	0.07	0.09	0.10	0.13
Share With Air Conditioning	9.38	29.30	7.38	-2.00	3.04	-0.07	0.10
Total Rent Paid to Owner	1,801.64	529.83	1,984.33	182.69***	60.43	0.34	0.11
Rent Paid by PHA	1,399.60	600.91	1,600.12	200.52***	64.80	0.33	0.11
Utilities Paid (estimate by PHAs)	138.04	86.14	164.85	26.81***	9.16	0.31	0.11
Total Out of Pocket Expenditures (Tenant)	467.56	368.11	498.78	31.22	71.49	0.08	0.19

Notes: This table shows the effect of the CMTO treatment on a variety of neighborhood and unit characteristics. Each row of the table reports the mean and standard deviation of the relevant outcome in the treatment and control groups as well as an estimate from a separate OLS regression of neighborhood and housing unit characteristics on an indicator for treatment status. All regressions include a PHA indicator and use robust standard errors. The control group mean is a raw mean while the treatment group mean is constructed as the control mean plus the treatment effect estimate. Panel A shows treatment effects on neighborhood characteristics unconditional on lease-up. Panel B shows treatment effects on unit characteristics for the subsample who leased up because these characteristics are only available for those who leased up. The share of workers with a short commute to work and mean commute time are constructed using tract-level data from table NP031B of the 2000 Decennial Census or tract-level data from table B08303 of the 2006-2010 American Community Survey, both obtained from the NHGIS database. Fraction with a short to commute to work is computed by taking the share of people who commute less than 15 minutes to work over all workers 16 years and over who did not work at home. Mean commute time is constructed using the share of workers commuting to work in specific bins (< 5 minutes, 5-9 minutes, 10-14 minutes, etc.), imputing the mean time commuted in a given bin (i.e. for 5-9 minutes, imputing mean commute time of 7 minutes), and then calculating a sum of imputed mean commute times within each bin weighted by the share commuting. The Household Appliance Index is the sum of six indicators for common appliances observed in the rental listings: microwaves; refrigerators; washers; dryers; dishwashers; and garbage disposal. We exclude 5 households whose voucher was transferred to a different PHA in this table. *** *p<0.01,* ** *p<0.05,* * *p<0.1*

Table 3
Heterogeneity of Treatment Effects on Fraction Who Move to High-Opportunity Areas - Phase 1

	Share Moving to High-Opportunity Area (%), Unconditional on Lease-Up					
	Control Mean	Treatment Mean	Treatment Effect	SE	N	P-Value
	(1)	(2)	(3)	(4)	(5)	(6)
A. Pooled						
All Families	15.4	53.3	37.8	4.2	422	0.000
All Families (Controls)	15.4	52.8	37.4	4.5	422	0.000
B. By Head of Household Demographic Characteristics						
Black Non-Hispanic	11.2	48.0	36.8	5.9	204	0.000
White Non-Hispanic	19.6	62.3	42.7	9.0	103	0.000
Other Race/Ethnicity	19.6	56.7	37.0	8.5	112	0.000
Born Outside the U.S.	12.9	51.3	38.5	6.8	148	0.000
Born in the U.S.	16.9	55.8	38.9	5.3	273	0.000
English Isn't Primary Language	13.5	56.9	43.3	9.7	78	0.000
20 Years or More in Seattle/King County	15.7	51.4	35.7	6.5	180	0.000
Less Than 20 Years in Seattle/King County	15.4	54.8	39.4	5.6	241	0.000
Started in High Opportunity Tract	25.0	72.6	47.6	13.5	42	0.000
Didn't Start in High Opportunity Tract	13.0	45.7	32.6	5.0	289	0.000
Income ≤ $19,000 (Sample Median)	16.7	53.5	36.8	6.0	218	0.000
Income > $19,000 (Sample Median)	14.3	53.5	39.2	6.0	203	0.000
No College	9.9	53.2	43.3	5.7	224	0.000
Some College or More	24.7	52.8	28.1	6.8	194	0.000
Currently Working	13.1	45.5	32.4	5.6	239	0.000
Currently Not Working	19.2	61.5	42.3	6.6	182	0.000
Uses Child Care	19.4	45.2	25.8	6.3	207	0.000
Doesn't Use Childcare	11.8	60.8	49.1	5.6	214	0.000
C. By Perceptions About Moving at Baseline						
Feels Good About Moving to an Opportunity Area	17.9	53.4	35.4	5.2	302	0.000
Doesn't Feel Good About Moving to an Opportunity Area	9.1	53.4	44.4	7.4	119	0.000
Satisfied With Current Neighborhood	14.4	55.7	41.3	5.9	200	0.000
Unsatisfied/Indifferent With Current Neighborhood	17.3	50.8	33.4	6.4	194	0.000
Sure Wants to Leave Current Neighborhood	17.9	56.5	38.6	6.2	209	0.000
Sure Wants to Stay in Current Neighborhood or Indifferent	13.6	49.3	35.7	6.2	184	0.000
Feels Good About Moving to Racially Different Neighborhood	15.2	55.1	39.9	4.8	328	0.000
Feels Bad/Indifferent About Moving to Racially Different Neighborh	17.6	49.0	31.3	9.5	91	0.001
Sure Could Pay for Moving Expenses	15.4	63.1	47.7	7.7	121	0.000
Not Sure Could Pay for a Moving Expenses	15.6	50.4	34.8	5.0	300	0.000
Sure Could Find a New Place	16.3	51.5	35.1	6.2	207	0.000
Not Sure Could Find a New Place	17.3	55.3	37.9	6.8	169	0.000
D. By Children Characteristics						
Mean Children Age at or Above Median (6.3 years)	15.6	51.9	36.3	6.1	204	0.000
Mean Children Age Below Median (6.3 years)	15.5	53.1	37.6	6.1	205	0.000
More than 2 Children	13.4	44.2	30.7	7.1	137	0.000
2 Children or Fewer	16.4	58.8	42.4	5.2	285	0.000
Considering Different Schools	12.9	52.5	39.6	6.2	190	0.000
Not Considering Different Schools	16.7	52.5	35.9	7.6	136	0.000

Notes: This table reports treatment effects by subgroup, estimated using a regression of an indicator for leasing up in a high-opportunity area on the treatment group indicator and a PHA fixed effect. In row 2, we additionally control for the baseline characteristics shown in Table 1. We exclude 5 households whose voucher was transferred to a different PHA in this table. See Appendix Table 4 for definitions of the variables used to construct the subgroups. All regressions use robust standard errors. All of the effects shown are statistically significant with $p<0.01$.

Table 4
Creating Moves to Opportunity Program Costs

	Average Cost
A. Total Costs	
Cost of CMTO services per issuance	$2,668
Cost of CMTO services per lease / average 7-year HAP costs per lease	2.5%
B. Costs by Service Category	
Cost of CMTO financial assistance per issuance	$1,057
Cost of CMTO program services per issuance	$1,500
Cost of PHA CMTO administration per issuance	$392
Cost savings of PHA services paid by CMTO	($281)
C. Housing Assistance Payment (HAP) Costs	
Average incremental HAP costs per lease per year	$2,519
Average incremental HAP costs per leased family over 7 years	$17,633
(Incremental HAP + CMTO services per lease) / average 7-year HAP costs per lease	17.2%
D. Phase 2 Treatment Arms	
T1 (Financial Assistance + Info) cost per issuance	$424
T2 (Reduced Services) cost per issuance	$720
T3 (CMTO) cost per issuance	$2,778

Notes: This table reports average cost metrics for the CMTO program. Panel A reports two measures of average total CMTO service costs: per voucher issued and per family leased as a percentage of 7-year housing assistance payment (HAP) voucher costs for one leased family. The second measure is defined as the cost of CMTO services per lease up divided by the average HAP cost for the control group over seven years (a conservative estimate of the average voucher duration for families with children) in KCHA and SHA. Panel B reports average costs by category. Financial assistance costs include security deposits, adminstrative fees, holding fees, pro-rated rent, renter's insurance, damage mitigation insurance claims, and screening fees. Program services include costs paid to the Navigator service providers, which include costs for staff, management, administrative assistance, mileage, overhead, and materials. PHA administration costs per issuance consist of a project manager at each PHA spending 50% time managing CMTO service implementation. In Panel A, Cost of CMTO services per issuance is the sum of all CMTO programmatic costs listed in Panel B, including subtracting the average control group additional security deposit assistance that would have been provided by the PHAs as part of existing PHA policy regardless of CMTO net of security deposits paid for non-opportunity treatment group moves. Panel C reports the incremental HAP expenditure for the treatment group relative to the control group per family that leased up, driven by the fact that treatment group families leased units in more expensive areas on average, which had higher HAP payments because of the tiered payment standards used in KCHA and SHA. Average incremental HAP costs per leased family over 7 years is the expected present value of the annual incremental HAP expenditure for treatment over control summed over the typical lifetime of a voucher (7 years) under the assumption that growth rate of rents is the same as the discount rate. The last row of Panel C reports the sum of the incremental HAP costs per lease over 7 years and the up-front CMTO services per lease as a share of the average expected lifetime HAP costs per family leased in the control group. Panel D repeats the measure of average total CMTO service costs from Panel A separately for each of the three Phase 2 treatment arms.

Table 5
Prevalence of Qualitative Mechanisms in CMTO Phase 1 and Phase 2

	Number of Observations	*Mechanism 1: Emotional Support and Communication*	*Mechanism 2: Opportunity Area Motivation*	*Mechanism 3: Streamlining*	*Mechanism 4: Landlord Brokering*	*Mechanism 5: Short-term Financial Assistance*
Phase 1						
Treated Families who Moved to High-Opportunity Nbhds.	74	60.8%	31.1%	73.0%	60.8%	81.1%
All Treated Families	117	50.4%	25.6%	53.8%	47.0%	59.8%
Phase 2						
Treatment Arm 1 (Incentivized Information)	37	5.4%	24.3%	2.7%	5.4%	27.0%
Treatment Arm 2 (Reduced Support Services)	34	38.2%	32.4%	52.9%	14.7%	50.0%
Treatment Arm 3 (Full Customized Services)	19	68.4%	26.3%	52.6%	31.6%	68.4%

Notes: This table describes the count and prevalence of five qualitative mechanisms for treatment group families in Phase 1 and Phase 2. Phase 1 interviews were conducted with families who did and did not move to opportunity neighborhoods; Phase 2 interviews only focused on those who had leased-up in an opportunity area (OA). The five qualitative mechanisms were identified by reading transcripts and coding the 117 treatment group interviews in Phase 1. Each cell lists the prevalence of the mechanism listed in the relevant column for the corresponding group, defined as the number of cases who reported that mechanism as a percentage of the total number of cases in the group. See Appendix C for details on the coding protocol used to identify these mechanisms. Of the 90 families interviewed in Phase 2, two families (one in Treatment Arm 1 and one in Treatment Arm 2) did not complete the baseline survey, and so are not included in the Phase 2 analyses.

Appendix Table 1
Costs of CMTO vs. Other Mobility Programs

Program	Cost Metric	Estimated Cost	Source
1. Creating Moves to Opportunity (Phase 1)	Cost per family issued	$2,668	Table 4
2. Creating Moves to Opportunity (Phase 1)	Cost per opportunity move	$4,997	Appendix B.A
3. Moving to Opportunity	Cost per opportunity move	$4,814	Feins et al. (1997)
4. Housing Opportunity Program	Cost per opportunity move	$4,925	Schwartz et al. (2017)
5. Baltimore Housing Mobility Program	Cost per opportunity move	$3,427	Rinzler et al. (2015)
6. Chicago Regional Housing Choice Initiative	Cost per opportunity move	$2,939	Schwartz et al. (2017)
7. Hypothetical Mobility Program	Cost per family issued	$4,500	Sard, Cunningham, and Greenstein (2018)

Notes: This table reports cost metrics for CMTO and other mobility programs. Costs in rows 3-6 have been adjusted for inflation to 2018 dollars using the CPI. See Appendix B for details on how these costs were computed.

Appendix Table 2
Qualitative Study Sampling and Response Rates

	Treatment	*Control*	*Total N*	*N / Target Sample Size*	*N / Number Contacted*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
A. Sampling Targets					
Still Searching (as of April 2019)	71 (100%)	24 (25%)	95		
Leased up	78 (50%)	29 (20%)	107		
Total Targeted	149 (67%)	53 (25%)	202		
B. Recruitment					
Interviewed	119	42	161	80%	85%
Refusals	13	4	17	8%	9%
Contact, No Interview Yet	9	2	11	5%	
No Contact/Bad Contact Info	8	5	13	6%	
C. Response Rate by Treatment Status					
N Interviewed / Target Sample Size	80%	79%			

Notes: This table shows the sampling scheme and response rates for the qualitative study sample in Phase 1. Panel A shows the number and percentage of participants who were randomly targeted for participation in the qualitative study from each group, based on their treatment status and lease-up status as of April 15, 2019 for households in the Seattle Housing Authority and April 23, 2019 in the King County Housing Authority. Panel B shows the number of households who we were able to successfully interview within this group; the number who refused; and the number whom we attempted to contact but were not yet able to interview or rearch. Column 4 shows the number of households in each of these categories as a share of all households targeted, and Column 5 shows household interviews and refusals as a share of households with whom we had some contact. Panel C shows the percentage of households interviewed as a share of the number of households targeted by treatment group.

Appendix Table 3

Summary Statistics and Balance Tests for Households in Experimental Sample - Phase 2

	Pooled		Control	Treatment Arm 1		Treatment Arm 2		Treatment Arm 3	
	Mean	SD	Mean	Mean	P-Value of T-C Difference	Mean	P-Value of T-C Difference	Mean	P-Value of T-C Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. Head of Household Demographics									
Age (years)	33.9	8.0	33.4	32.9	0.7	35.1	0.3	34.2	0.5
Annual Household Income ($)	19,260	13,021	17,370	16,844	0.8	21,845	0.027**	20,675	0.1
% Speak English (w/o Translator)	92.0	27.2	93.1	95.4	0.6	91.7	0.8	88.3	0.3
% Born Outside the U.S.	29.0	45.5	25.0	23.1	0.8	30.6	0.5	36.4	0.1
% Black Non-Hispanic	48.1	50.1	54.8	47.7	0.4	50.0	0.5	40.3	0.077*
% White Non-Hispanic	24.4	43.0	26.0	24.6	0.9	25.0	0.9	22.1	0.6
% Hispanic	8.4	27.7	9.6	6.2	0.4	4.2	0.2	13.0	0.5
% Asian Non-Hispanic	5.6	23.0	0.0	4.6	0.081*	5.6	0.044**	11.7	0.002***
% Female Head of Household	82.0	38.5	87.5	84.4	0.6	79.2	0.2	77.3	0.1
% Married Head of Household	1.4	11.8	1.4	1.6	0.9	2.8	0.5	0.0	0.3
% Less than High School Grad	16.0	36.8	19.2	24.6	0.5	13.9	0.4	7.8	0.042**
% High School Degree	36.2	48.2	39.7	29.2	0.2	38.9	0.9	36.4	0.7
% Attended Some College	43.2	49.6	34.2	44.6	0.2	41.7	0.4	51.9	0.029**
% BA or more	4.5	20.8	6.8	1.5	0.1	5.6	0.7	3.9	0.4
% Homeless	8.7	28.3	8.2	9.2	0.8	8.5	1.0	9.1	0.9
% Currently Working	56.3	49.7	49.3	49.2	1.0	64.8	0.057*	61.0	0.1
% Works Full-Time (Over 35 Hours/Week)	25.4	43.6	17.8	16.9	0.9	35.7	0.012**	30.7	0.071*
% Commute > 30 min to Work	36.0	48.2	33.3	28.1	0.7	41.3	0.4	38.3	0.7
% with Car and Driver's License	58.3	49.4	52.8	60.3	0.4	58.6	0.5	61.6	0.3
Number of Children	2.2	1.1	2.1	1.8	0.1	2.2	0.5	2.5	0.061*
Children's Average Age	6.7	3.5	6.6	6.2	0.4	7.0	0.6	7.1	0.4
B. Neighborhood-Related Questions									
% Starting in High-Opportunity Tract	15.0	35.9	6.9	23.1	0.1	18.8	0.2	12.1	0.5
% Satisfied with Current Neighborhood	50.0	50.1	48.5	45.8	0.8	49.2	0.9	55.7	0.4
% Would Leave Neighborhood if Got Voucher	46.9	50.0	53.0	50.8	0.8	44.6	0.3	39.7	0.1
% Feel They Could Find Place in New Neighborhood	59.7	49.1	64.1	61.0	0.7	56.3	0.3	57.7	0.5
% Could Pay for a Move	26.2	44.1	30.6	21.5	0.2	27.8	0.7	24.7	0.4
% Good with Moving to Racially Diff Neighborhood	66.2	47.4	62.9	74.6	0.1	58.6	0.7	69.3	0.4
% Good with Moving to Specific Neighborhood in Opportunity Area	51.9	50.1	63.0	52.3	0.2	43.1	0.018**	49.4	0.091*
% Considering Different School for Any Child	57.1	49.6	55.9	56.8	0.9	61.7	0.5	54.1	0.9
% Unsatisfied with Any Child's Current School	20.1	40.2	23.7	20.5	0.7	20.0	0.6	16.4	0.3
% Primary Motivation to Move is Schools	40.8	49.2	37.9	39.0	0.9	34.8	0.8	50.7	0.1
% Primary Motivation to Move is Safety	21.4	41.1	28.8	20.3	0.3	22.7	0.3	14.1	0.033**
% Primary Motivation to Move is Bigger/Better Home	17.6	38.1	16.7	20.3	0.6	19.7	0.7	14.1	0.7
C. Characteristics of Origin Neighborhood (Census Tract)									
Predicted Mean Household Income Rank (p=25)	43.9	3.6	43.4	43.4	1.0	44.6	0.2	43.9	0.6
Incarceration Rate (p=25)	2.3	1.4	2.0	2.5	0.1	2.3	0.3	2.3	0.4
Teen Birth Rate (Women; p=25)	22.4	7.8	22.4	21.4	0.6	22.0	0.8	23.8	0.4
% in Poverty (2016 ACS)	17.0	9.8	19.5	16.4	0.2	17.2	0.4	14.9	0.078*
% Black (ACS 2013-2017)	11.9	9.3	14.0	11.7	0.4	9.5	0.050*	12.2	0.4
% Low-Inc. 3rd Graders Proficient in Math (2015)	41.0	11.8	40.9	41.7	0.8	38.9	0.5	42.8	0.5
% in Extreme Poverty (Rate > 40%) Tract (2016 ACS)	3.5	18.4	8.3	0.0	0.079*	2.7	0.3	2.6	0.3
	N		N	N		N		N	
	287		73	65		72		77	
F-Test				F-Statistic	P-Value	F-Statistic	P-Value	F-Statistic	P-Value
				0.994	0.494	0.983	0.511	1.563	0.04

Notes: This table presents baseline summary statistics for the 287 households who were issued a voucher in the second phase of the CMTO experiment. We present mean and standard deviations for the full sample and means separately for the control group and the three treatment groups: the incentivized information group (Treatment Arm 1), the reduced support services group (Treatment Arm 2), and the full customized services group (Treatment Arm 3). In Columns 5, 7, and 9, we show the p-value for a test of the difference between treatment and control group means, estimated by regressing the relevant outcome variable on the treatment group indicator and an indicator for being in the Seattle or King County housing authority (since randomization was within PHA). The outcomes in Panels A and B come from the baseline survey administered as part of this study, complemented with administrative data from the PHAs at the time of voucher issuance (in particular, annual household income, race and ethnicity, head of household marital status and gender come from PHA administrative data); see Appendix Table 4 for definitions of these variables. The first three variables of Panel C show Census tract-level measures of mean household income rank, incarceration rates and teen birth rates for children whose parents were at the 25th percentile of the national household income distribution drawn from the Opportunity Atlas (Chetty, Friedman, Hendren, Jones, and Porter 2018). The remaining rows of Panel C are obtained from publicly available ACS data and the Stanford Education Data Archive (for the math proficiency variable). The number of observations varies across outcomes because of non-response. We report an omnibus test of balance by regressing treatment status on all baseline variables in the table, controlling for PHA, and compute the F-statistic from a test of the variables' joint significance. To preserve the full sample in that regression, we replace missing values in each variable with a constant and add an indicator variable for an outcome being missing. The resulting F-statistic and p-value are shown at the bottom of the table. All regressions use robust standard errors. *** *p<0.01,* ** *p<0.05,* * *p<0.1*

Appendix Table 4
Baseline Survey Questions and Coding of Variables

	Survey Instrument Reference	Variable Coding Details
A. Baseline Variables		
% Speak English	Q7. Is an interpreter or translation service being used for survey administration?	
% Born Outside the U.S.	Q10. In what country were you born?	
% Less than High School Grad	Q22. What is the highest level of education that you have completed?	= Grade 9 or less OR Grade 10 or grade 11 OR Attended grade 12 but did not receive high school diploma or GED certificate
% High School Degree	Q22. What is the highest level of education that you have completed?	= GED certificate OR High school diploma
% Attended Some College	Q22. What is the highest level of education that you have completed?	= Some college or Associate's or two-year degree
% BA or more	Q22. What is the highest level of education that you have completed?	= Four-year college degree or higher
% Homeless	Q14. Where do you currently live?	= Homeless or in a group shelter
% Currently Working	Q15. Are you currently working for pay?	
% Commute > 30 min to Work	Q17. How long does it take you to get to your job?	= 31 to 45 minutes OR 46 minutes to one hour OR More than one hour
% with Car and Driver's License	Q19. Do you have a valid driver's license? AND Q20. Do you have access to a car that runs?	
% Satisfied with Current Neighborhood	Q32. Which of the following statements best describes how satisfied you are with your current neighborhood?	= Very satisfied OR Somewhat satisfied
% Would Leave Neighborhood if Got Voucher	Q33. Which of the following statements best describes how you feel about staying in your current neighborhood if you receive a voucher?	= Somewhat sure I want to move to a different neighborhood OR Very sure I want to move to a different neighborhood
% Feel They Could Find Place in New Neighborhood	Q47: How sure are you that you could find a home in a new neighborhood in [Seattle/King County]?	= Very sure OR Fairly sure
% Could Pay for a Move	Q50. How sure are you that you will be able to pay for any moving expenses?	= Very sure OR Fairly sure
% Good with moving to Racially Diff Neighborhood	Q43. How would you feel about moving to a neighborhood where almost all of the other residents are of a different race or ethnicity than your own?	= Very good OR Good
% Good with Moving to Specific Neighborhood in Opportunity Area	Q36. If a home or apartment were to be available, how would you feel about moving to ___? Would you feel… AND Q39. How would you feel about moving to ___? AND Q42. How would you feel about moving to neighborhoods ___?	= Very good OR Good [in at least one of the questions]
Number of Children	Remind me how many children do you have?	
Children's Average Age	Q53. What is the child's age?	
% Considering Different School for Any Child	Q58. Are you currently considering transferring him/her to a different school (or Pre-K/Pre-school program)?	= Yes [for at least one child]
% Unsatisfied with Any Child's Current School	Q57. How satisfied are you with his/her current school (or Pre-K/Pre-school program)?	= Somewhat unsatisfied OR Very unsatisfied [for at least one child]
20 years or more in Seattle/King County	Q13. How long have you lived in the Seattle or King County area in your lifetime?	
Uses Child Care	Q27. What types of child care do you use for your child or children? (Check all that apply)	
Feels Good About Moving to an Opportunity Area	see % Good with Moving to Specific Neighborhood in Opportunity Area	
Sure Wants to Leave Current Neighborhood	see % Would Leave Neighborhood if Got Voucher	
Sure Could Find a New Place	see % Feel They Could Find Place in New Neighborhood	
B. Public Housing Authority Data		
% Black / Hispanic / Latino / White	3k. Use code or codes at bottom of page that the family says best indicates each household member's race. Select as many codes as appropriate	
Income < $19,000	19h:The total dollar amounts listed in column 19f.	Note: 19f is income minus exclusions

Notes: This table presents definitions of the variables that come from the baseline survey and from PHA administrative data (HUD form 50058). The baseline questionnaire can be found here: https://opportunityinsights.org/wp-content/uploads/2019/08/CMTOBaselineSurvey.pdf.

Appendix Table 5a

Summary Statistics for Households in Qualitative Sample vs. Full Sample - Phase 1

	Full Sample		Qualitative Sample		Not in Qualitative Sample		P-Value of Qual vs. Non-Qual Diff.
	Mean (1)	N (2)	Mean (3)	N (4)	Mean (5)	N (6)	(7)
A. Head of Household Demographics							
Age	34.20	425	34.24	161	34.17	264	0.993
Annual Household Income ($)	20,009	424	20,298	161	19,833	263	0.588
% Speak English (w/o Translator)	81.41	425	83.85	161	79.92	264	0.271
% Born Outside the U.S.	35.14	424	34.78	161	35.36	263	0.823
% Black Non-Hispanic	49.05	422	52.80	161	46.74	261	0.302
% White Non-Hispanic	24.41	422	21.74	161	26.05	261	0.344
% Hispanic	8.29	422	8.07	161	8.43	261	0.779
% Asian Non-Hispanic	6.87	422	7.45	161	6.51	261	0.675
% Female Head of Household	81.80	423	85.71	161	79.39	262	0.081*
% Married Head of Household	2.84	423	2.48	161	3.05	262	0.946
% Less than High School Grad	21.62	421	18.63	161	23.46	260	0.148
% High School Degree	31.83	421	31.68	161	31.92	260	0.844
% Attended Some College	41.57	421	44.72	161	39.62	260	0.345
% BA or more	4.99	421	4.97	161	5.00	260	0.951
% Homeless	13.44	424	13.66	161	13.31	263	0.959
% Currently Working	56.60	424	51.55	161	59.70	263	0.129
% Works Full-Time (Over 35 Hours/Week)	28.30	424	26.09	161	29.66	263	0.562
% Commute > 30 min to Work	34.03	238	36.14	83	32.90	155	0.598
% with Car and Driver's License	63.36	423	62.73	161	63.74	262	0.790
Number of Children	2.22	425	2.19	161	2.25	264	0.565
Children's Average Age	6.62	412	6.63	158	6.62	254	0.869
B. Neighborhood-Related Questions							
% Starting in High-Opportunity Tract	12.57	334	13.49	126	12.019	208	0.730
% Satisfied with Current Neighborhood	50.76	396	50.00	150	51.220	246	0.831
% Would Leave Neighborhood if Got Voucher	53.16	395	52.67	150	53.469	245	0.748
% Feel They Could Find Place in New Neighborhood	54.76	378	57.14	147	53.247	231	0.488
% Could Pay for a Move	28.77	424	29.19	161	28.517	263	0.991
% Good with Moving to Racially Diff Neighborhood	78.44	422	74.38	160	80.916	262	0.145
% Good with Moving to Specific Neighborhood in Opportunity Area	71.70	424	67.08	161	74.525	263	0.162
% Considering Different School for Any Child	58.36	329	59.52	126	57.635	203	0.819
% Unsatisfied with Any Child's Current School	14.59	329	19.05	126	11.823	203	0.094*
% Primary Motivation Schools	42.45	424	39.13	161	44.487	263	0.276
% Primary Motivation Safety	21.46	424	19.25	161	22.814	263	0.321
% Primary Motivation Bigger/Better Home	15.80	424	19.88	161	13.308	263	0.081*
C. Characteristics of Origin Neighborhood (Census Tract)							
Predicted Mean Household Income Rank (p=25)	43.91	419	44.07	158	43.81	261	0.498
Incarceration Rate (p=25)	2.14	419	2.10	158	2.16	261	0.636
Teen Birth Rate (Women; p=25)	23.09	419	22.43	158	23.49	261	0.183
% in Poverty (2016 ACS)	16.58	419	17.07	158	16.29	261	0.541
% Black (ACS 2013-2017)	11.40	419	11.79	158	11.17	261	0.587
% Low-Inc. 3rd Graders Proficient in Math (2015)	41.37	410	41.22	153	41.45	257	0.909
% in Extreme Poverty Tract (2016 ACS)	2.63	419	1.90	158	3.07	261	0.336

F-Tests	F-Statistic	P-Value	N
Unconditional on Lease-up	0.847	0.735	425
Conditional on Lease-up	0.697	0.917	356

Notes: This table compares the households in the Phase 1 qualitative sample to the households in the full experimental sample. The qualitative sample is composed of all households successfully interviewed for the qualitative study. The set of households not in the qualitative sample is defined as all households in the experimental sample who are not included in the qualitative sample. In the last column, we show the p-value for a test of the difference between the qualitative and non-qualitative-sample means, estimated by regressing the relevant outcome variable on the an indicator for being in the qualitative sample along with the PHA indicator. We report an omnibus test of balance between the two samples by regressing the qualitative sample indicator on all variables shown in the table, plus a PHA indicator, and compute the resulting F-Statistic for the joint significance of these variables (excluding the PHA indicator). We do so in two ways: first, for all households who were issued a voucher, and second restricting the sample to households that either leased-up and were not part of the qualitative study or leased-up and were interviewed for the qualitative study after lease-up. See Table 1 and Appendix Table 4 for definitions of the variables. All regressions use robust standard errors. **** p<0.01, ** p<0.05, * p<0.1*

Appendix Table 5b

Summary Statistics for Households in Qualitative Sample vs. Full Sample - Phase 2

	Full Sample		Qualitative Sample		Not in Qualitative Sample		P-Value of Qual vs. Non-Qual Diff.
	Mean (1)	N (2)	Mean (3)	N (4)	Mean (5)	N (6)	(7)
A. Head of Household Demographics							
Age	33.91	287	32.53	86	34.49	201	0.030**
Annual Household Income ($)	19,260	285	18,682	85	19,505	200	0.774
% Speak English (w/o Translator)	91.96	286	96.51	86	90.00	200	0.032**
% Born Outside the U.S.	29.02	286	16.28	86	34.50	200	0.000***
% Black Non-Hispanic	48.08	287	74.42	86	36.82	201	0.000***
% White Non-Hispanic	24.39	287	12.79	86	29.35	201	0.001***
% Hispanic	8.36	287	2.33	86	10.95	201	0.002***
% Asian Non-Hispanic	5.57	287	1.16	86	7.46	201	0.005***
% Female Head of Household	81.98	283	84.71	85	80.81	198	0.395
% Married Head of Household	1.41	283	1.18	85	1.52	198	0.933
% Less than High School Grad	16.03	287	13.95	86	16.92	201	0.529
% High School Degree	36.24	287	33.72	86	37.31	201	0.577
% Attended Some College	43.21	287	51.16	86	39.80	201	0.084*
% BA or more	4.53	287	1.16	86	5.97	201	0.023**
% Homeless	8.74	286	9.30	86	8.50	200	0.859
% Currently Working	56.29	286	55.81	86	56.50	200	0.988
% Works Full-Time (Over 35 Hours/Week)	25.44	283	29.07	86	23.86	197	0.304
% Commute > 30 min to Work	36.02	161	35.42	48	36.28	113	0.948
% with Car and Driver's License	58.27	278	57.14	84	58.76	194	0.739
Number of Children	2.17	287	2.02	86	2.23	201	0.136
Children's Average Age	6.74	280	6.61	84	6.80	196	0.613
B. Neighborhood-Related Questions							
% Starting in High-Opportunity Tract	15.00	334	21.05	38	12.195	82	0.246
% Satisfied with Current Neighborhood	50.00	396	46.15	78	51.648	182	0.423
% Would Leave Neighborhood if Got Voucher	46.90	395	48.72	78	46.111	180	0.702
% Feel They Could Find Place in New Neighborhood	59.69	378	62.34	77	58.564	181	0.705
% Could Pay for a Move	26.22	424	22.09	86	28.000	200	0.270
% Good with Moving to Racially Diff Neighborhood	66.19	422	60.24	83	68.718	195	0.282
% Good with Moving to Specific Neighborhood in Opportunity Area	51.92	424	39.53	86	57.214	201	0.009***
% Considering Different School for Any Child	57.14	329	52.94	68	58.974	156	0.407
% Unsatisfied with Any Child's Current School	20.09	329	17.65	68	21.154	156	0.575
% Primary Motivation Schools	40.84	424	35.90	78	42.935	184	0.340
% Primary Motivation Safety	21.37	424	20.51	78	21.739	184	0.662
% Primary Motivation Bigger/Better Home	17.56	424	24.36	78	14.674	184	0.087*
C. Characteristics of Origin Neighborhood (Census Tract)							
Predicted Mean Household Income Rank (p=25)	43.86	143	44.03	47	43.77	96	0.701
Incarceration Rate (p=25)	2.25	143	2.24	47	2.26	96	0.947
Teen Birth Rate (Women; p=25)	22.44	143	22.65	47	22.34	96	0.823
% in Poverty (2016 ACS)	16.97	143	15.20	47	17.83	96	0.098*
% Black (ACS 2013-2017)	11.87	143	10.90	47	12.35	96	0.353
% Low-Inc. 3rd Graders Proficient in Math (2015)	41.04	141	43.21	45	40.02	96	0.164
% in Extreme Poverty Tract (2016 ACS)	3.50	143	0.00	47	5.21	96	0.024**

F-Tests	F-Statistic	P-Value	N
Unconditional on Lease-up	1.892	0.002	287
Conditional on Lease-up	2.292	0.000	234

Notes: This table compares the households in the Phase 2 qualitative sample to the households in the full experimental sample. The qualitative sample is composed of all households successfully interviewed for the qualitative study. The set of households not in the qualitative sample is defined as all households in the experimental sample who are not included in the qualitative sample. In the last column, we show the p-value for a test of the difference between the qualitative and non-qualitative-sample means, estimated by regressing the relevant outcome variable on the an indicator for being in the qualitative sample along with the PHA indicator. We report an omnibus test of balance between the two samples by regressing the qualitative sample indicator on all variables shown in the table, plus a PHA indicator, and compute the resulting F-Statistic for the joint significance of these variables (excluding the PHA indicator). We do so in two ways: first, for all households who were issued a voucher, and second restricting the sample to households that either leased-up and were not part of the qualitative study or leased-up and were interviewed for the qualitative study after lease-up. See Table 1 and Appendix Table 4 for definitions of the variables. All regressions use robust standard errors. **** p<0.01, ** p<0.05, * p<0.1*

Appendix Table 6

Summary Statistics for Households in Qualitative Sample by Treatment Group Status - Phase 1

	Control		Treatment		P-Value of T-C Difference
	Mean (1)	N (2)	Mean (3)	N (4)	(8)
A. Head of Household Demographics					
Age	32.24	42	34.94	119	0.031**
Annual Household Income ($)	20073.17	41	20649.12	114	0.888
% Speak English (w/o Translator)	83.33	42	84.03	119	0.898
% Born Outside the U.S.	33.33	42	35.29	119	0.831
% Black Non-Hispanic	57.14	42	51.26	119	0.577
% White Non-Hispanic	19.05	42	22.69	119	0.582
% Hispanic	9.52	42	7.56	119	0.746
% Asian Non-Hispanic	2.38	42	9.24	119	0.072*
% Female Head of Household	92.86	42	83.19	119	0.064*
% Married Head of Household	2.38	42	2.52	119	0.902
% Less than High School Grad	26.19	42	15.97	119	0.243
% High School Degree	30.95	42	31.93	119	0.987
% Attended Some College	38.10	42	47.06	119	0.303
% BA or more	4.76	42	5.04	119	0.953
% Homeless	19.05	42	11.76	119	0.332
% Currently Working	54.76	42	50.42	119	0.565
% Works Full-Time (Over 35 Hours/Week)	28.57	42	25.21	119	0.573
% Commute > 30 min to Work	26.09	23	40.00	60	0.328
% with Car and Driver's License	52.38	42	66.39	119	0.126
Number of Children	2.10	42	2.22	119	0.533
Children's Average Age	5.24	42	7.13	116	0.003***
B. Neighborhood-Related Questions					
% Starting in High-Opportunity Tract	12.12	33	13.98	93	0.780
% Satisfied with Current Neighborhood	46.15	39	51.35	111	0.647
% Would Leave Neighborhood if Got Voucher	56.41	39	51.35	111	0.662
% Feel They Could Find Place in New Neighborhood	62.50	40	55.14	107	0.458
% Could Pay for a Move	33.33	42	27.73	119	0.599
% Good with Moving to Racially Diff Neighborhood	83.33	42	71.19	118	0.052*
% Good with Moving to Specific Neighborhood in Opportunity Area	66.67	42	67.23	119	0.967
% Considering Different School for Any Child	70.00	30	56.25	96	0.169
% Unsatisfied with Any Child's Current School	20.00	30	18.75	96	0.888
% Primary Motivation Schools	35.71	42	40.34	119	0.603
% Primary Motivation Safety	16.67	42	20.17	119	0.541
% Primary Motivation Bigger/Better Home	19.05	42	20.17	119	0.897
C. Characteristics of Origin Neighborhood (Census Tract)					
Predicted Mean Household Income Rank (p=25)	44.50	41	43.92	117	0.425
Incarceration Rate (p=25)	1.92	41	2.16	117	0.320
Teen Birth Rate (Women; p=25)	21.34	41	22.81	117	0.337
% in Poverty (2016 ACS)	15.75	41	17.53	117	0.302
% Black (ACS 2013-2017)	11.37	41	11.94	117	0.722
% Low-Inc. 3rd Graders Proficient in Math (2015)	41.99	39	40.96	114	0.624
% in Extreme Poverty Tract (2016 ACS)	4.88	41	0.85	117	0.269

F-Tests	F-Statistic	P-Value	N
Unconditional on Lease-up	0.864	0.694	161
Conditional on Lease-up	0.719	0.871	130

Notes: This table replicates the summary statistics in Table 1, but restricts the sample to families who participated in the qualitative survey (see Appendix Table 5 for summary statistics of this sample). In addition to the F-Statistic of joint significance using all families who participated in the qualitative study, we show a second F-Statisctic restricting the sample to households who leased-up and were interviewed after lease-up if they participated in the qualitative study. All regressions use robust standard errors. See Table 1 for further details. *** *p<0.01, ** p<0.05, * p<0.1*

Appendix Table 7

Neighborhood Characteristics of High vs. Low Opportunity Areas

	Tract Means, Weighted by Num. of. Children in Below Median Income Families				
	All Tracts (1)	Non-High-Opportunity Tracts (2)	High-Opportunity Tracts (3)	High-Opportunity Tracts Moved Into By CMTO Participants (4)	Z-Score for (4)-(3) (5)
Tract Income and Other Characteristics					
Median HH Income (2017)	75,987	68,270	103,277	98,260	-0.17
% Labor Force Participation (2010)	69.80	69.82	69.76	70.35	0.10
% Poverty (2017)	13.00	14.32	8.35	9.97	0.19
Median Home Value (2010)	366,669	334,383	481,909	479,475	-0.02
Census Mail Response Rate	77.29	76.57	79.84	78.47	-0.25
Theil Index of Racial Segregation	0.13	0.14	0.12	0.11	-0.20
# Jobs For No HS Degree, 1 Mile Radius	189.62	199.07	156.21	170.26	0.04
Mean Commute Time in 2000 (Minutes)	29.01	29.62	26.86	27.08	0.05
% Commute < 15 Mins	17.47	17.14	18.65	18.12	-0.08
Distance to City Hall of Largest City in CZ (Miles)	11.84	12.21	10.51	9.53	-0.14
Resident Demographics					
% White (2017)	53.81	51.16	63.17	63.01	-0.01
% Black (2017)	9.11	10.74	3.35	4.48	0.13
% Hispanic	12.78	14.36	7.20	7.28	0.01
% Foreign-Born (2016)	24.19	23.99	24.90	23.82	-0.09
% Married (2010)	50.24	48.29	57.14	53.48	-0.34
% of Children with Single Parents (2013-2017)	29.61	32.60	19.05	22.57	0.25
% >= College Education (2017)	39.33	34.21	57.46	58.80	0.07
Population Density (2010, # People per Square Mile)	2,174	2,255	1,888	2,082	0.12
Children's Long-Term Outcomes					
Predicted Mean Individual Income Rank (p=25)	46.73	45.70	50.37	49.74	-0.16
Predicted Mean Household Income Rank (p=25)	45.50	44.16	50.27	48.54	-0.37
Teenage Birth Rate for Women (p=25)	19.67	22.06	11.25	10.79	-0.06
Incarceration Rate (p=25)	1.92	2.11	1.28	1.20	-0.05
Other Indices of Opportunity					
Kirwan Child Opportunity Index - Overall Score	-0.04	-0.15	0.34	0.37	0.06
Kirwan Child Opportunity Index - Educational Subscore	-0.13	-0.31	0.51	0.54	0.04
Kirwan Child Opportunity Index - Health/Environment Subscore	0.05	0.02	0.16	0.20	0.16
Kirwan Child Opportunity Index - Social/Economic Subscore	-0.05	-0.17	0.35	0.36	0.02
HUD Transit Index	79.56	79.72	78.99	81.00	0.18
Environmental Health Index	13.22	12.50	15.53	14.21	-0.07

Notes: This table shows neighborhood characteristics for different groups of Census tracts. The first three columns show means (weighted by the number of people in the 2000 Decennial Census with below median income) for all tracts, low-opportunity tracts, and high-opportunity tracts, respectively. The fourth column shows means for high-opportunity tracts to which CMTO participants moved in Phase 1, weighted by the number of CMTO participants who moved to each tract. The final column shows the Z-score of the difference between the weighted average for all high opportunity tracts and the weighted average of high opportunity tracts to which CMTO families moved. Data on commute times come from the 2000 Decennial Census (mean commute time) and from the 2012-2016 ACS (% commute time < 15 min), resident demographics and tract income from the ACS; children's long-term outcomes from the Opportunity Atlas; and other indices of opportunity from The Kirwan Child Opportunity Index constructed by The Kirwan Institute for the Study of Race and Ethnicity and from HUD's Affirmatively Furthering Fair Housing Data and Mapping Tool (AFFH-T).

Appendix Table 8
Heterogeneity of Treatment Effects on Lease-up Rates - Phase 1

	Lease-up Rates (%)					
	Control Mean	Treatment Mean	Treatment Effect	SE	N	P-Value
	(1)	(2)	(3)	(4)	(5)	(6)
A. Pooled and by Housing Authority						
All Families	86.8	87.3	0.5	3.3	425	0.882
All Families (Controls)	86.8	87.0	0.2	3.3	425	0.946
B. By Head of Household Demographic Characteristics						
Black Non-Hispanic	89.1	90.2	1.1	4.3	207	0.797
White Non-Hispanic	84.8	85.4	0.6	7.0	103	0.927
Other Race/Ethnicity	83.9	84.6	0.6	7.1	112	0.927
Born Outside the U.S.	87.3	89.1	1.8	5.3	149	0.740
Born in the U.S.	86.4	87.0	0.6	4.1	275	0.887
English Isn't Primary Language	89.5	92.7	3.3	6.5	79	0.619
English Is Primary Language	86.1	85.9	-0.1	3.8	345	0.975
20 years or more in Seattle/King County	89.4	86.2	-3.2	4.8	182	0.509
Less than 20 years in Seattle/King County	84.7	87.9	3.2	4.5	242	0.477
Started in High Opportunity Tract	95.0	95.5	0.5	6.8	42	0.946
Didn't Start in High Opportunity Tract	87.2	86.1	-1.2	4.0	292	0.766
Income ≤ $19,000 (sample median)	86.5	85.7	-0.8	4.7	220	0.866
Income > $19,000 (sample median)	87.9	89.6	1.8	4.4	204	0.693
No College	86.1	87.5	1.4	4.6	225	0.754
Some College or More	87.3	86.7	-0.6	4.8	196	0.897
Currently Working	88.6	87.1	-1.5	4.2	240	0.729
Currently Not Working	83.8	87.5	3.7	5.3	184	0.479
Uses Child Care	87.0	85.2	-1.8	4.9	209	0.716
Doesn't Use Childcare	86.4	88.2	1.8	4.6	215	0.692
C. By Perceptions About Moving at Baseline						
Feels Good About Moving to an Opportunity Area	87.8	91.1	3.3	3.5	304	0.344
Doesn't Feel Good About Moving to an Opportunity Area	83.9	78.2	-5.7	7.2	120	0.426
Satisfied With Current Neighborhood	86.8	87.3	0.5	4.8	201	0.912
Unsatisfied/Indifferent With Current Neighborhood	87.9	86.7	-1.2	4.9	195	0.807
Sure Wants to Leave Current Neighborhood	87.9	87.6	-0.3	4.6	210	0.953
Sure Wants to Stay in Current Neighborhood or Indifferent	87.8	86.2	-1.6	4.9	185	0.741
Feels Good About Moving to Racially Different Neighborhood	88.7	87.1	-1.6	3.6	331	0.654
Feels Bad/Indifferent About Moving to Racially Different Neighborhood	76.5	87.5	11.0	8.7	91	0.205
Sure Could Pay for Moving Expenses	83.3	85.8	2.4	6.7	122	0.714
Not Sure Could Pay for a Moving Expenses	88.3	87.8	-0.5	3.8	302	0.890
Sure Could Find a New Place	86.5	89.3	2.7	4.5	207	0.544
Not Sure Could Find a New Place	87.0	86.2	-0.9	5.3	171	0.872
D. By Children's Characteristics						
Mean Children Age at or Above Median (6.3 years)	84.7	86.1	1.4	5.0	206	0.781
Mean Children Age Below Median (6.3 years)	88.8	87.9	-0.9	4.6	206	0.845
More than 2 Children	89.6	84.7	-4.9	5.8	137	0.406
2 Children or Less	85.4	88.8	3.4	4.0	288	0.403
Considering Different Schools	85.3	84.6	-0.7	5.2	192	0.894
Not Considering Different Schools	86.9	84.9	-2.0	5.9	137	0.741

Notes: This table replicates Table 3 using an indicator for leasing up anywhere using one's voucher as the outcome instead of leasing up in a high-opportunity area. See Table 3 for details. **** p<0.01, ** p<0.05, * p<0.1*

Appendix Table 9
Calculation of Lifetime Earnings Impact of CMTO

(1) Average Upward Mobility (in ranks) in control group destinations	44.55
(2) [Translated to 2015 USD]	$35,979
(3) Treatment effect (TOT) on Tract-Level Upward Mobility (in ranks)	4.20
(4) Estimated causal effect of move from birth [= 62% of (3)]	2.60
(5) Expected Upward Mobility (in ranks) for treated [= (1) + (4)]	47.16
(6) [Translated to 2015 USD]	$38,942
(7) Causal effect of CMTO on yearly income at age 34 (2015 USD) [= (6) - (2)]	$2,963
(8) Avg family income at age 34 (2015 USD, from ACS)	$64,160
(9) Undiscounted income over the lifecycle from ACS, assuming 1% income growth (2015 USD)	$4,585,149
(10) Impact as % of avg family income in ACS [= (7) / (8)]	4.62%
(11) Causal treatment effect on undiscounted lifetime income (USD) [= (10) * (9)]	$211,730
(12) Avg undiscounted income over the lifecycle for low-income children in Seattle area (2015 USD)	$2,539,340
(13) Impact as % of avg low-income lifetime earnings in Seattle area [= (11) / (12)]	8.34%
(14) Discounted income over the lifecycle from ACS, 1% income growth (2015 USD)	$1,825,930
(15) Causal treatment effect on discounted lifetime income (USD) [= (10) * (14)]	$84,316

Notes: This table outlines the steps we use to translate our estimated treatment effects into lifetime earnings effects for the children whose families moved to high-opportunity neighborhoods as a result of Phase 1 of CMTO. We estimate the impact on incomes for a child that moved to a high-opportunity neighborhood at birth. Row (1) presents the average level of upward mobility in the destination tracts to which families in the control group moved using data from the Opportunity Atlas (i.e. the family income rank at age 34 of children in the 1978-83 birth cohorts, based on their childhood neighborhood, for families at the 25th percentile of the parental income distribution). Row (2) translates this level into 2015 USD by mapping this percentile to dollars using the national income distribution for 31-37 year olds in 2014-2015. Row (3) presents the treatment effect of CMTO on upward mobility for those who moved to an opportunity neighborhood (TOT). Row (4) multiplies this effect by 62%, based on the estimate from Chetty et al. (2018) that children who move at birth to a neighborhood with 1 rank higher upward mobility grow up to have an income rank that is 0.62 units higher. Row (5) presents the sum of this effect and the control group mean. Row (6) translates this into 2015 USD using the same approach as in Row (2). Row (7) computes the difference in expected income levels between the treated and untreated groups. Row (8) reports the mean family income (individual income plus spousal income for married couples, to match our measure of family income in the Opportunity Atlas) from the 2015 ACS at age 34. Row (9) presents the undiscounted sum of mean family income in the 2015 ACS, summing across all ages and assuming 1% wage growth from birth. Row (10) computes the percentage impact on incomes by dividing (7) by (8). Row (11) computes the impact on lifetime undiscounted income assuming the percentage impact on income over the life cycle is constant. Row (12) reports an estimate of the undiscounted mean family income over the lifecycle for children born to parents in the 25th percentile of the national income distribution who grew up in a low-opportunity area in Seattle and King County. We estimate this value by mutiplying the mean income for children growing up in low-income (25th percentile) families in low-opportunity areas in Seattle and King County by row (9) divided by row (8). Row (13) reports the earnings gain from moving to a high-opportunity area as a percentage of mean income for children growing up in low-income families in low-opportunity areas in Seattle and King County by dividing (11) by (12). Rows (14) and (15) compute the impact on discounted lifetime income. Row (14) reports mean lifetime income in the ACS discounted over the life cycle at 2%, assuming 1% income growth from birth. Row (15) reports the impact on discounted lifetime income, again assuming the percentage impact over the life cycle is constant.

Appendix Table 10
Heterogeneity of Treatment Effects on Fraction Who Move to High-Opportunity Areas - Phase 2

	Share Moving to High-Opportunity Area (%), Unconditional on Lease-Up									
		Treatment Arm 1			Treatment Arm 2			Treatment Arm 3		
	Control Mean	Treatment Effect	SE	N	Treatment Effect	SE	N	Treatment Effect	SE	N
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Pooled										
All Families	12.50	8.88	6.40	137	13.82**	6.52	144	40.78***	6.95	149
All Families (Controls)	12.50	5.46	7.50	137	19.29***	7.19	144	46.98***	8.09	149
B. By Head of Household Demographic Characteristics										
Black Non-Hispanic	12.82	9.62	9.18	70	20.12**	9.70	75	42.33***	10.64	70
White Non-Hispanic	15.79	15.38	14.57	35	7.19	13.04	37	36.91**	15.24	36
Other Race/Ethnicity	7.14	4.40	10.31	32	9.64	12.12	32	45.53***	11.63	43
Born Outside the U.S.	11.76	21.14	14.32	32	23.46*	12.59	39	20.63*	11.90	45
Born in the U.S.	12.96	5.34	7.25	104	11.37	7.80	104	52.20***	8.32	103
English Isn't Primary Language	9.09	18.75	18.63	18	41.38***	15.75	25	46.87***	16.75	24
English Is Primary Language	13.33	7.49	6.98	118	9.19	7.16	118	39.70***	7.74	124
20 Years or More in Seattle/King County	9.68	2.12	7.83	65	16.19	9.96	62	43.93***	11.11	59
Less Than 20 Years in Seattle/King County	14.63	17.13*	9.85	72	12.64	8.90	81	38.58***	9.11	90
Started in High Opportunity Tract	0.00	83.33***	17.57	8	33.33	22.22	8	100.00***	0.00	6
Didn't Start in High Opportunity Tract	11.54	8.46	11.17	46	19.23*	11.23	52	36.74***	11.41	55
Income ≤ $19,000 (Sample Median)	15.79	5.60	9.26	76	14.37	10.51	68	31.26***	10.32	76
Income > $19,000 (Sample Median)	8.82	13.18	9.10	60	16.05*	8.24	75	50.81***	9.30	73
No College	4.76	15.16**	7.56	77	24.18***	8.21	80	36.80***	9.22	76
Some College or More	23.33	-0.17	11.05	60	-0.25	10.56	64	39.45***	10.94	73
Currently Working	5.56	18.09**	7.84	68	16.22**	7.37	82	43.47***	8.39	83
Currently Not Working	19.44	-1.39	9.57	69	16.50	11.83	61	42.95***	10.99	66
Uses Child Care	6.67	8.42	8.21	56	15.43*	8.72	61	41.79***	10.83	57
Doesn't Use Childcare	17.07	8.93	9.41	80	13.25	9.44	81	38.68***	9.34	91
C. By Perceptions About Moving at Baseline										
Feels Good About Moving to an Opportunity Area	17.39	0.29	8.75	80	21.29**	10.68	77	58.88***	9.05	84
Doesn't Feel Good About Moving to an Opportunity Area	3.85	21.86***	8.35	57	12.51*	6.98	67	26.98***	8.46	65
Satisfied With Current Neighborhood	9.68	19.72*	10.24	58	16.65*	9.25	63	41.70***	9.71	70
Unsatisfied/Indifferent With Current Neighborhood	17.65	-8.39	8.49	66	6.05	9.96	67	34.25***	11.40	65
Sure Wants to Leave Current Neighborhood	22.86	-6.68	10.01	65	8.14	11.35	64	31.40**	12.44	62
Sure Wants to Stay in Current Neighborhood or Indifferent	3.33	14.68**	7.16	59	17.18**	7.61	66	47.25***	8.65	71
Feels Good About Moving to Racially Different Neighborhood	13.64	5.95	7.94	91	13.22	8.85	85	41.87***	8.75	96
Feels Bad/Indifferent About Moving to Racially Different Neighborhood	12.00	19.47	13.28	41	15.15	10.46	54	35.05***	12.35	48
Sure Could Pay for Moving Expenses	13.64	-6.58	10.02	36	12.17	12.34	42	37.95***	14.03	41
Not Sure Could Pay for a Moving Expenses	12.24	13.45*	7.81	100	14.41*	7.73	101	40.79***	8.16	107
Sure Could Find a New Place	10.00	15.63*	8.78	76	17.80**	8.99	76	48.77***	9.24	81
Not Sure Could Find a New Place	21.74	-9.25	10.79	46	3.27	12.19	51	22.44*	12.52	53
D. By Children Characteristics										
Mean Children Age at or Above Median (6.3 years)	23.53	-4.55	10.66	60	-2.39	9.98	72	38.17***	10.69	76
Mean Children Age Below Median (6.3 years)	2.78	22.53***	7.88	72	30.84***	8.89	69	38.22***	8.92	71
More than 2 Children	16.00	-3.72	11.20	40	2.91	10.08	53	43.01***	10.77	59
2 Children or Fewer	10.64	12.76*	7.31	97	21.07**	8.41	91	40.92***	9.01	90
Considering Different Schools	21.21	-3.29	10.51	58	5.87	10.32	70	48.38***	10.99	66
Not Considering Different Schools	3.85	16.14	10.24	45	26.77**	10.59	49	34.80***	10.02	54

Notes: This table reports treatment effects by subgroup for each of the Phase 2 treatment arms: the incentivized information group (Treatment Arm 1), the reduced support services group (Treatment Arm 2), and the full customized services group (Treatment Arm 3), as in Table 3 for Phase 1. Each treatment effect is estimated using a separate regression of an indicator for leasing up in a high-opportunity area on the treatment group indicator and a PHA fixed effect. In row 2, we additionally control for the baseline characteristics shown in Table 1. All regressions use robust standard errors. *** *p<0.01,* ** *p<0.05,* * *p<0.1*

Appendix Table 11
Treatment Effects on Neighborhood Characteristics - Phase 2

			Treatment Arm 1		Treatment Arm 2		Treatment Arm 3	
	Control Mean	Control Standard Deviation	Treatment Effect	SE	Treatment Effect	SE	Treatment Effect	SE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tract Income and Other Characteristics								
Median HH Income (2017)	70,719.16	21,339.38	-5,546.22	4,185.60	-1,178.75	4,242.33	11847.97**	4,838.56
% Labor Force Participation (2010)	0.70	0.06	-0.01	0.01	-0.01	0.01	-0.01	0.01
% Poverty (2017)	13.70	8.27	2.08	1.60	0.67	1.47	-0.28	1.50
Median Home Value (2010)	357,022.03	80,255.34	-18,000.00	15,158.81	-409.97	17,437.43	66742.63***	22,028.05
Census Mail Response Rate	76.96	3.96	0.07	0.76	0.23	0.76	0.99	0.77
Theil Index of Racial Segregation	0.14	0.04	-0.02*	0.01	-0.02**	0.01	-0.02**	0.01
# Jobs For No HS Degree, 1 Mile Radius	160.19	252.19	82.82	69.65	63.02	76.29	67.91	57.43
Mean Commute Time in 2000 (Minutes)	29.37	4.43	-0.48	0.66	-0.76	0.61	-1.53**	0.66
% Commute < 15 Mins	16.10	6.45	2.71*	1.43	0.58	1.07	3.11**	1.22
Distance to City Hall of Largest City in CZ (Miles)	11.36	7.33	-0.50	1.25	-0.94	0.93	-1.30	1.21
Distance from Origin Neighborhood (Miles)	5.27	8.20	4.16*	2.35	1.79	1.78	4.50**	1.99
Resident Demographics								
% White (2017)	56.00	16.04	-2.73	2.96	-3.07	2.93	-1.06	3.06
% Black (2017)	9.95	8.50	-0.40	1.43	-0.17	1.45	-1.57	1.39
% Hispanic (2017)	11.92	7.68	1.07	1.31	1.85	1.47	-0.94	1.35
% Foreign-Born (2016)	21.77	9.95	2.05	1.88	1.88	1.62	2.91	1.80
% Married (2010)	47.04	9.94	-1.94	1.73	-1.06	1.55	1.76	1.70
% of Children with Single Parents (2013-2017)	30.48	12.58	4.06*	2.32	0.67	2.26	-1.94	2.21
% >= College Education (2017)	39.87	16.37	-1.47	2.80	-0.31	3.04	7.13**	3.20
Population Density (2010, # People per Square Mile)	2,289.38	1,141.83	156.49	254.45	1.59	179.80	158.57	254.16
Children's Long-Term Outcomes								
Predicted Mean Individual Income Rank (p=25)	46.10	3.30	0.19	0.61	0.27	0.56	1.73***	0.61
Predicted Mean Household Income Rank (p=25)	44.51	4.19	-0.10	0.70	-0.04	0.66	1.67**	0.74
Predicted Mean Household Income Rank for White Children (p=25)	47.51	4.62	-0.51	0.88	-1.05	0.74	0.38	0.80
Teenage Birth Rate for Women (p=25)	18.95	8.41	0.05	1.44	1.52	1.49	-2.06	1.49
Incarceration Rate (p=25)	2.09	1.25	-0.23	0.21	0.41	0.28	-0.55**	0.23
Other Indices of Opportunity								
Kirwan Overall Child Opportunity Score	-0.10	0.35	0.00	0.07	0.01	0.07	0.19***	0.07
Kirwan Educational Subscore	-0.27	0.45	0.05	0.10	0.06	0.10	0.31***	0.11
Kirwan Health/Environment Subscore	-0.01	0.25	0.02	0.05	-0.02	0.05	0.12***	0.05
Kirwan Social/Economic Opportunity Subscore	-0.01	0.55	-0.08	0.10	0.00	0.09	0.14	0.09
HUD Transit Index	80.02	9.94	1.74	1.81	3.12**	1.46	1.02	1.64
Environmental Health Index	8.82	8.55	0.73	2.27	-1.50	1.66	1.91	2.31

Notes: This table shows the effects on a variety of neighborhood characteristics of each of the Phase 2 treatment arms: the incentivized information group (Treatment Arm 1), the reduced support services group (Treatment Arm 2), and the full customized services group (Treatment Arm 3), as in Table 2 for Phase 1. Each row of the table reports the control mean of the relevant outcome in the treatment and control groups as well as an estimate from a separate OLS regression of neighborhood characteristics on an indicator for treatment status. Each of the three treatment arm effects is estiatmated using a separate regression. All regressions include a PHA indicator and use robust standard errors. The control group mean is a raw mean while the treatment group mean is constructed as the control mean plus the treatment effect estimate. The share of workers with a short commute to work and mean commute time are constructed using tract-level data from table NP031B of the 2000 Decennial Census or tract-level data from table B08303 of the 2006-2010 American Community Survey, both obtained from the NHGIS database. Fraction with a short to commute to work is computed by taking the share of people who commute less than 15 minutes to work over all workers 16 years and over who did not work at home. Mean commute time is constructed using the share of workers commuting to work in specific bins (< 5 minutes, 5-9 minutes, 10-14 minutes, etc.), imputing the mean time commuted in a given bin (i.e. for 5-9 minutes, imputing mean commute time of 7 minutes), and then calculating a sum of imputed mean commute times within each bin weighted by the share commuting. *** *p<0.01*, ** *p<0.05*, * *p<0.1*

Appendix Table 12
Intervention Dosage: Treated Households' Usage of CMTO Services

	Pooled		Moved to Non-High-Opportunity Tract		Moved to High Opportunity Tract	
	N	Mean	N	Mean	N	Mean
	(1)	(2)	(3)	(4)	(5)	(6)
A. Usage of Search Assistance Services						
Total hours in contact with non-profit or PHA staff	221	5.99	75	4.47	118	7.05
Hours in contact non-profit or PHA staff per month	221	1.35	75	1.04	118	1.70
Percent that received search assistance	221	97.74	75	96.00	118	98.31
Percent that received rental application coaching	221	91.40	75	86.67	118	94.92
Percent that did a neighborhood tour	221	17.65	75	12.00	118	22.88
Percent that visited locations with non-profit staff	221	21.27	75	12.00	118	29.66
B. Linkage to Units and Landlords						
Percent linked to a unit through the MIS system	221	46.15	75	8.00	118	79.66
Percent linked to a unit of a landlord contacted by non-profit staff	221	27.60	75	5.33	118	46.61
C. Financial Assistance						
Percent that received any financial assistance (%)	221	63.80	75	28.00	118	95.76
Total amount of assistance among families that received financial assistance ($)	141	1651	21	261	113	1992
Percent that received screening fee assistance (%)	221	57.01	75	26.67	118	83.90
Amount of screening fee assistance among families that received screening fee assistance ($)	126	80	20	65	99	81
Percent that received deposit assistance (%)	221	50.68	75	1.33	118	93.22
Amount of deposit assistance among families that received deposit assistance ($)	112	1608	1	2200	110	1613

D. Correlations Between Usage of CMTO Services Among Families who Moved to High-Opportunity Areas

	Time Meeting with CMTO Staff	Financial Assistance	Unit Found Through Housing Locator
Time Meeting with CMTO Staff	1		
Financial Assistance	0.19	1	
Unit Found Through Housing Locator	0.11	-0.10	1

Notes: This table shows service usage statistics for families in the Phase 1 CMTO treatment group as recorded by the housing authorities and non-profit staff running the CMTO services. In Panel A, time meeting with CMTO staff was estimated based on the lengths of specific interactions, which includes in-person meetings and phone calls. The share of households receiving specific services was derived from contact logs between the non-profit staff and the households. Links to units and landlords come from the MIS platform set up to facilitate interactions between landlords, non-profit staff, and households. Financial assistance includes assistance to defray moving costs, such as screening fees, security deposits, and holding fees. In Columns 1 and 2, we pool all families in the treatment group. In Columns 3 and 4, we restrict the sample to treatment group families who moved to non-high-opportunity tracts. In Columns 5 and 6, we restrict the sample to treatment group families who moved to high-opportunity tracts. Panel D shows Pearson correlations between usage of different CMTO service categories among families in the treatment group who moved to high-opportunity areas.

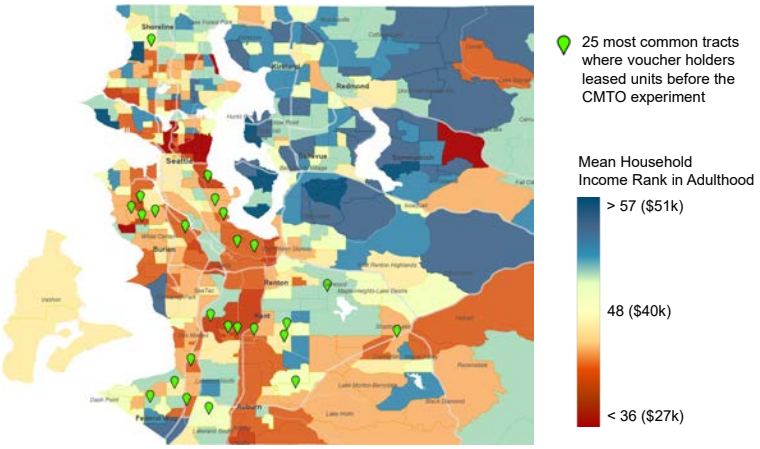
Appendix Table 13
Impacts of Financial Incentives: Difference-in-Difference Estimates Based on Payment Standard Reforms

Reform:	KCHA 5 Tier Voucher Payment Standard Reform				SHA Family Access Supplement			
Outcome:	% Moving to High Opportunity		Median 2 BR Rent in Destination Tract ($)		% Moving to High Opportunity		Median 2 BR Rent in Destination Tract ($)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DD Estimate	-3.592	-4.699	70.52		13.79***	13.82***	-22.31	-11.84
	(5.754)	(6.209)	(52.05)		(5.11)	(5.26)	(74.14)	(76.50)
Controls (Fixed Effects):								
Number of Children		X		X		X		X
Month Voucher Issued		X		X		X		X
Sample	KCHA and SHA Voucher Recipients with Children				All SHA Voucher Recipients			
Observations	533	528	323	534	534	534	414	414

Notes: This table shows difference-in-difference estimates of the effects of changes in payment standards on the rate at which families move to higher-opportunity or more expensive neighborhoods using the OLS regression specification in equation (2). Columns 1-4 estimate the effects of KCHA's 5-tier voucher payment standard introduced in March 2016, which increased payment standards in more expensive neighborhoods. We treat KCHA as the "treatment" group and SHA as the "control" group and use data on households with children who were issued a voucher in either KCHA or SHA between July 2015 and November 2016 to estimate these specifications. Columns 5-8 estimate the effects of SHA's Family Access Supplement (FAS), which provided higher payments for families with children moving to areas designated as "high opportunity" in CMTO and was introduced in February 2018. These specifications use data on households in SHA with and without children who were issued a voucher between August 2017 and October 2018, excluding those issued a voucher between February and April 2018, which is when the CMTO pilot took place (see Figure 11 and Section 7a for details). The dependent variable in Columns 1-2 and 5-6 is an indicator for moving to a "high opportunity" neighborhood, as defined in Figure 2 in the CMTO experiment. The dependent variable in Columns 3-4 and 7-8 is the median rent for two-bedroom units (based on the 2011-2015 American Community Survey) in the tract where households leased up, restricting the sample to households who leased up before their voucher expired. The odd numbered columns show the raw difference-in-difference estimates using the specification in equation (2), without any additional controls. The even numbered columns add a set of indicator variables for the number of children in the household and the month in which the voucher was issued. Robust standard errors are reported in parentheses. *** *p<0.01, ** p<0.05, * p<0.1*

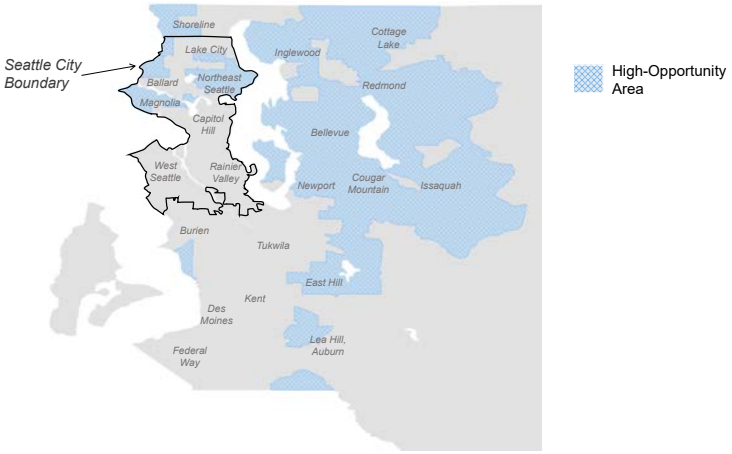
FIGURE 1: The Geography of Opportunity in Seattle

A. Fraction Who Lease Units in High-Opportunity Areas



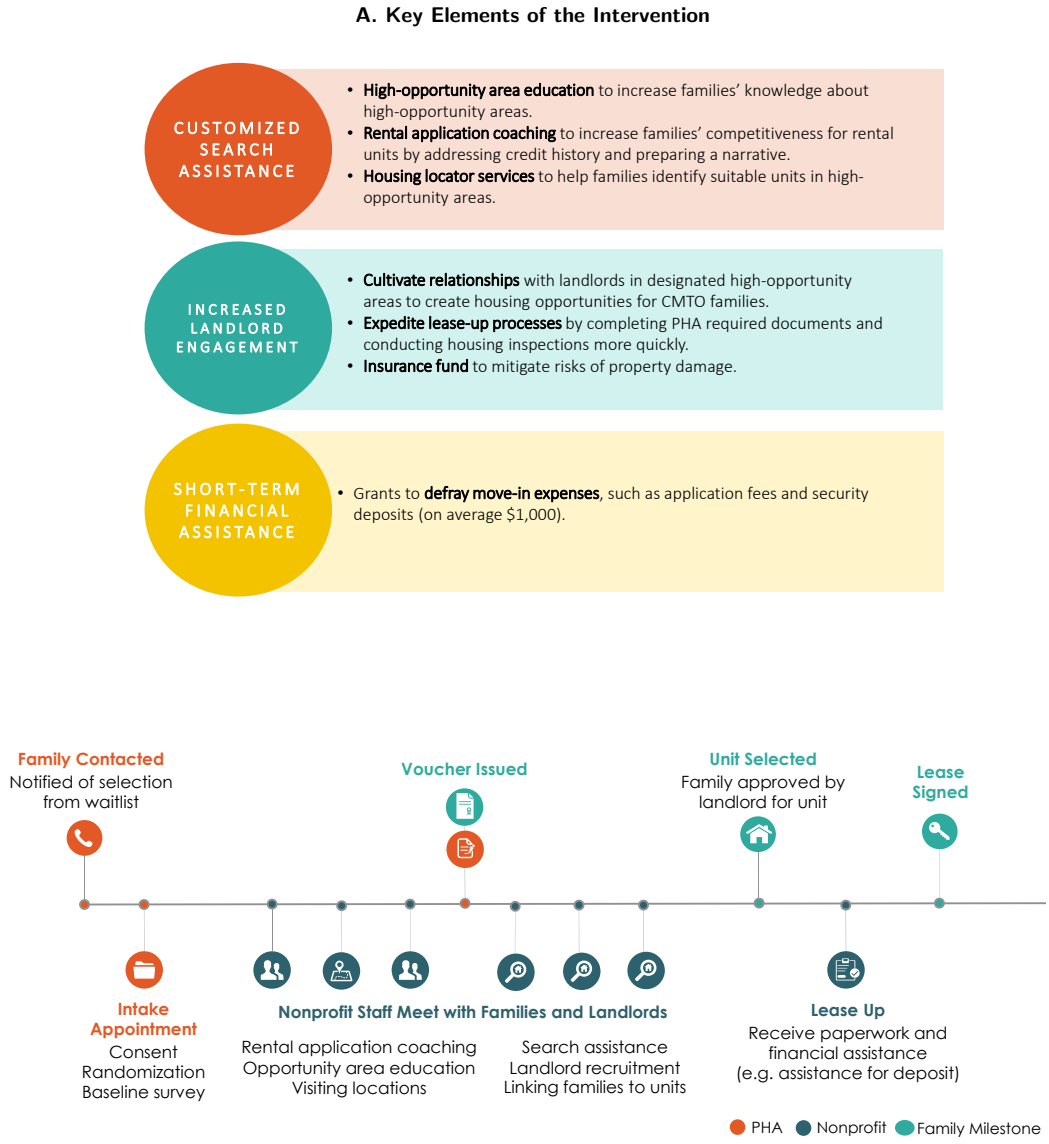
This map must be printed in color to be interpretable

B. CMTO High-Opportunity Neighborhoods



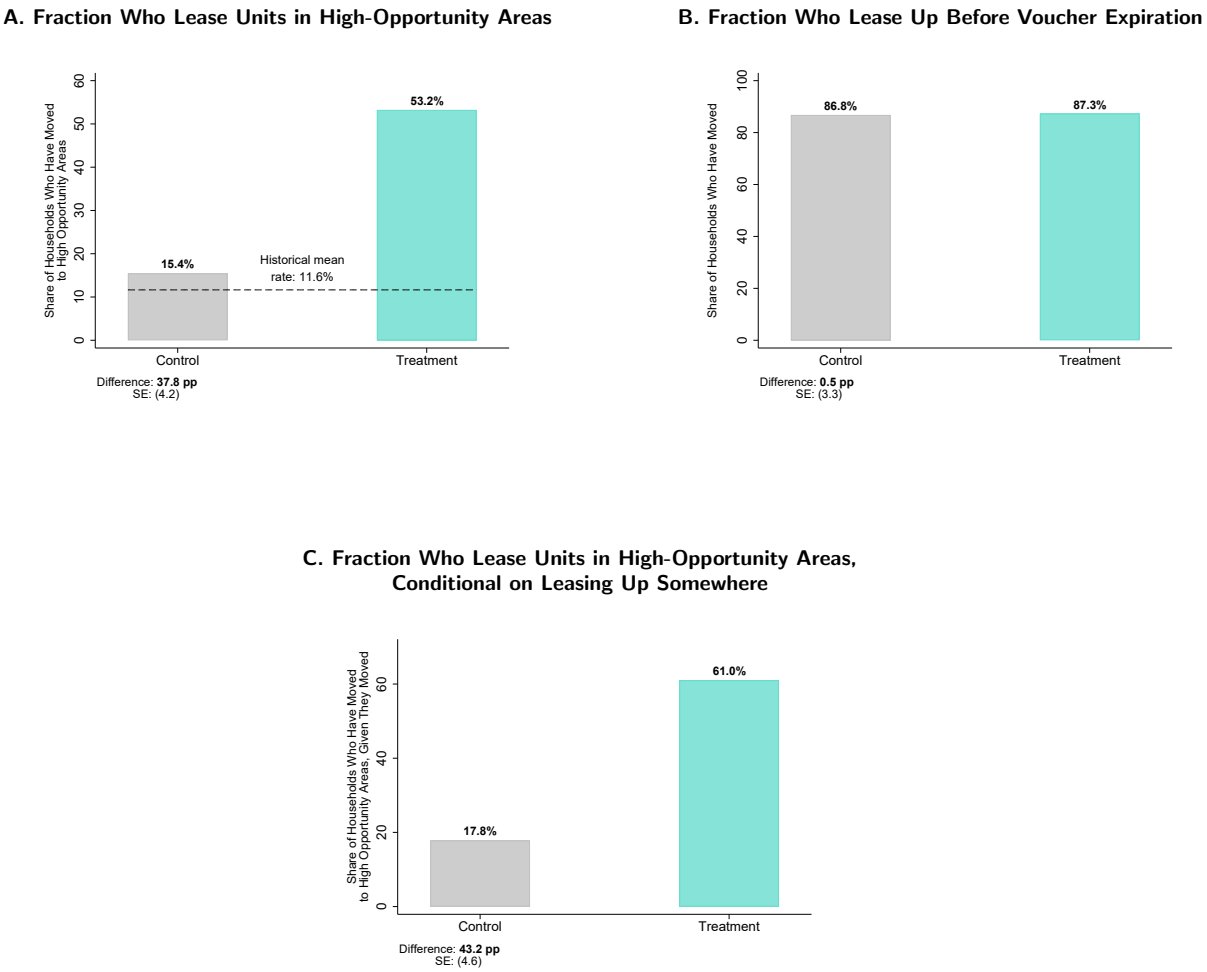
Notes: The map in Panel A shows the Opportunity Atlas estimates of upward mobility, defined as the mean predicted household income rank in 2014-15 for children whose parents were at the 25th percentile of the national household income distribution (an income of $27,000) for children in the 1978-1983 birth cohorts. This measure is estimated separately in each tract as described in Chetty, Friedman, Hendren, Jones, and Porter (2018). To facilitate interpretation of the percentile ranks, we also show the dollar value corresponding to each percentile shown in the legend based on the income distribution of children in the 1978-83 birth cohorts. Green dots show the 25 most common tracts where families with children leased units using a Housing Choice Voucher administered by the King County or Seattle housing authorities in 2015-2017, before the CMTO experiment (based on voucher household shares of the total tract population in 2010). Panel B shows the tracts designated as high-opportunity areas in the CMTO experiment, which are shown in blue cross-hatch, defined using the algorithm described in Appendix A.

FIGURE 2: CMTO Program Structure



Notes: Panel A of this figure describes the key components of the CMTO intervention. Panel B presents a stylized timeline of the treatment intervention from the perspective of a family in the treatment group.

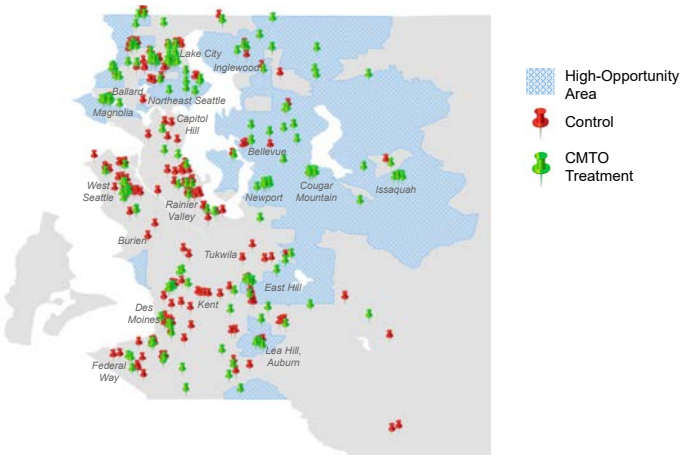
FIGURE 3: Treatment Effects of Bundled CMTO Program on Neighborhood Choice



Notes: This figure shows the treatment effects of the bundled CMTO program on families' neighborhood choices using data from the Phase 1 experimental sample. Panel A presents the treatment effect on the fraction who lease up a unit in a high-opportunity tract, as defined in Figure 1b. The dashed line in Panel A shows the fraction of voucher recipients who leased units in high-opportunity areas between 2015 and 2017. Panel B presents the treatment effect on leasing up in any area prior to voucher expiration. Panel C presents the treatment effect on leasing up in a high-opportunity area conditional on leasing up somewhere. In all panels, the control mean is calculated as the mean within households in the control group. Treatment effects, reported below each panel, are estimated using an OLS regression of the outcome on a treatment indicator and an indicator for being in KCHA/SHA (since randomization occurred within each housing authority). The treatment mean plotted is calculated as the control mean plus the estimated treatment effect. Standard errors reported are robust standard errors. Panels A and B use the full Phase 1 experimental sample, excluding five households whose voucher was transferred to a different public housing authority (other than KCHA/SHA). Panel C further restricts the sample to the 370 households who leased up somewhere using their voucher before it expired. All panels focus on the first lease-up after voucher issuance.

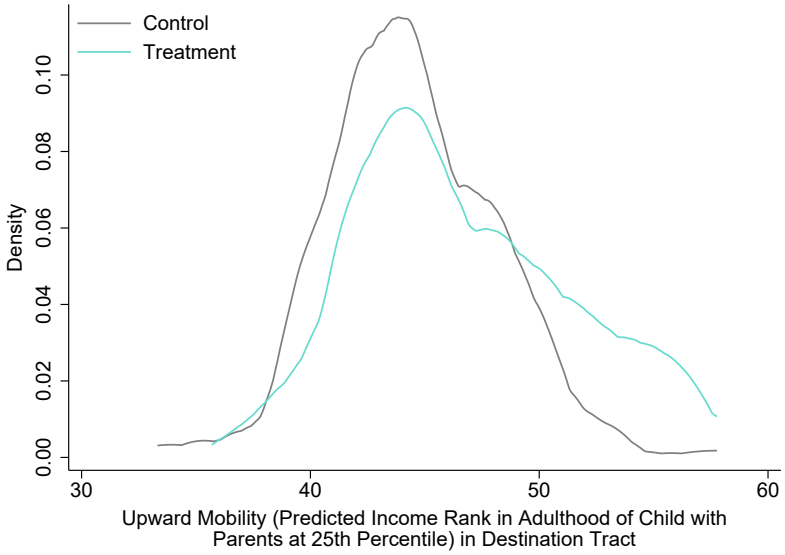
FIGURE 4: Neighborhoods Chosen by Households in Treatment vs. Control Group

A. Map of Destination Tracts for Voucher Recipients



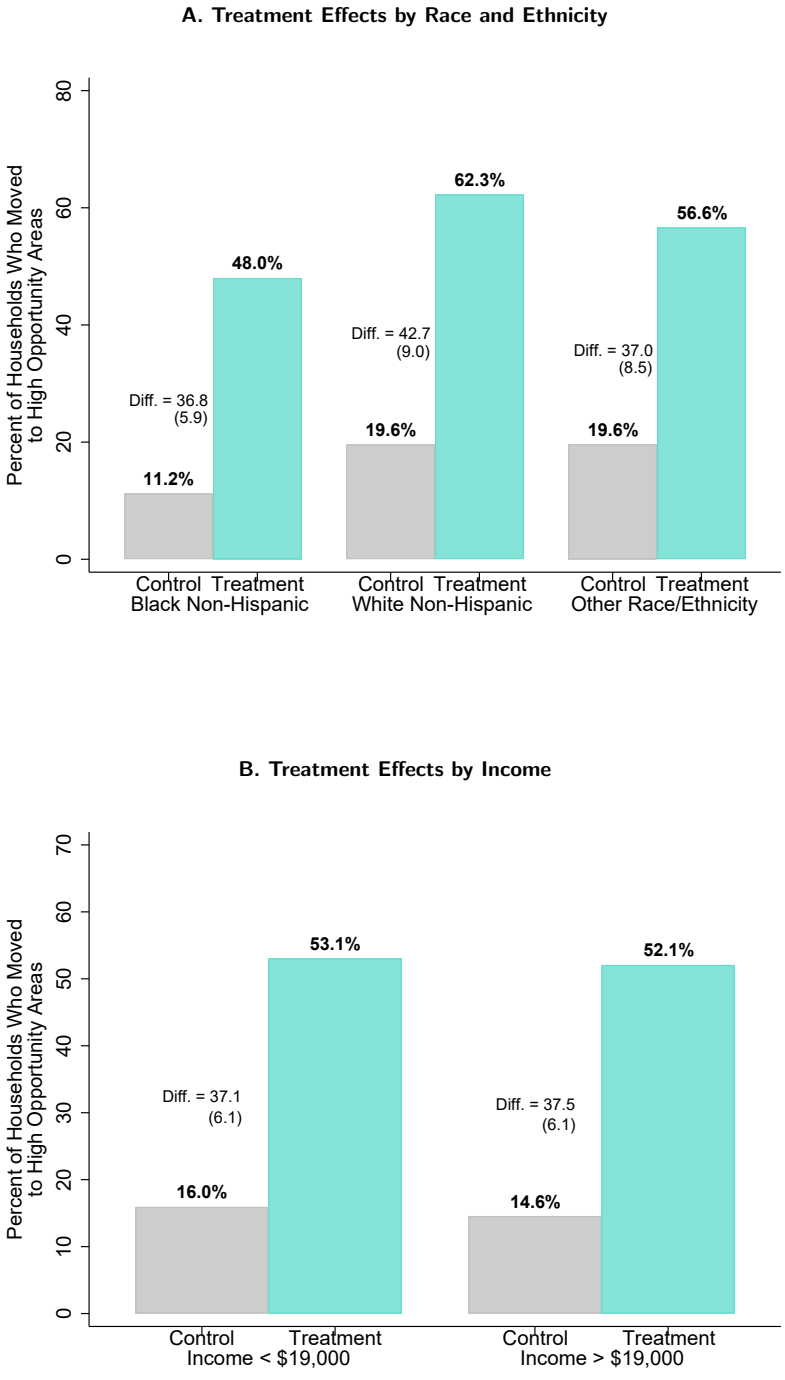
This map must be printed in color to be interpretable

B. Distribution of Tract-Level Upward Mobility in Destinations Chosen by Treatment vs. Control Group



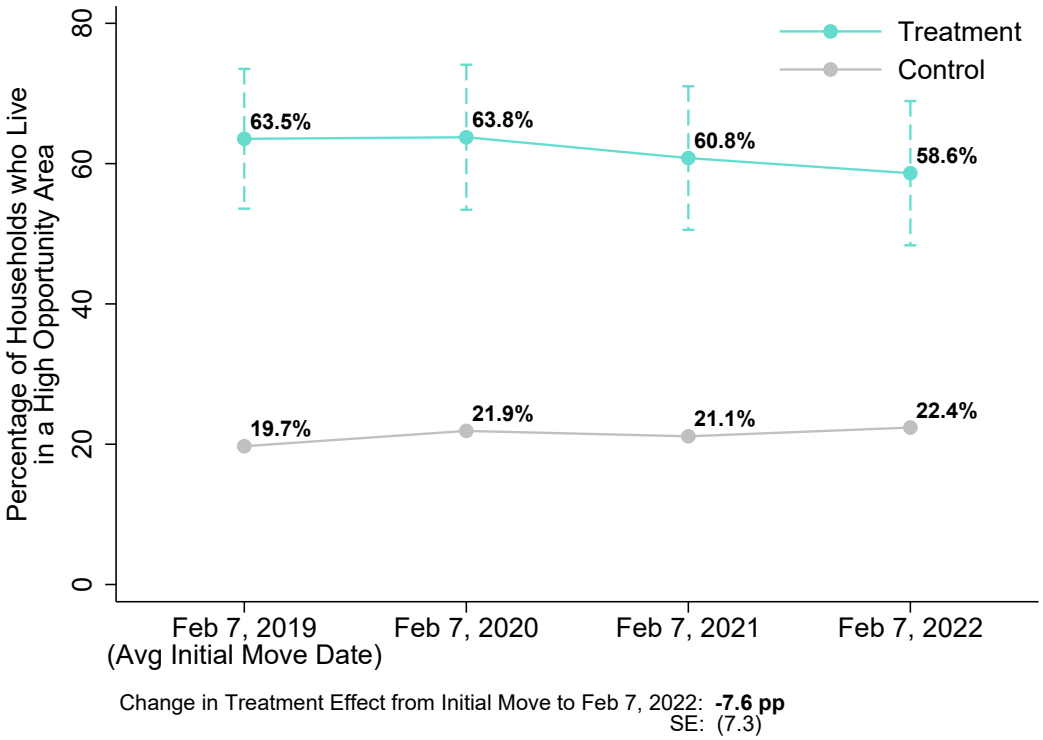
Notes: Panel A presents a map of the destination tracts for families in the CMTO treatment and control groups who moved using their vouchers in the first phase experiment. High-opportunity areas are highlighted in blue cross-hatch. We focus on the destination tract of the first lease-up after voucher issuance. We exclude 5 households whose vouchers were transferred to different public housing authorities (3 households) or who used their vouchers to lease up units outside of King County (2 households). To protect confidentiality, we add a small amount of random noise to the destination tract centroids shown in the maps. Panel B plots the distribution of upward mobility (based on the Opportunity Atlas estimates shown in Figure 1a) in the tracts to which families in the control and CMTO treatment groups move using their vouchers. We focus on upward mobility in the tract of first lease-up after voucher issuance, restricting the sample to households who leased up. Bandwidths for the kernel densities are calculated to minimize integrated square error assuming the data is Gaussian and a Gaussian kernel is used.

FIGURE 5: Heterogeneity in Treatment Effects



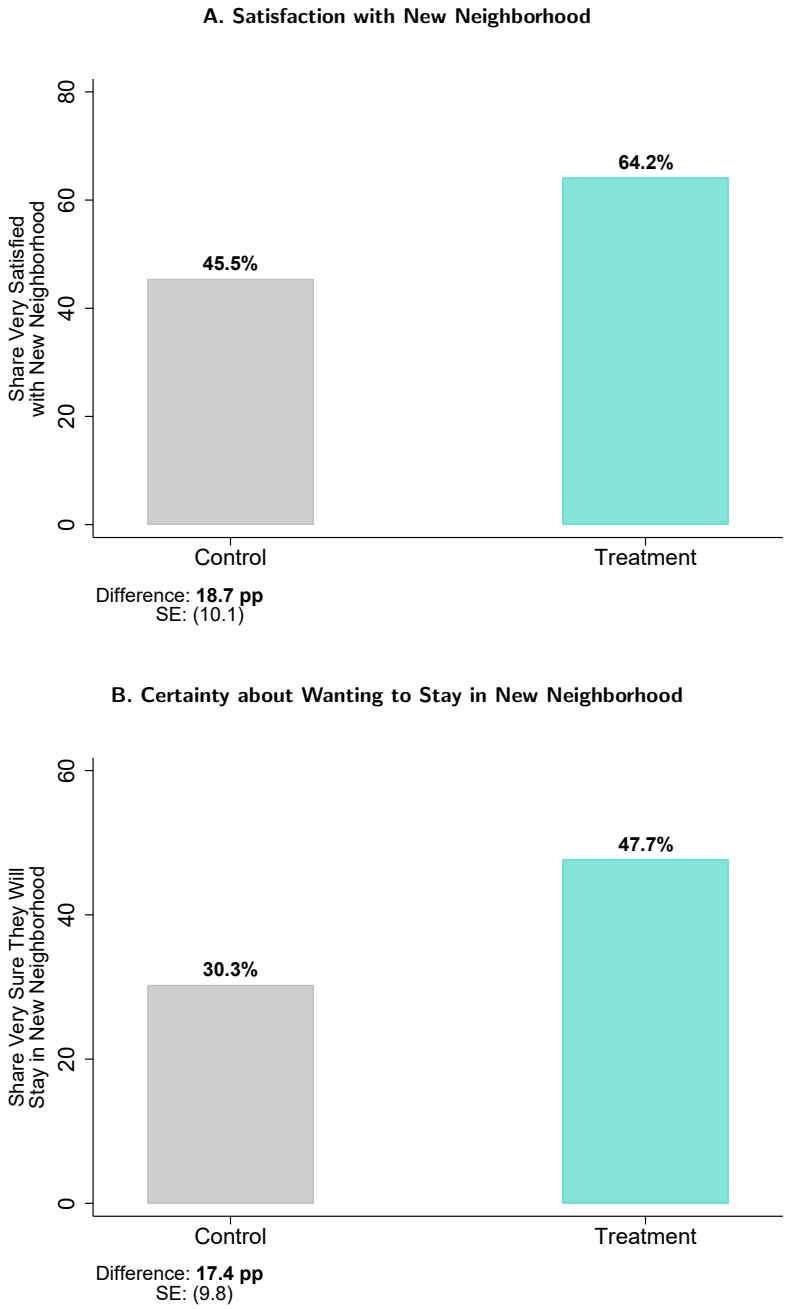
Notes: This figure presents estimates of treatment effects on the share of households moving to high-opportunity areas by race/ethnicity (Panel A) and baseline income level (Panel B) of the voucher recipient using the Phase 1 experimental sample. Treatment and control means are estimated separately within each subgroup following exactly the same method used to construct the pooled estimates reported in Panel A of Figure 3; see notes to that figure for further details. Panel A uses the 98% of participants who report their race and Panel B uses the 99% who report their income. The cutoff used in Panel B ($19,000) to divide the two groups corresponds to the median income of the participants in the experiment.

FIGURE 6: Persistence of Treatment Effects on Neighborhood Choice



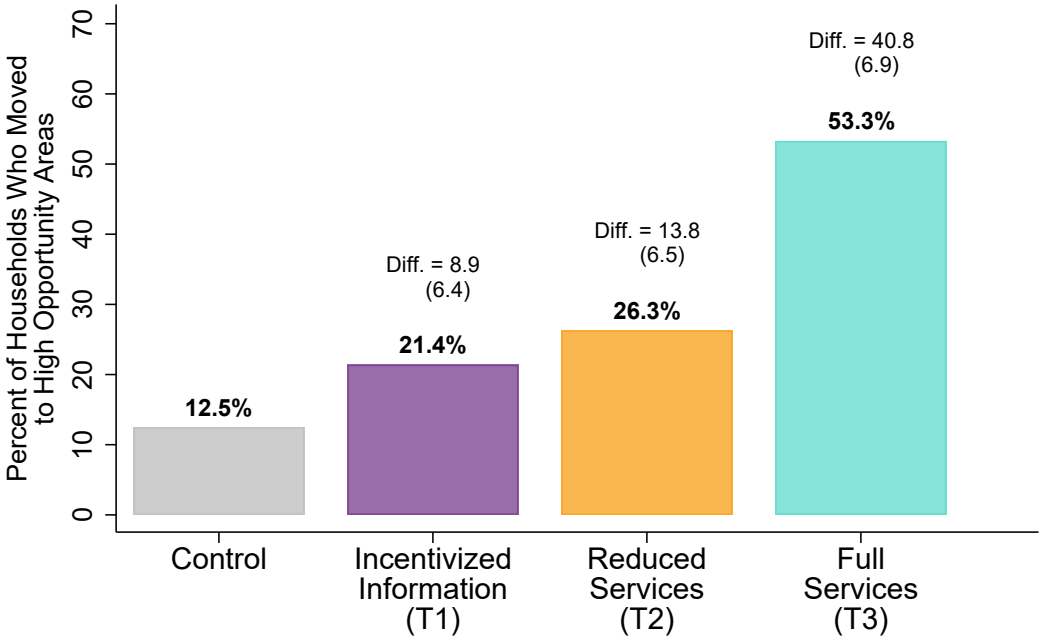
Notes: This figure examines whether the CMTO treatment has persistent effects on the share of families who live in high-opportunity areas. It plots the fraction of families in the first phase experimental sample who initially leased a unit in a high-opportunity area (whose average lease-up date was February 7, 2019) alongside the fraction who live in a high-opportunity area as of February 7, 2020, February 7, 2021, and February 7, 2022. The figure also shows 95% confidence intervals for each of the treatment effect estimates. Treatment and control means are estimated among the subsample of households who leased up following exactly the same method used to construct the pooled estimates reported in Panel C of Figure 3; see notes to that figure for further details. We exclude households whose location we cannot track as of February 7, 2022 because their voucher was transferred to another public housing authority or because they ended their participation in the voucher program entirely. We find no significant differences in the likelihood of voucher transfer or termination of program participation between the treatment and control groups.

FIGURE 7: Treatment Effects on Post-Move Neighborhood Satisfaction



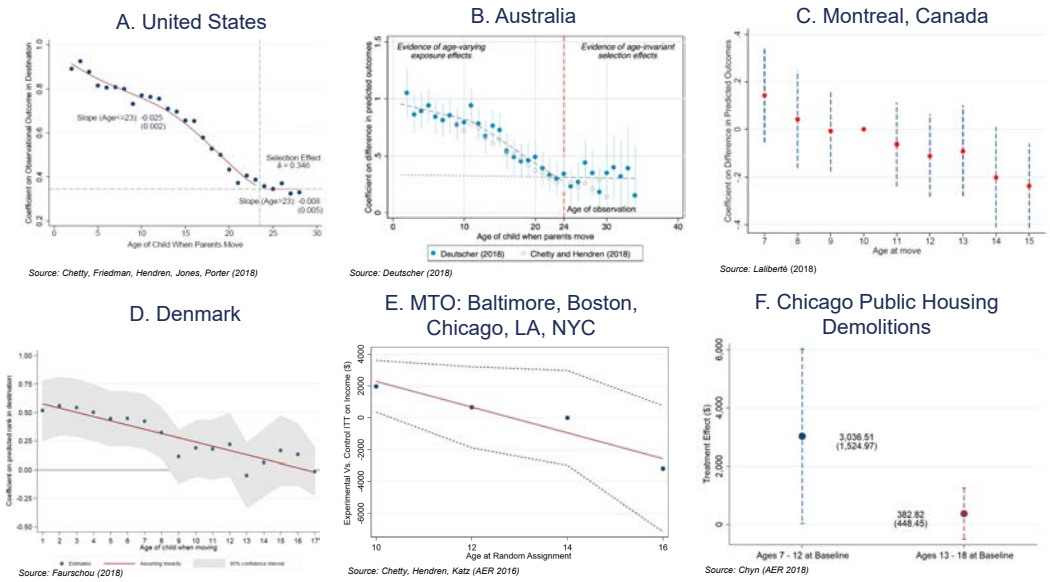
Notes: This figure shows treatment effects using data from a follow-up qualitative survey administered to a random sample of participants in the Phase 1 experiment. Panel A shows treatment effects on measures of neighborhood satisfaction. Participants were asked, "Which of the following statements best describes how satisfied you are with your current neighborhood? 1. Very Satisfied - 2. Somewhat satisfied - 3. In the middle - 4. Somewhat dissatisfied - 5. Very dissatisfied - 6. (No Answer)." Panel B presents measures of the certainty with which participants want to stay in their new neighborhood. Participants were asked, "Which of the following statements best describes how you feel about staying in your current neighborhood? - 1. Very sure I want to stay - 2. Somewhat sure I want to stay - 3. In the middle - 4. Somewhat sure I want to move to a different neighborhood - 5. Very sure I want to move to a different neighborhood - 6. (No Answer)." The outcomes in each panel are the fraction of respondents who give an answer of "1" to the relevant question. Treatment and control means are estimated among the subsample of households who leased up and were surveyed post-lease-up, following exactly the same method used to construct the pooled estimates reported in Panel C of Figure 3; see notes to that figure for further details. For the full distribution of responses to these two questions, see Appendix Figure 6.

FIGURE 8: Treatment Effects of Phase Two Interventions on Share of Families who Move to High-Opportunity Areas



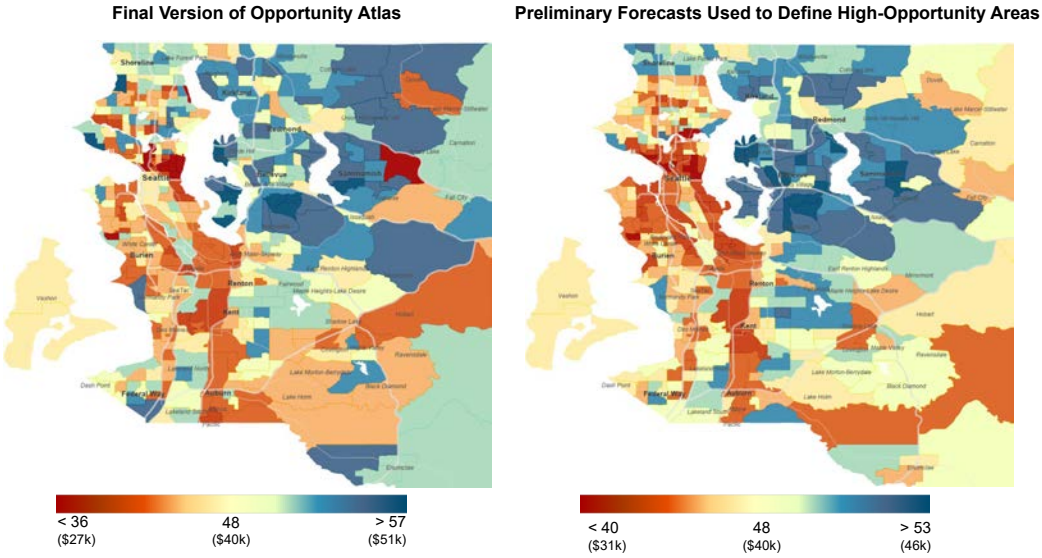
Notes: This figure shows the treatment effects of the Phase 2 interventions on the fraction who lease up a unit in a high-opportunity area, as defined in Figure 2. The control mean is calculated as the mean within households in the control group. Treatment effects are estimated using an OLS regression of the outcome on a treatment indicator and an indicator for being in KCHA/SHA (since randomization occurred within each housing authority). Each of the three treatment effects is estimated using a separate regression, and each treatment mean plotted is calculated as the control mean plus the estimated treatment effect. Standard errors reported are robust standard errors. This figure uses the full Phase 2 experimental sample and focuses on the first lease-up after voucher issuance.

APPENDIX FIGURE 1: Causal Effects of Moving to a Better Neighborhood by Age at Move: Evidence from Prior Research



Notes: This figure reproduces estimates from a recent set of papers estimating the causal effects of the neighborhood in which a child grows up on his or her outcomes in adulthood. Each panel depicts the causal effect of moving to an area with better observed outcomes, by the age at which children make that move. Panels A-D all use variants of the movers research design developed in Chetty and Hendren (2018) to estimate childhood exposure effects. Panel A presents tract-level estimates of exposure effects on income in the U.S. from Chetty, Friedman, Hendren, Jones and Porter (2018). Panel B presents estimates of exposure effects on income in Australia from Deutscher (2018). Panel C presents estimates of exposure effects on university enrollment in Montreal, Canada from Laliberté (2018). Panel D presents exposure effect estimates on income in Denmark from Faurschou (2018). Panel E shows treatment effects on income in adulthood by age at move from the Moving to Opportunity experiment studied in Chetty, Hendren and Katz (2016). Panel F shows Chyn's (2018) estimates of the effect of moving to a better neighborhood on income in adulthood by age at move, exploiting the demolition of public housing projects as a quasi-experiment.

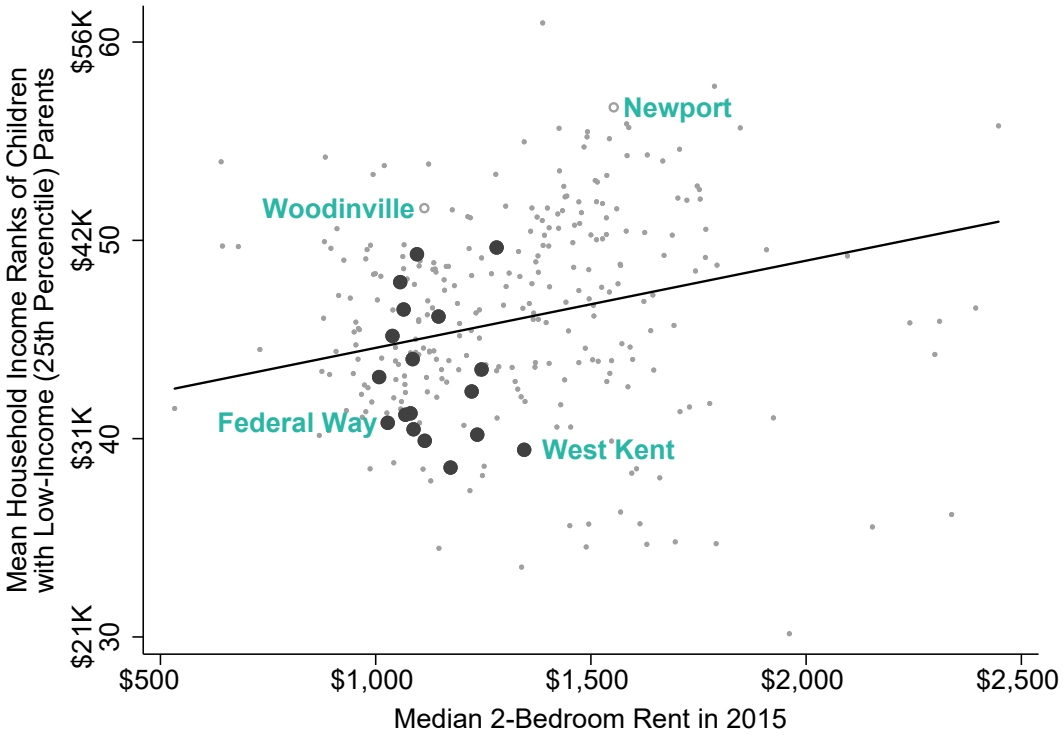
APPENDIX FIGURE 2: Preliminary vs. Final Versions of Opportunity Atlas Upward Mobility Measures



These maps must be printed in color to be interpretable

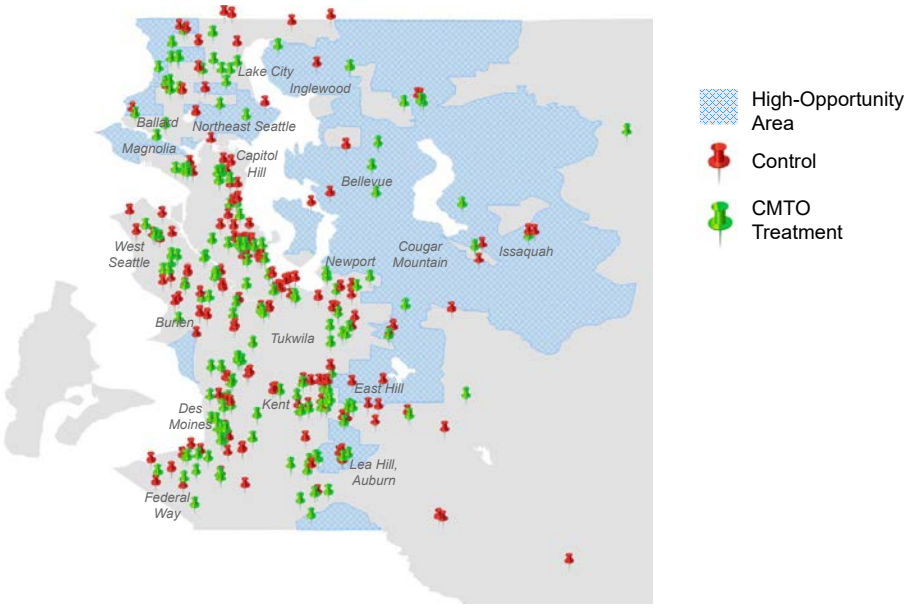
Notes: This figure compares the final version of the upward mobility measures from the Opportunity Atlas (shown in Figure 1a) – which are the statistics we use to measure the impacts of the CMTO intervention – to the preliminary forecasts that we used to define the "high opportunity" neighborhoods shown in Figure 1b. See notes to Figure 1 for details on the definition of upward mobility, Chetty et al. (2018) for details on the construction of the final Opportunity Atlas measure, and Appendix A for details on how the preliminary forecasts of upward mobility were constructed.

APPENDIX FIGURE 3: Upward Mobility vs Median Rent, by Tract



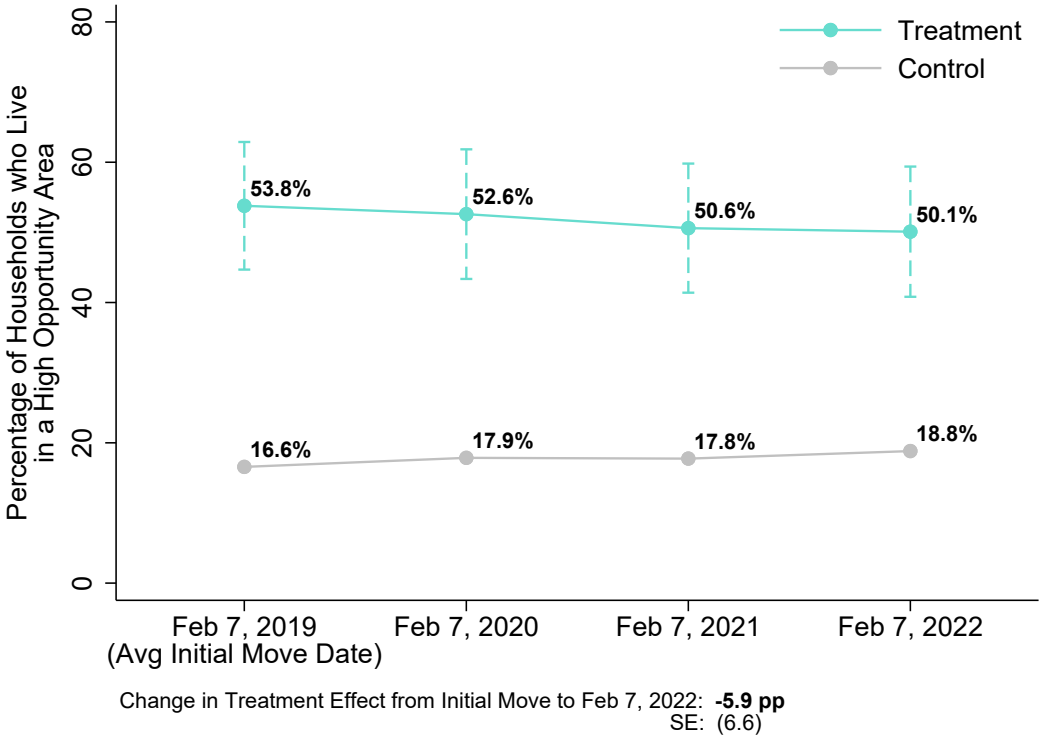
Notes: This figure presents a scatter plot of upward mobility in each tract vs. median rent for two-bedroom, renter-occupied units surveyed in the 2011-2015 American Community Survey. The inner numbers on the vertical axis show the Opportunity Atlas estimates of mean household income ranks depicted in Figure 1a, while the outer numbers on the vertical axis convert those ranks to 2015 dollars based on the income distribution for children in the 1978-83 birth cohorts. The darker points show 18 of the 25 tracts highlighted in Figure 1a, which include Federal Way and West Kent (seven of the 25 most common tracts are not shown due to missing rental data). The black best-fit line is estimated using a regression of upward mobility on median rent for two-bedroom homes, weighted by the number of children growing up in households below the 50th percentile of the national income distribution in each tract. Woodinville and Newport, denoted by hollow points, are examples of tracts with rents comparable to Federal Way and West Kent but offer much better prospects for upward mobility for children.

APPENDIX FIGURE 4: Map of Origin Tracts for Voucher Recipients



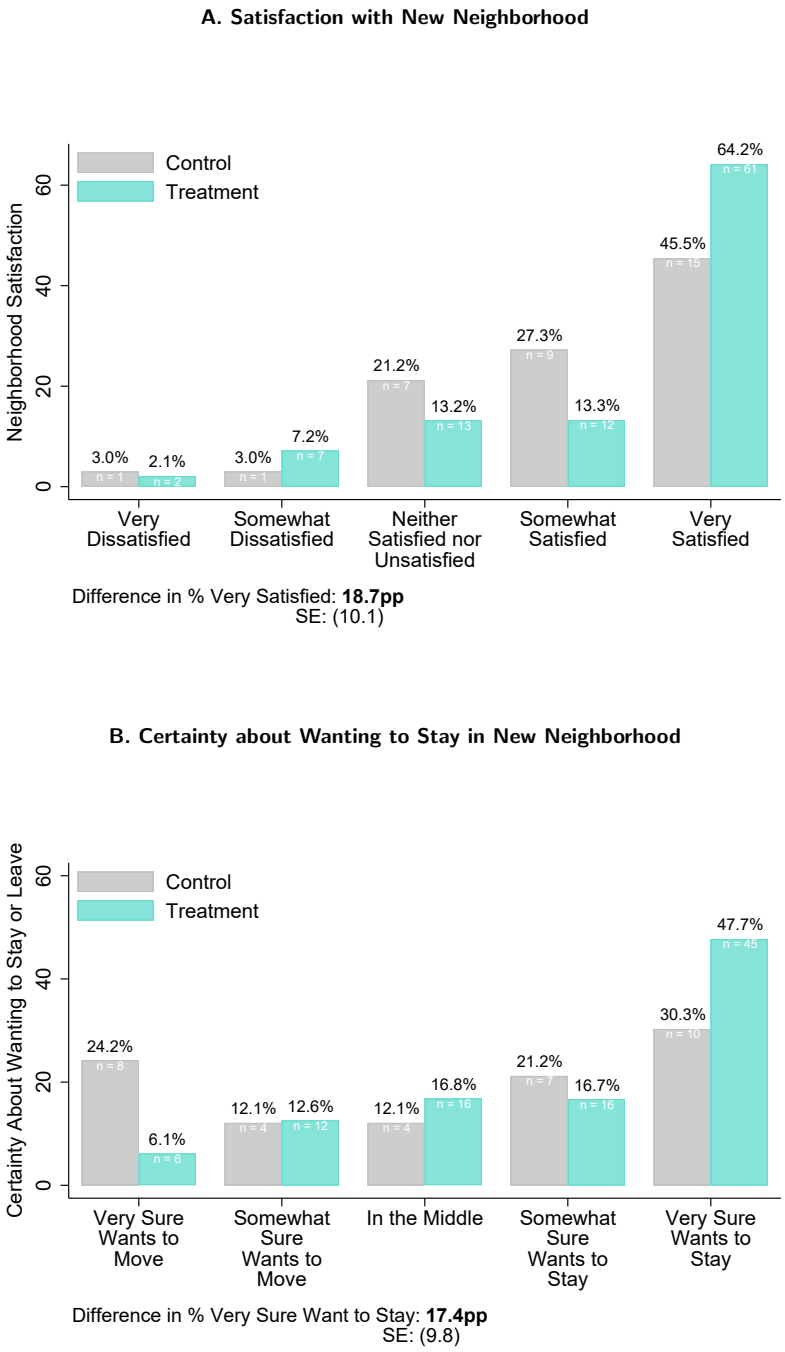
Notes: This figure presents a map of the tracts where participants in the Phase 1 epxeriment lived at baseline, by treatment or control group assignment. High-opportunity areas are highlighted in blue cross-hatch. Voucher recipients whose origin location was outside the area of Seattle and King County (86 recipients), who where homeless at baseline and didn't report an origin location (6 recipients), or whose voucher was transferred to a PHA not in the study (5 recipients) are excluded from the map. To protect confidentiality, we add a small amount of random noise to the destination tract centroids shown in the maps.

APPENDIX FIGURE 5: Unconditional Persistence of Treatment Effects on Neighborhood Choice



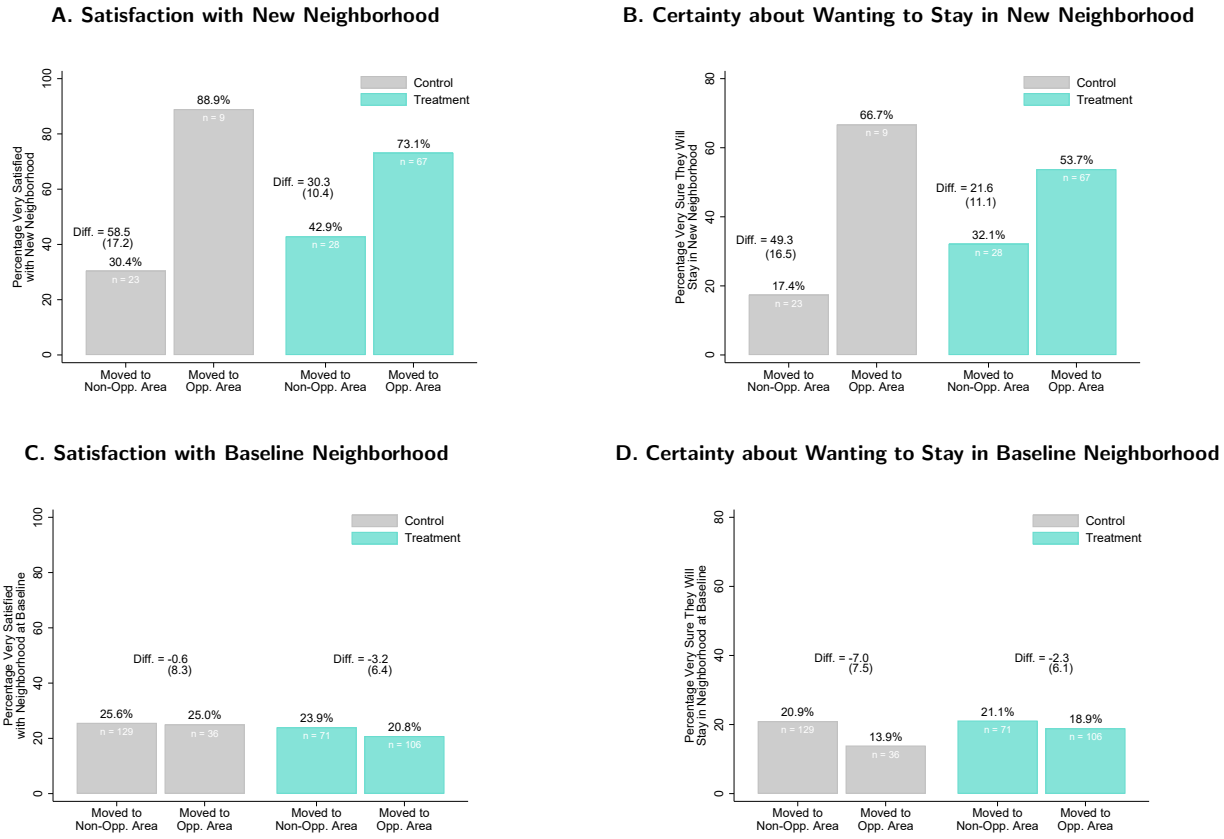
Notes: This figure replicates Figure 6, but does not condition on families leasing up a unit. See notes to that figure for details.

APPENDIX FIGURE 6: Treatment Effects on Post-Move Neighborhood Satisfaction



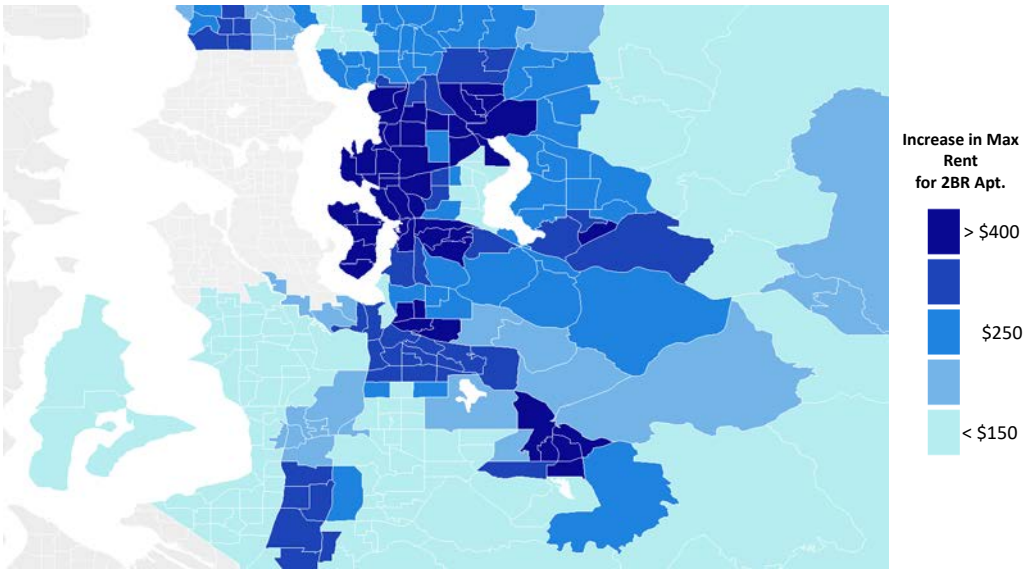
Notes: This figure uses data from a follow-up qualitative survey administered to a random sample of CMTO participants. Panel A shows the distribution of neighborhood satisfaction in the treatment and control groups. Participants were asked, "Which of the following statements best describes how satisfied you are with your current neighborhood? 1. Very Satisfied - 2. Somewhat satisfied - 3. In the middle - 4. Somewhat dissatisfied - 5. Very dissatisfied - 6. (No Answer)." Panel B presents measures of the certainty with which participants want to stay in their new neighborhood. Participants were asked, "Which of the following statements best describes how you feel about staying in your current neighborhood? - 1. Very sure I want to stay - 2. Somewhat sure I want to stay - 3. In the middle - 4. Somewhat sure I want to move to a different neighborhood - 5. Very sure I want to move to a different neighborhood - 6. (No Answer)." The sample consists of all households who leased-up and were surveyed after lease-up. Two households that did not provide an answer to either question are dropped from each panel.

APPENDIX FIGURE 7: Neighborhood Satisfaction in Low vs. High-Opportunity Areas



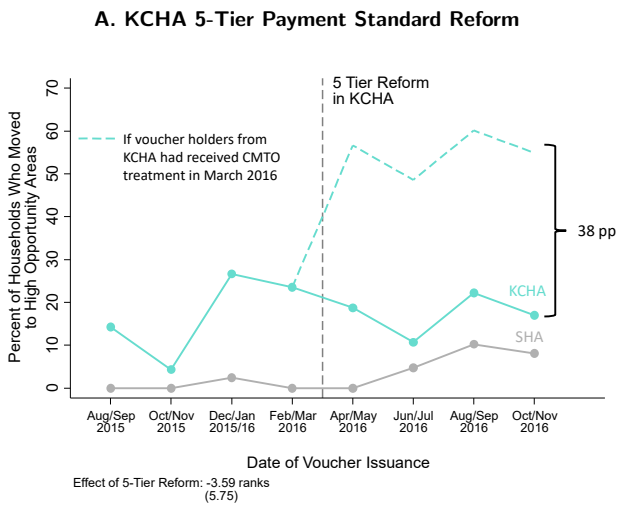
Notes: Panels A and B of this figure present the same measures of neighborhood satisfaction and certainty about wanting to stay as in Figure , further disaggregating treatment and control group differences by whether families moved to high-opportunity areas or not. We construct these figures by plotting raw shares for each group: control group households that moved to an area not designated as high-opportunity, control group households that moved to a high-opportunity area, treatment group households who moved to an area not designated as high-opportunity, and treatment group households that moved to a high-opportunity area. The differences in the outcomes between households who moved to high-opportunity areas vs. those who did not are estimated by running separate regressions by treatment group on an indicator for having moved to a high-opportunity area. Panels C and D replicate Panels A and B, but use data from responses to the same questions asked in the baseline survey with reference to the neighborhoods where families were living at the point of voucher application (in contrast with Panels A and B, which use responses given after lease-up using their voucher).

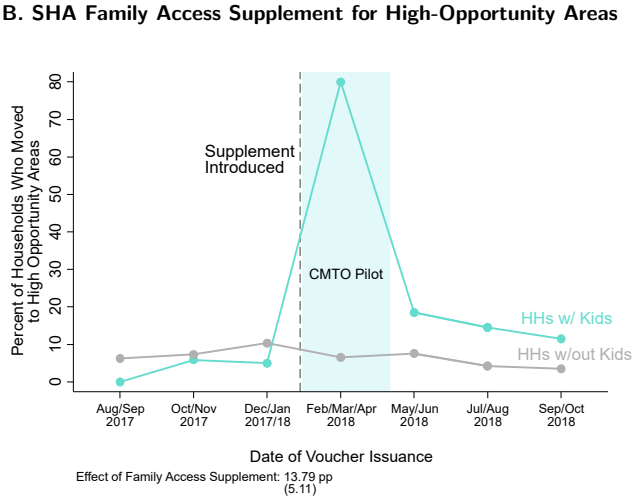
APPENDIX FIGURE 8: Changes to King County Housing Authority Payment Standards in March 2016



Notes: This figure maps the changes in payment standards implemented in March 2016 by KCHA. The map plots the changes in the maximum monthly rent for a two-bedroom apartment that could be paid for using a housing voucher from KCHA, comparing maximum rents in the pre-period (January 2015 to February 2016) to the post-period (March 2016 to December 2017). Darker areas experienced larger increases in maximum rent allowances.

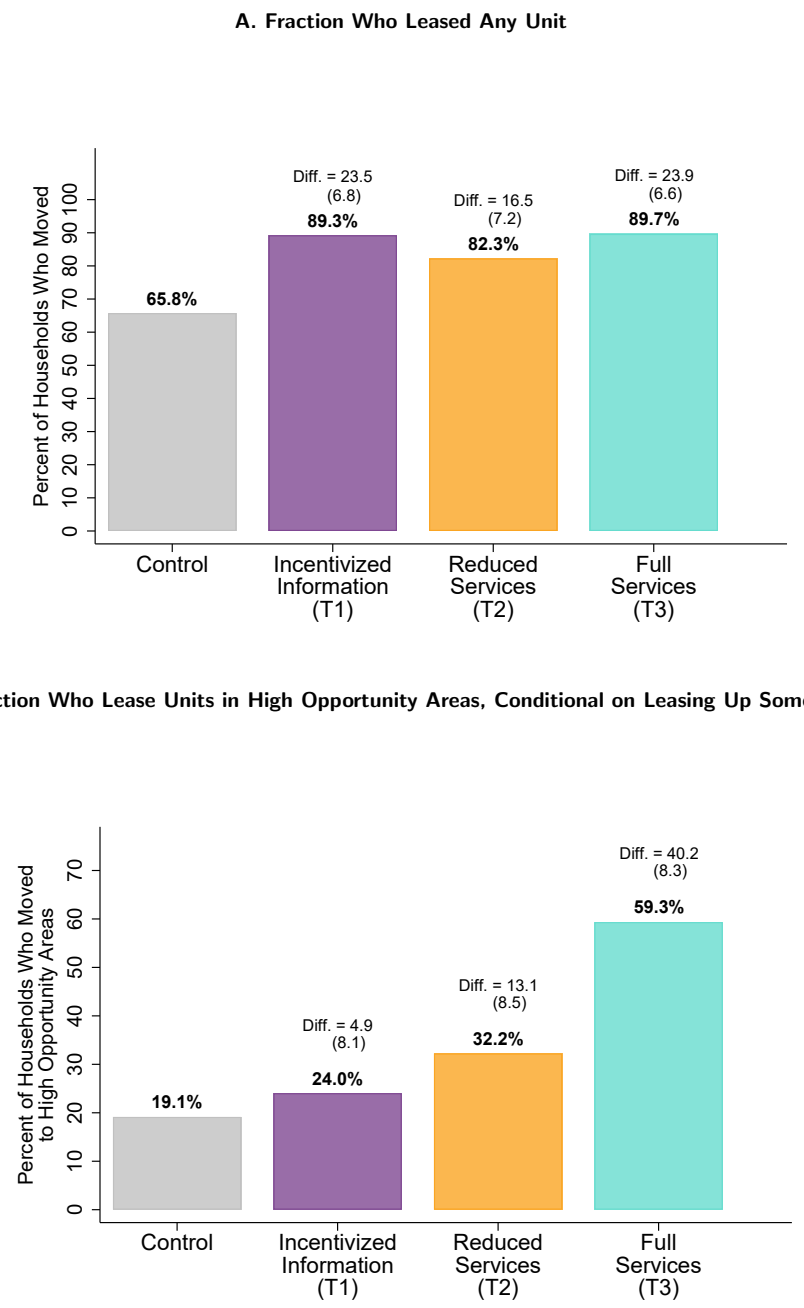
APPEDNDIX FIGURE 9: Effects of Voucher Payment Standards on Moving to Opportunity: Quasi-Experimental Estimates





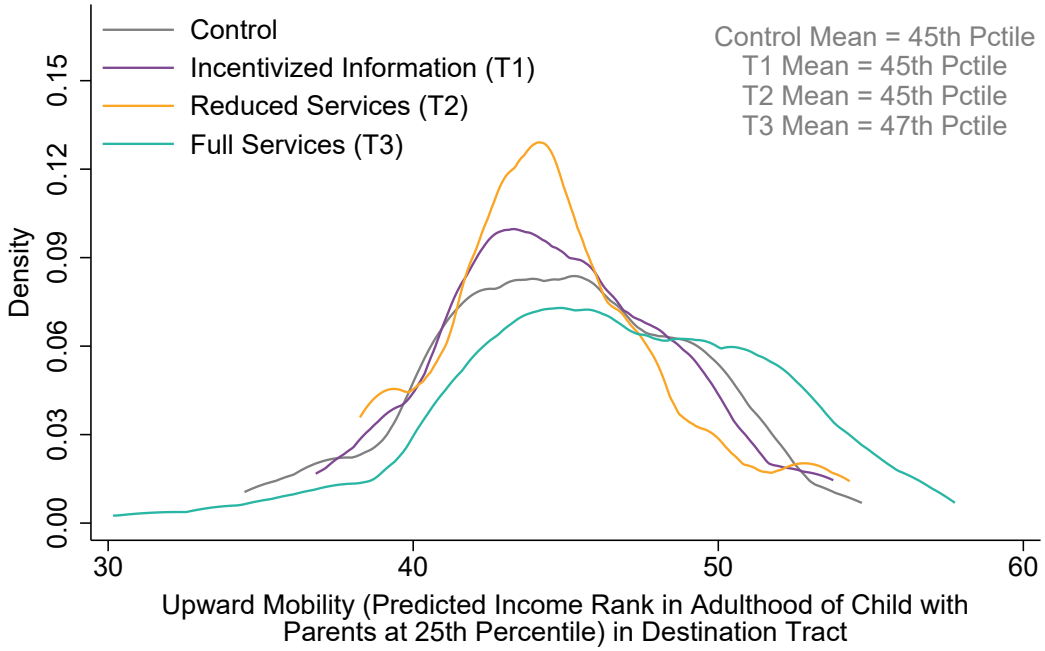
Notes: This figure plots the share of households who move to high-opportunity areas around the introduction of two payment standard reforms, in two-month units. In Panel A, we analyze the introduction of a 5-Tier Voucher Payment Standard system in March 2016 by the King County Housing Authority, which increased payment standards in more expensive neighborhoods. We plot the fraction of voucher recipients with children who choose to lease up in high-opportunity areas (as defined in the CMTO experiment in Figure 1b) in both KCHA and SHA around this reform. We also report a difference-in-difference estimate of the treatment effect, estimated using the specification in Appendix E. As a benchmark, we show the effect of the CMTO intervention on the same scale using the dashed line in the figure. This line is constructed by adding the treatment effect of CMTO on moving to high-opportunity areas shown in Figure 3a to the grey series after March 2016. In Panel B, we analyze the introduction of the Family Access Supplement (FAS) in SHA in February 2018, which increased payment standards in high-opportunity areas as defined exactly in the CMTO experiment. The FAS was implemented at the same time as the start of the CMTO pilot, which was conducted from February-April 2018, shown by the shaded region in the figure, and continued after the pilot ended. The FAS was only available to families with children; we therefore use families without children within SHA as a comparison group to evaluate the impacts of this reform. We again plot the fraction of voucher recipients in each group who choose to lease up in high-opportunity areas around this reform and report a difference-in-difference estimate of the reform's impact (excluding the CMTO pilot period) using the specification in Appendix E.

APPENDIX FIGURE 10: Treatment Effects of Phase Two Interventions on Neighborhood Choice



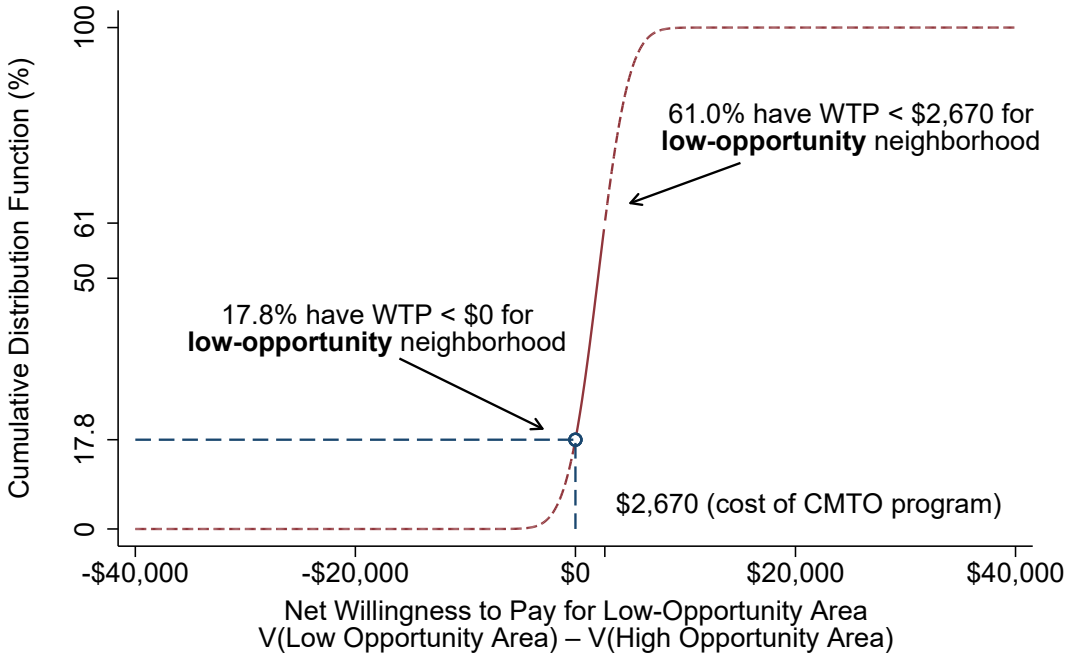
Notes: This figure shows the treatment effects on families' neighborhood choices of the three Phase 2 treatment arms: the incentivized information group (T1), the reduced support services group (T2), and the full customized services group (T3). Panel A presents the treatment effect on leasing up in any area prior to voucher expiration. Panel B presents the treatment effect on leasing up in a high-opportunity area conditional on leasing up somewhere. In both panels, the control mean is calculated as the mean within households in the control group. Each of the three treatment effects, reported below each panel, is estimated using a separate OLS regression of the outcome on a treatment indicator and an indicator for being in KCHA/SHA (since randomization occurred within each housing authority). Each treatment mean plotted is calculated as the control mean plus the estimated treatment effect. Standard errors reported are robust standard errors. Panel A uses the full sample. Panel B restricts the sample to the 234 households who leased up somewhere using their voucher before it expired. Both panels focus on the first lease-up after voucher issuance.

APPENDIX FIGURE 11: Phase Two Distribution of Tract-Level Upward Mobility in Destinations Chosen by Treatment vs. Control Groups



Notes: This figure plots the distribution of upward mobility (based on the Opportunity Atlas estimates shown in Figure 1a) in the tracts to which families move using their vouchers, in the control and treatment groups in the Phase 2 experimental sample: the incentivized information group (T1), the reduced support services group (T2), and the full customized services group (T3), as in Figure 4b for Phase 1. We focus on upward mobility in the tract of first lease-up after voucher issuance, restricting the sample to households who leased up. Bandwidths for the kernel densities are calculated to minimize integrated square error assuming the data is Gaussian and a Gaussian kernel is used.

APPENDIX FIGURE 12: Distribution of Preferences for High-Opportunity Neighborhoods Implied by Frictionless Model



Notes: This figure illustrates what we can learn about families' net willingness to pay to live in low- vs. high-opportunity neighborhoods under the assumptions of a frictionless model of neighborhood choice in which CMTO services are valued at their production cost (see Appendix F). The open circle represents the share of families in the control group who chose to lease up in high-opportunity neighborhoods, i.e. the fraction of families who have a negative net willingness to pay to live in low-opportunity neighborhoods. The closed circle represents the share of families in the treatment group who chose to lease up in high-opportunity neighborhoods, i.e. the fraction of families who have a net willingness to pay to live in low-opportunity neighborhoods below $2,670, the cost of the CMTO services they were offered. Any distribution of preferences must pass through these two points – i.e., it must be that 43.2% of households have a WTP between $0 and $2,670 – in order to match the behavior observed in the CMTO experiment under a frictionless model of neighborhood choice. The red curve shows one such distribution.