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Online Appendix
Creating Moves to Opportunity: Experimental Evidence on Barriers to Neighborhood Choice

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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: $Var(\widehat{y}_t) = Var(y_t) + Var(e_t)$. 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

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

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 $\hat{\kappa}_t = \frac{var(y_t) - var(\hat{\beta}X_t)}{var(y_t) - var(\hat{\beta}X_t) + se_t^2}$ (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 $\hat{y}_t$, se_t.

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

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

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 $\hat{y}_t$ toward the predicted value based on the covariates, with the optimal shrinkage rate depending upon the degree of noise in the estimate of $\hat{y}_t$. In places with large standard errors, se_t, there is little information in the residuals; but if $\hat{y}_t$ is estimated with zero error, the estimate of $\hat{y}_t$ is pure signal and hence the optimal forecast is based purely on $\hat{y}_t$.

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. (2018b) 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]

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. (2018b), 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

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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 (Chetty et al. 2018a) data provide a good starting point for predicting upward mobility (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.

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 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

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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.

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.

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.

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 $131 in PHA administrative costs. For the reduced services (T2) arm, the costs were $208 in financial assistance, $538 for program service costs, and $169 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 $261 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

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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.

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 calculated 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 excluded 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 8 graduate students and 33 undergraduate students and research staff 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, more than 50 people conducted

interviews and qualitative analyses.

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 door-knocking, 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 in the face of significant constraints (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. When the data collection was complete, 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 consistency 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 recruitment, 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 also 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 and Phase 2: six CMTO introductory group information and voucher issuance sessions for different treatment arms; three in-person observations of families with CMTO staff at their initial one on one meetings; attendance at two CMTO navigator meetings; five informational meetings with all of the CMTO family and housing search assistance team members and PHA research liaisons (two by phone and three 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 during COVID, 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 (KCHA 2018).

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 14. 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. 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 (SHA 2022).

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

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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 14), consistent with Collinson and Ganong (2018), although the estimates are somewhat imprecise and hence not statistically significant.

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.

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 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 14. 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

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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.

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.

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 sig-

nificant additional 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. After showing why a frictionless model with $\delta_i \leq 1$ appears inconsistent with the data, we discuss reasons why families may value CMTO services at more than their marginal cost.

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 particular, CMTO families are likely liquidity constrained and may be ex-ante unaware of these services' value to them, especially given the qualitative evidence in Section VII on the emotional and mental support that CMTO navigators provided. In such 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.

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.

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

	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.

	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

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

	Control		Treatment		P-Value of T-C
	Mean (1)	N (2)	Mean (3)	N (4)	Difference (8)
A. Head of Household Demographics					
Age	32.24	42	34.94	119	0.031**
Annual Household Income ($)	19738.10	42	20495.80	119	0.826
% 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	0.872	0.681	161
Conditional on Lease-up	0.725	0.866	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

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)

	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).

	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 (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: Lifetime Earnings Impacts of CMTO: Alternative Assumptions

		Assumption				Effect on Lifetime Earnings		Marginal Value of Public Funds (MVPF)	
		Causal Effect of Place	Years of Exposure per Child	Parent Income Percentile	Children per Household	Undiscounted	Present Discounted Value	No CMTO Value	CMTO Valued at Cost
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1]	Baseline	62%	7	25	2.2	$131,924	$59,949	1.34	2.68
[2]	Low Causal Effect of Place	50%	7	25	2.2	$106,065	$48,198	1.01	2.27
[3]	High Causal Effect of Place	75%	7	25	2.2	$159,980	$72,699	1.76	3.19
[4]	Low Exposure to New Neighborhood	62%	5.82	25	2.2	$109,299	$49,668	1.05	2.32
[5]	High Exposure to New Neighborhood	62%	9.24	25	2.2	$174,683	$79,380	2.00	3.50
[6]	Lower Parent Income Percentile	62%	7	17	2.2	$129,959	$59,056	1.32	2.65
[7]	One Child per Household	62%	7	25	1	$59,588	$27,078	0.51	1.64
[8]	Two Children per Household	62%	7	25	2	$119,759	$54,421	1.18	2.48
[9]	Three Children per Household	62%	7	25	3	$180,582	$82,060	2.10	3.63

Notes: This table shows the lifetime earnings and marginal value of public funds (MVPF) calculations under different sets of assumptions. The MVPF is the ratio of the benefits that the policy provides to its recipients (measured as their willingness to pay), divided by the policy's net cost to the government (Hendren and Sprung-Keyser 2022). Row 1 shows the inputs used to calculate the baseline MVPF of 1.35. The baseline causal effect of place is 62%, based on the estimate from Chetty et al. (2018) that on average, 62% of the variation in outcomes in the Opportunity Atlas reflects the causal effect of childhood exposure for movers across tracts. Rows 2 and 3 show the sensitivity of the lifetime earnings and MVPF calculations to variation in this causal effect of place. Rows 4 and 5 show the lifetime earnings and MVPF when the number of years of exposure to high-opportunity neighborhoods is varied. The calculations in rows 4 and 5 assume exposure of 7 (the average length of the voucher) and 16 (assuming exposure up to age 23, with an average age of approximately 7 at the time of the move) years respectively, adjusted for the persistence estimates in Figure 6. For this adjustment, we use the slopes of the treatment and control persistence estimates and assume linear extrapolation, generating an effective exposure of roughly 5.82 years and 9.24 years respectively. Row 6 shows the lifetime earnings and MVPF for children with parental income rank at the 18th percentile. The 18th percentile income rank corresponds to the average income of families in the CMTO study of $20,275 (Table 1). Rows 7-9 show the sensitivity of the lifetime earnings and MVPF estimates to changes in the average number of children in each household (in Table 1, the average number of children in households in the CMTO study is 2.2). The last two columns presents the MVPF under the assumption that (i) CMTO is not valued by the parents so that the only benefits are the impacts on the kids and (ii) that CMTO is additionally valued by the parents at the cost of the services provided.

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

	Control Mean	Control Standard Deviation	Treatment Arm 1		Treatment Arm 2		Treatment Arm 3	
			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

	Pooled		Moved to Non-High-Opportunity Tract		Moved to High Opportunity Tract	
	N (1)	Mean (2)	N (3)	Mean (4)	N (5)	Mean (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.

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	55.92	70.52	13.79***	13.82***	-22.31	-11.84
	(5.754)	(6.209)	(49.23)	(52.05)	(5.107)	(5.262)	(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	325	323	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. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

APPENDIX FIGURE 1: Causal Effects of Moving to a Better Neighborhood by Age at Move:
Evidence from Prior Research
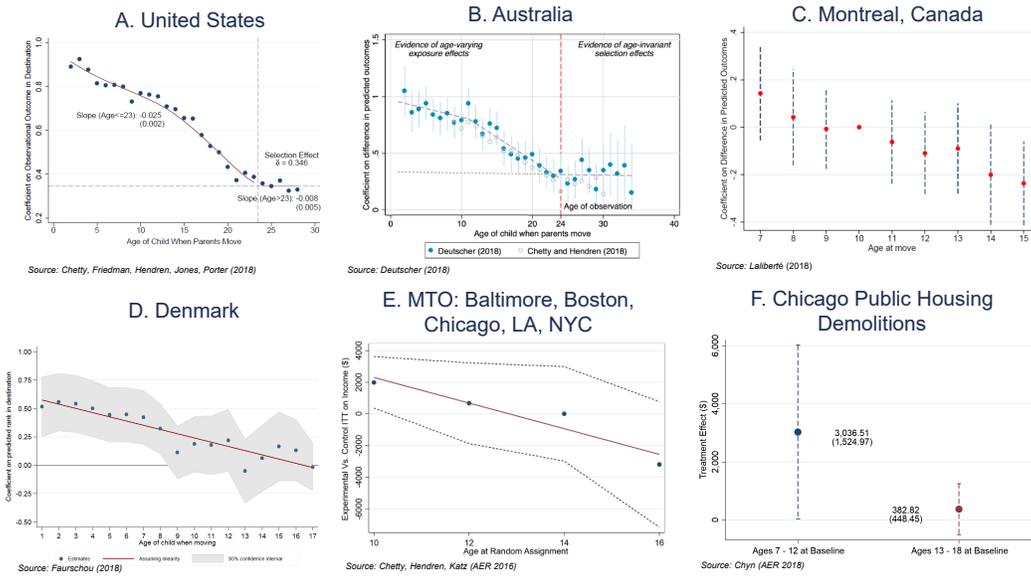
Notes: This figure reproduces estimates from a recent set of papers estimating the causal effects of the neighborhood in which a child grows up on his or her outcomes in adulthood. Each panel depicts the causal effect of moving to an area with better observed outcomes, by the age at which children make 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

Final Version of Opportunity Atlas

Preliminary Forecasts Used to Define High-Opportunity Areas

< 36	48	> 57
($27k)	($40k)	($51k)

< 40	48	> 53
($31k)	($40k)	(46k)

Population-Weighted Correlation Across Tracts: 0.74
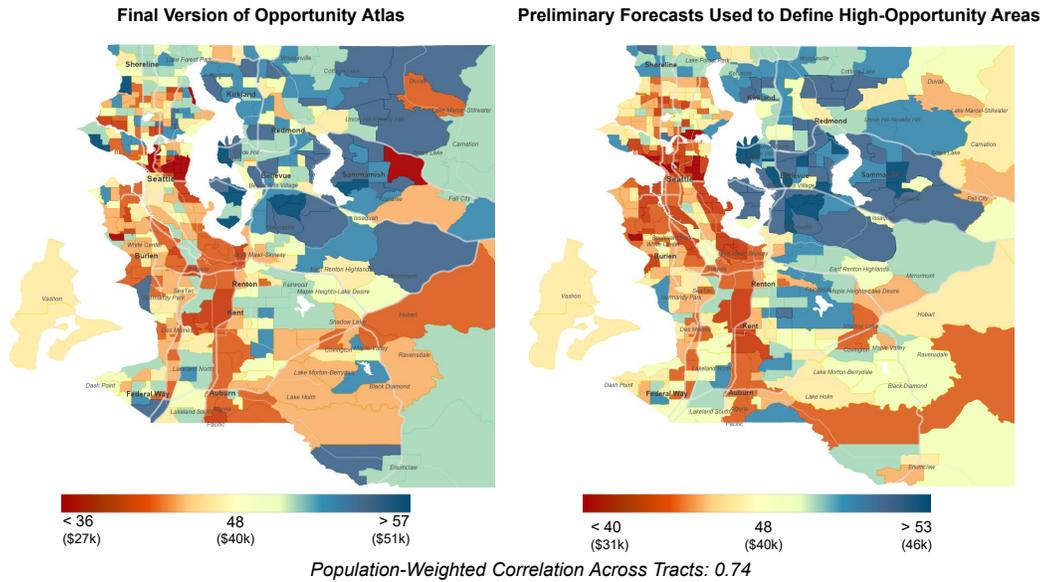
These maps must be printed in color to be interpretable

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
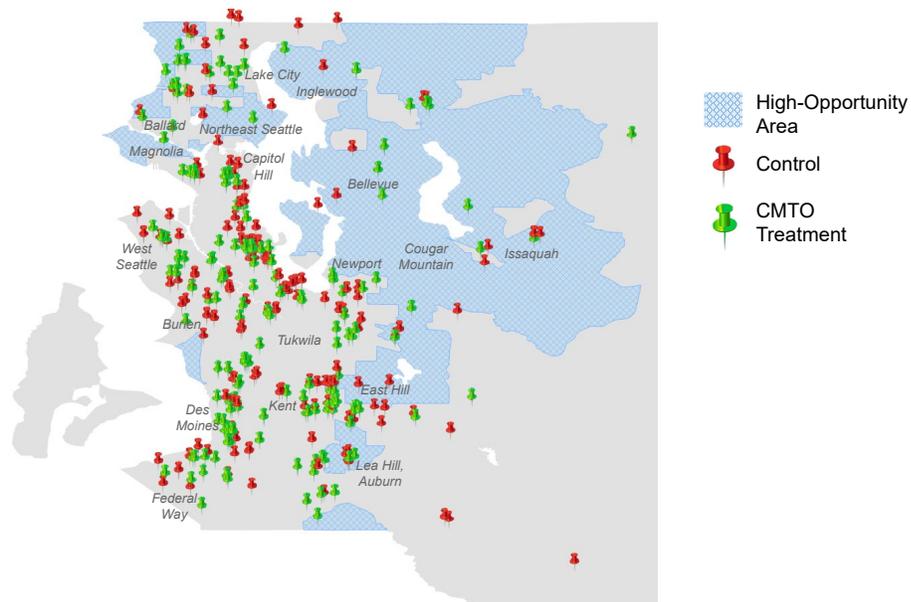
Notes: This figure presents a map of the tracts where participants in the Phase 1 epxeriment lived at baseline, by treatment or control group assignment. High-opportunity areas are highlighted in blue cross-hatch. Voucher recipients whose origin location was outside the area of Seattle and King County (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
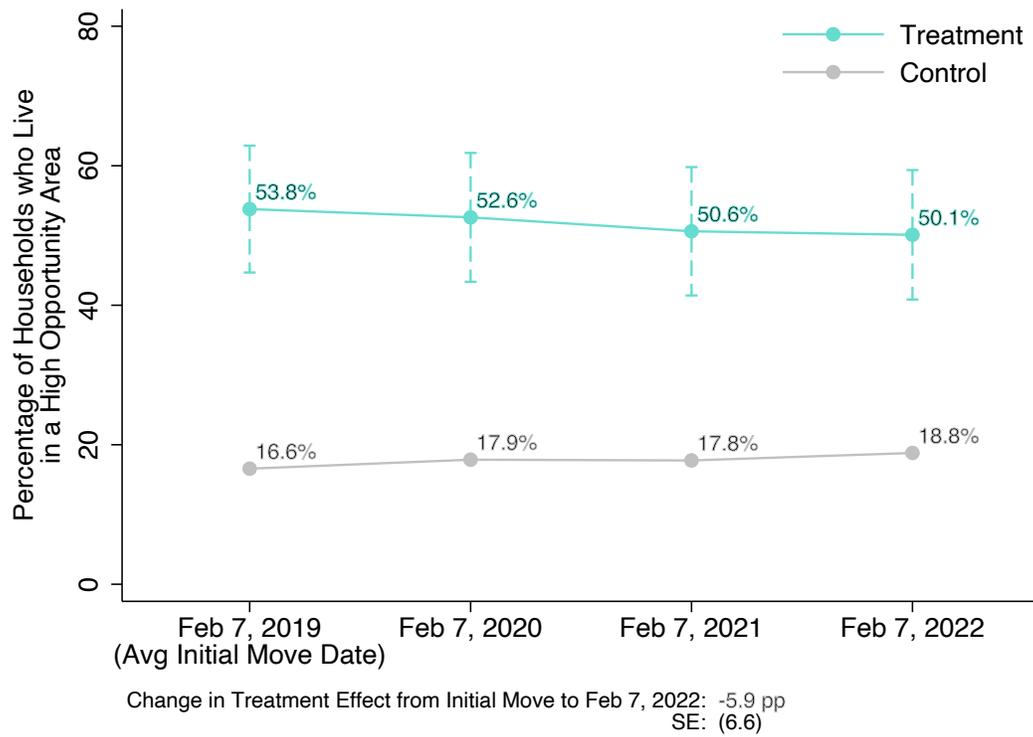
Notes: This figure replicates Figure 6, but does not condition on families leasing up a unit. See notes to that figure for details.

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

A. Satisfaction with New Neighborhood

Difference in % Very Satisfied: 18.7pp
SE: (10.1)

B. Certainty about Wanting to Stay in New Neighborhood

Difference in % Very Sure Want to Stay: 17.4pp
SE: (9.8)
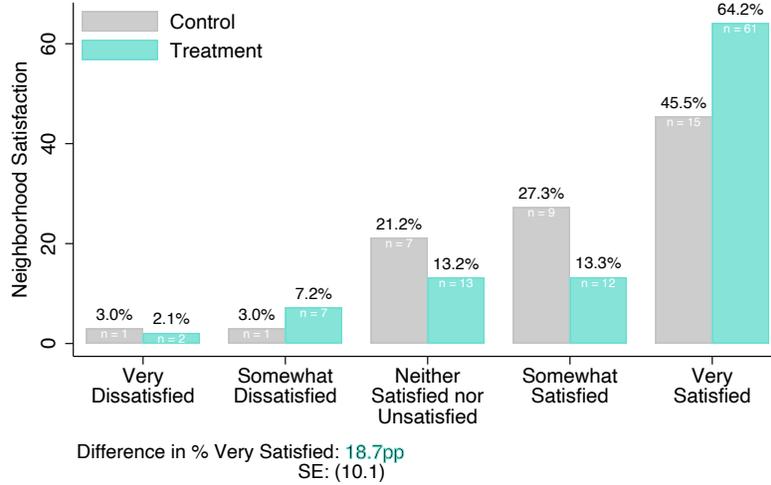
Notes: This figure uses data from a follow-up qualitative survey administered to a random sample of CMTO participants. Panel A shows the distribution of neighborhood satisfaction in the treatment and control groups. Participants were asked, "Which of the following statements best describes how satisfied 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

A. Satisfaction with New Neighborhood

B. Certainty about Wanting to Stay in New Neighborhood

C. Satisfaction with Baseline Neighborhood

D. Certainty about Wanting to Stay in Baseline Neighborhood
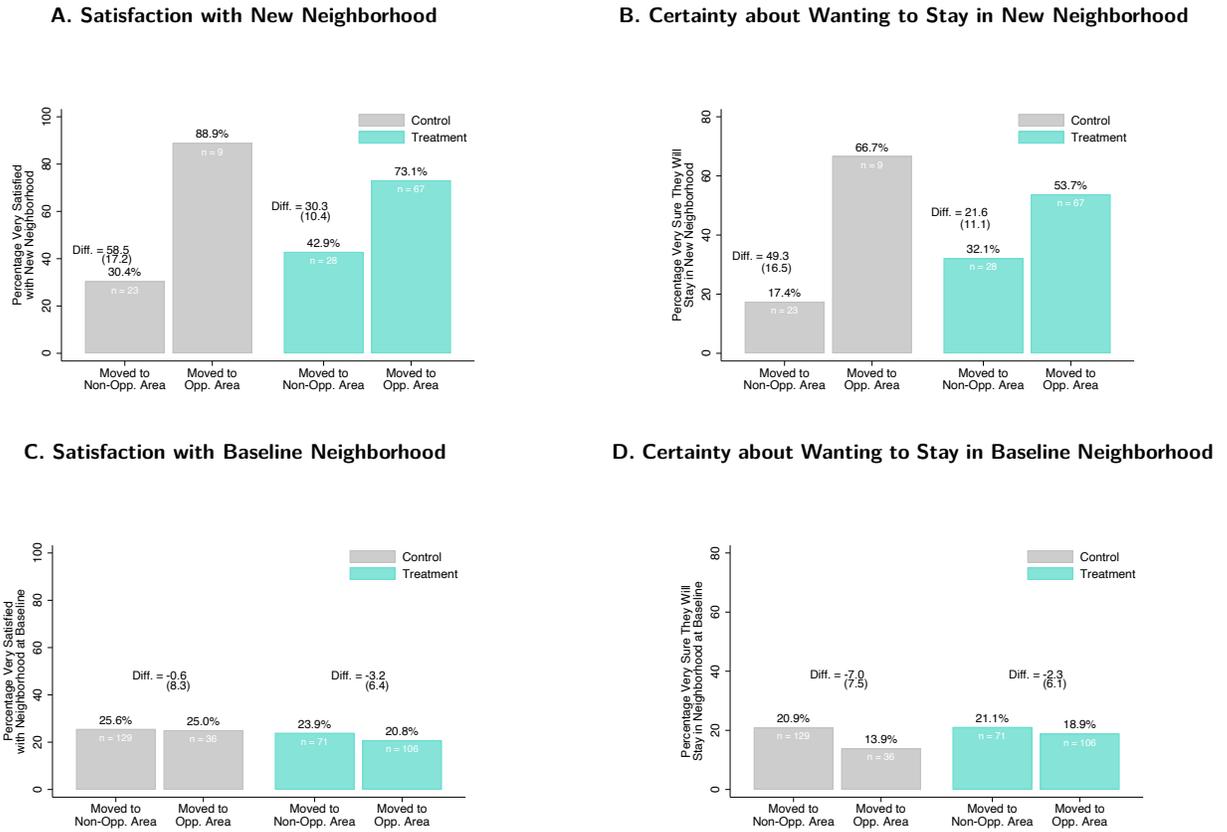
Notes: Panels A and B of this figure present the same measures of neighborhood satisfaction and certainty about wanting to stay as in Figure , further disaggregating treatment and control group differences by whether families moved to high-opportunity areas or not. We construct these figures by plotting 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
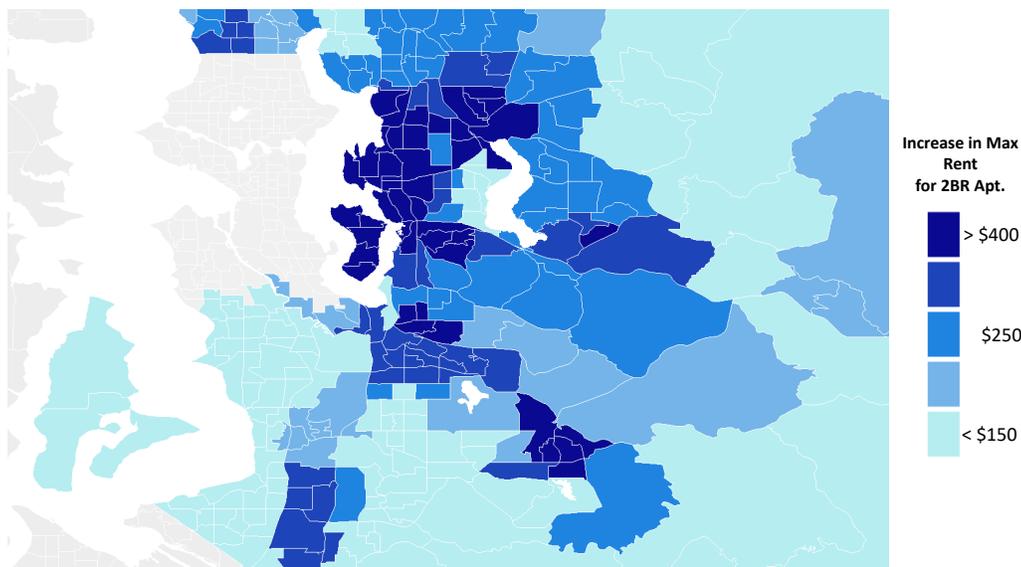

Notes: This figure maps the changes in payment standards implemented in March 2016 by KCHA. The map plots the changes in the maximum monthly rent for a two-bedroom apartment that could be paid for using a housing voucher from KCHA, comparing maximum rents in the pre-period (January 2015 to February 2016)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

A. KCHA 5-Tier Payment Standard Reform
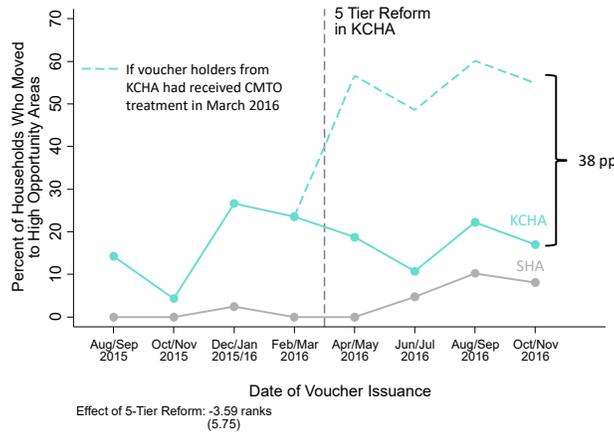
B. SHA Family Access Supplement for High-Opportunity Areas
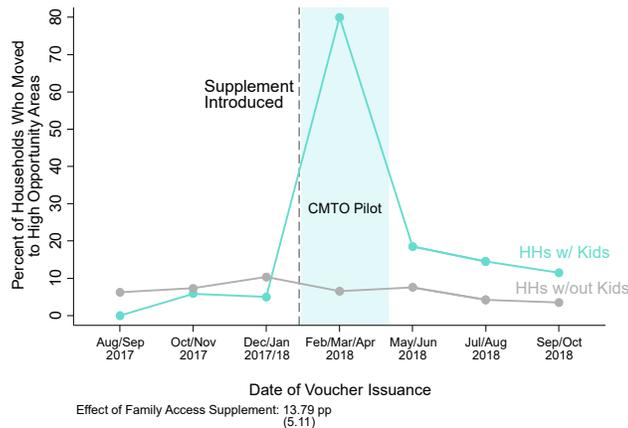
Notes: This figure plots the share of households who move to high-opportunity areas around the introduction of two payment standard reforms, in two-month units. In Panel A, we analyze the introduction of a 5-Tier Voucher Payment Standard system in March 2016 by the King County Housing Authority, which 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

A. Fraction Who Leased Any Unit
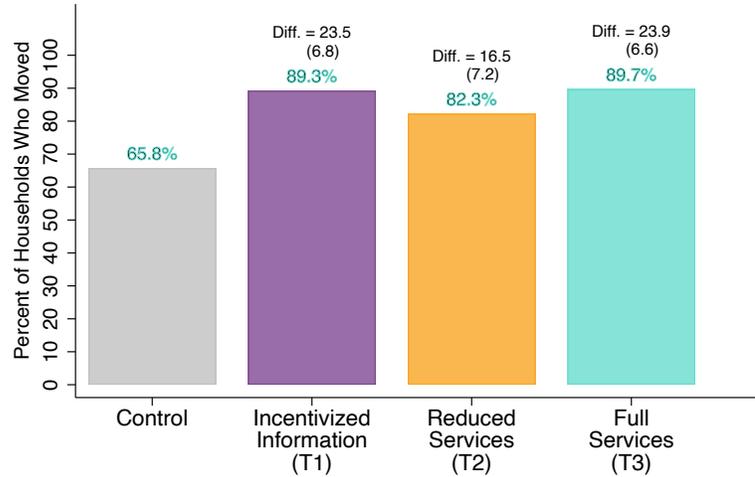
**B. Fraction Who Lease Units in High Opportunity Areas, Conditional on Leasing Up Somewhere**
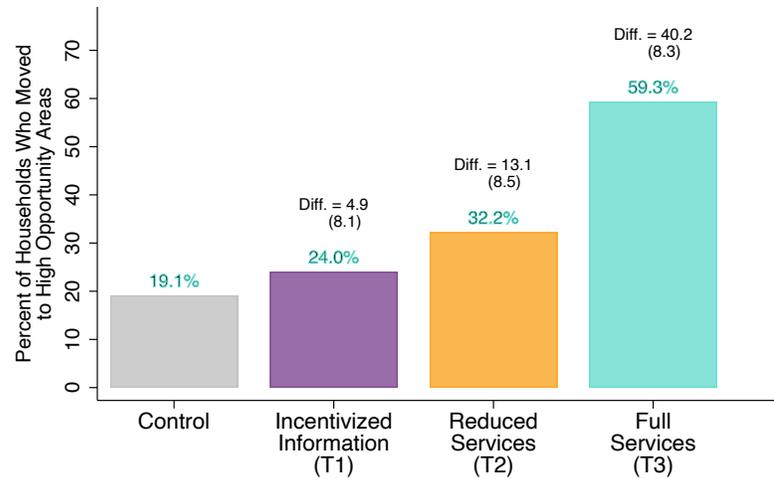
Notes: This figure shows the treatment effects on families' neighborhood choices of the three Phase 2 treatment arms: the incentivized information group (T1), the reduced support services group (T2), and the full customized services group (T3). Panel A presents the treatment effect on leasing up in any 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
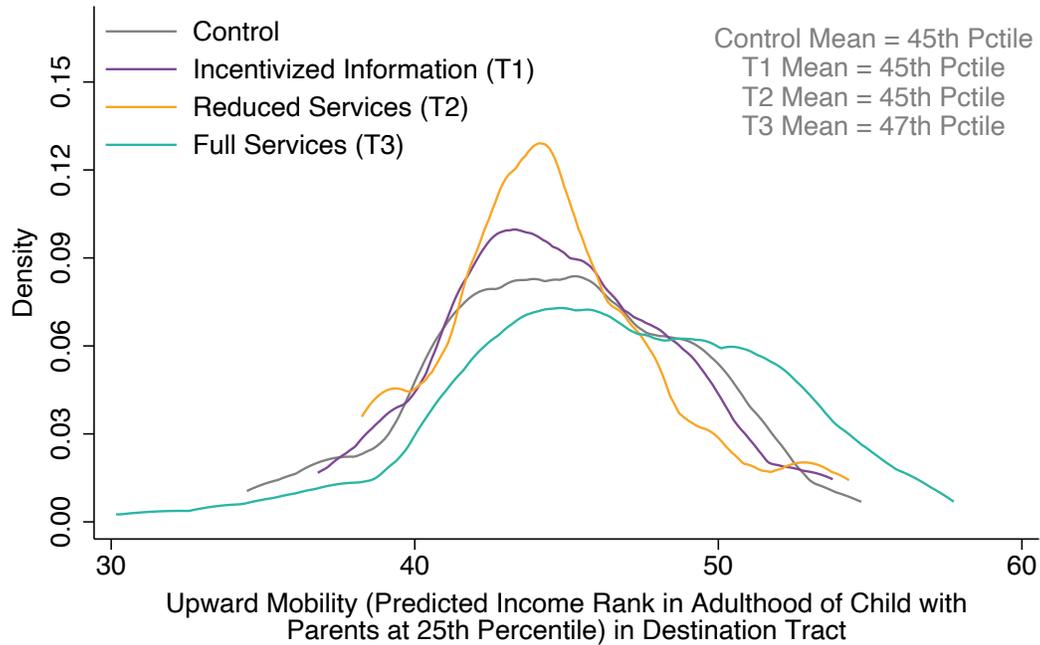
Notes: This figure plots the distribution of upward mobility (based on the Opportunity Atlas estimates shown in
Figure 1a) in the tracts to which families move using their vouchers, in the control and treatment groups in the
Phase 2 experimental sample: the incentivized information group (T1), the reduced 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
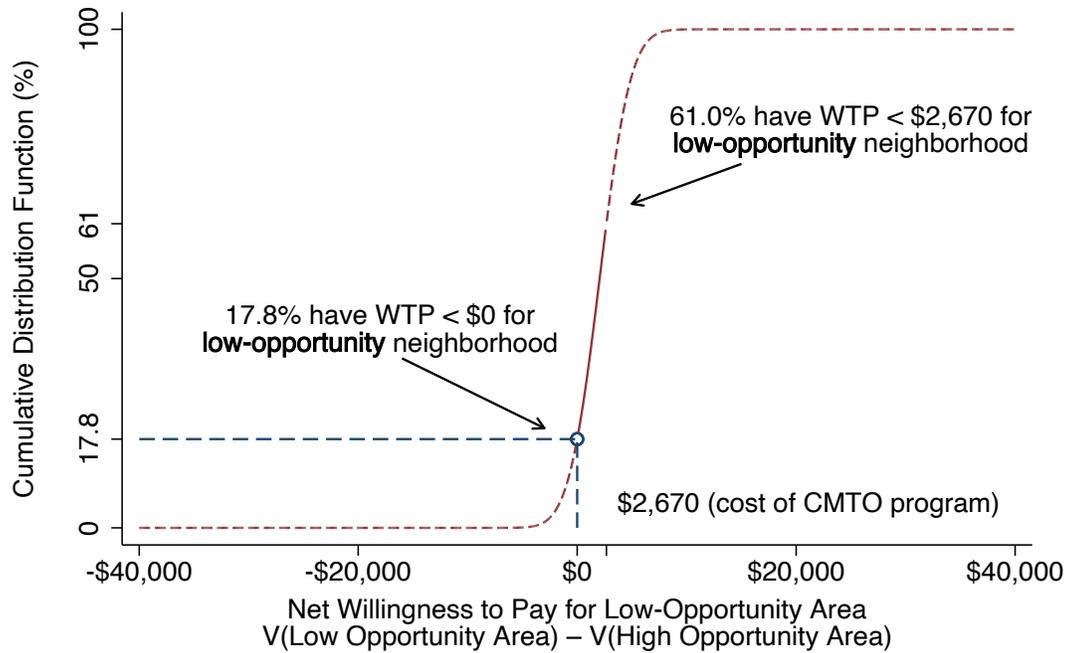
Notes: This figure illustrates what we can learn about families' net willingness to pay to live in low- vs. high-opportunity neighborhoods under the assumptions of a frictionless model of neighborhood choice in which CMTO services are valued at their production cost (see Appendix F). The open circle 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.