Neighborhood Revitalization and Residential Sorting

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Abstract

The HOPE VI Revitalization program sought to transform high-poverty neighborhoods into mixed-income communities through the demolition of public housing projects and the construction of new housing. We use longitudinal administrative data to investigate how the program affected both neighborhoods and individual residential outcomes. In line with the stated objectives, we find that the program reduced poverty rates in targeted neighborhoods and enabled subsidized renters to live in lower-poverty neighborhoods, on average. The primary beneficiaries were not the original neighborhood residents, most of whom moved away. Instead, subsidized renters who moved into the neighborhoods after an award experienced the largest reductions in neighborhood poverty. The program reduced the stock of public housing in targeted neighborhoods but expanded access to housing vouchers in other, lower-poverty neighborhoods. Spillover effects on the poverty rates of other neighborhoods were small and dispersed throughout the surrounding cities. Our estimates imply that cities that revitalized half of their public housing stock reduced the average neighborhood poverty rate among all subsidized renters by 4.1 percentage points.

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1 Introduction

Families in subsidized housing often live in high-poverty neighborhoods, which existing research shows can adversely affect health, behavior, and labor market outcomes (Chyn and Katz, 2021). Policymakers at the Department of Housing and Urban Development (HUD) have responded to this growing body of evidence by seeking to reduce residential segregation for subsidized renters through two distinct approaches. The first approach targets people, and seeks to help disadvantaged families relocate to better neighborhoods. Evidence from the Moving to Opportunity (MTO) experiment (Katz et al., 2001) and subsequent work (Collinson and Ganong, 2018; Bergman et al., 2019) illustrates the promise of this approach. However, the scalability of MTO-type interventions is limited by the willingness of subsidized households to move and the availability of affordable housing in low-poverty neighborhoods. The second approach targets places, and seeks to improve the neighborhoods where disadvantaged households reside. A common concern with place-based policies is that the original residents of targeted neighborhoods might be forced to move and therefore may not benefit from any improvements in neighborhood conditions. Despite being a potentially important policy tool, there is limited empirical evidence assessing whether place-based housing policies benefit the disadvantaged residents of targeted places.

In this paper we investigate how the HOPE VI Revitalization program, a large place-based policy, affected both neighborhoods and individual-level residential outcomes. The HUD-administered program allocated $6.3 billion from 1993 to 2010 across 261 grants. The aim was to transform high-poverty neighborhoods into mixed-income communities by demolishing distressed public housing projects and constructing a mix of new subsidized and market-rate housing units. The neighborhood-level changes were intended to benefit subsidized renters, allowing them to live in less economically segregated neighborhoods. But because the program could have affected residential sorting, a reduction in poverty rates in targeted neighborhoods need not benefit the original, subsidized renters in those neighborhoods. For example, the program could have lowered poverty rates in targeted neighborhoods but displaced subsidized renters to other, higher-poverty neighborhoods, thereby increasing their exposure to poverty. Our analysis seeks to answer two key questions: i) Did the program reduce poverty rates in targeted neighborhoods, and if so, through what mechanisms? ii) Did the program enable subsidized renters to live in lower poverty neighborhoods?

We estimate the effect of the Revitalization program by comparing neighborhoods that received an award to those that applied for but never received funding. The program targeted some of the most distressed public housing projects in the country. However, due to funding constraints, there were many similar projects that applied for but never received an award. We estimate stacked event-study regressions, reweighting by the inverse propensity score to adjust for any differences in observable pre-award characteristics that could otherwise bias the estimates. We track people and places over time using individual-level administrative data on income, place of residence, and subsidized housing participation. The data allow us to follow the original residents as they moved across neighborhoods and to observe everyone who moved into Revitalization neighborhoods after an award. The ability to decompose neighborhood change into parts attributable to out-migration and in-migration as well as to observe which individuals benefit from neighborhood changes are major improvements over existing work and are critical for answering our two main research questions.

We begin by showing that the Revitalization program led to a large, persistent reduction in poverty rates in targeted neighborhoods: poverty rates were 8 percentage points lower in targeted neighborhoods 15 years after an award. These estimates are similar to those from Tach and Emory (2017), who study the HOPE VI program using repeated cross-sectional data from Decennial Censuses and the American Community Survey (ACS) along with a difference-in-differences identification strategy. An advantage of our individual-level panel data is that it allows us to decompose the neighborhood-level changes into changes in the outcomes of different individuals. We find that the program reduced poverty rates primarily by changing who moved into the neighborhood as opposed to by displacing the original residents or increasing the incomes of subsidized renters. The change in migration flows is attributable to a reduction in the stock of public housing units—which led fewer poor households to move in—and the construction of new market-rate units—which attracted higher-income households. While the program reduced the share of Black non-Hispanic residents in the short-run, it did not have a significant effect on the racial composition of the neighborhood in the long-run.

Next, we investigate whether the poverty reductions in Revitalization neighborhoods led subsidized renters to live in lower poverty neighborhoods. There are four groups of subsidized renters who could have been affected by the program: i) the original Revitalization neighborhood residents, ii) subsidized renters who moved into Revitalization neighborhoods after

an award, iii) subsidized renters who would have moved into a Revitalization neighborhood absent an award, and iv) subsidized renters who lived in other neighborhoods potentially affected by program spillovers. We estimate the effect of the program on exposure to neighborhood poverty for each group. Inference for first two groups is based primarily on the stacked event-study estimator whereas inference for the latter two groups relies on an analysis of migration flows into and out of the targeted neighborhoods.

Most of the original Revitalization neighborhood residents (group i) moved away and had limited exposure to the reduction in poverty rates in targeted neighborhoods. Within 5 years of the award, 74 percent of the original public housing project residents in Revitalization neighborhoods had moved to a new neighborhood. Because of these high rates of residential mobility, the reduction in poverty rates for Revitalization neighborhoods is five times as large as the reduction in exposure to neighborhood poverty experienced by the original residents. The demolitions and subsequent rising housing prices led the original residents of the public housing projects and nearby market rate units to move away at higher rates. However, we find no impacts on the migration rates of residents with access to Housing Choice Vouchers (hereafter, housing vouchers). This is consistent with housing vouchers diminishing displacement by limiting exposure to price increases. While some of the original residents were displaced, we estimate that three-fourths of the original public housing residents who moved away would have done so even absent the intervention; this is because, in general, low-income renters in high-poverty neighborhoods are highly mobile.

The program enabled the subsidized renters who moved into Revitalization neighborhoods after an award (group ii) to live in lower poverty neighborhoods. This is not a mechanical result despite the observed reduction in poverty rates in Revitalization neighborhoods; the program could have attracted residents who, absent the intervention, would have lived in non-Revitalization neighborhoods with similar poverty rates to the post-Revitalization neighborhoods. We find that subsidized renters who move into Revitalization neighborhoods and failed applicant neighborhoods after an award move from neighborhoods with similar poverty rates. This suggests that the new subsidized renters in Revitalization and failed applicant neighborhoods had similar outside housing options. Using data on the characteristics of prior neighborhoods and individual incomes, we estimate that the program enabled the subsidized renters who moved into Revitalization neighborhoods after an award to live in neighborhoods with poverty rates that were 7.6 percentage points lower than the

neighborhoods they would have lived in absent the award.

Some subsidized renters would have moved into the Revitalization neighborhoods but ended up in different neighborhoods because of the award (group iii). The program reduced the size of the subsidized housing population in targeted neighborhoods by 20 percent in the long run, but—by expanding access to housing vouchers—did not reduce the city-wide supply of subsidized housing. We cannot identify who the subsidized renters in group iii are. However, the Revitalization and failed applicant neighborhoods were among the highest-poverty neighborhoods in their cities; the median Revitalization neighborhood was in the 98th percentile for neighborhood poverty in their surrounding county. Furthermore, households who moved into the failed applicant sites in the post-award period moved from neighborhoods where the poverty rate was 14 percentage points lower than the failed applicant neighborhood, on average. Thus, if individuals who would have moved into the Revitalization sites absent an award remained in their original neighborhoods, they likely would be residing in lower-poverty areas; if, instead, they moved to different, non-Revitalization neighborhood, there were a limited number of higher-poverty neighborhoods for them to move. Together, this suggests that the program likely led these households to live in lower-poverty neighborhoods.

We find that the spillover effects of the Revitalization program on the poverty rates of subsidized renters in other neighborhoods (group iv) are small and spread across many neighborhoods. If, as our evidence suggests, the program shaped the spatial distribution of poverty by affecting where poor adults lived (as opposed to increasing the income of poor individuals), then the reduction in poverty rates in Revitalization sites must be offset by an increase in poverty rates in other neighborhoods. However, by analyzing migration flows into and out of targeted neighborhoods, we argue that the low-income households displaced by the program were dispersed across many different neighborhoods throughout their cities instead of being concentrated in a small number of neighborhoods. As a result, we estimate that these displaced households increased the poverty rates of their new neighborhoods by at most 0.3 percentage points. We consider spillovers on adjacent neighborhoods using the stacked even-study estimator and find that the effects of the program are smaller in magnitude and quite local: the program reduced poverty rates by only 1.6 percentage points in neighborhoods adjacent to Revitalization neighborhoods.

Did the Revitalization program reduce exposure to neighborhood poverty for subsidized

households, on average? We take a weighted-average of our group-specific estimates of the effect on exposure to poverty and find that cities that revitalized half of their public housing stock reduced the average neighborhood poverty rate among all subsidized renters in the city by 4.1 percentage points. Reductions in exposure to neighborhood poverty for the new neighborhood residents explain 68 percent of this aggregate effect. While the program did not change the city-wide poverty rate, the reductions in poverty were concentrated in neighborhoods with many subsidized renters while the increases in poverty from spillovers were dispersed across many neighborhoods with fewer subsidized renters. In this way, the program achieved its goal of enabling subsidized renters to live in lower poverty neighborhoods.

The results clarify the trade-offs between neighborhood revitalization and displacement, illuminating a fundamental tension for place-based interventions. This trade-off is partly mechanical: a greater share of market-rate units necessitates a smaller share of subsidized units. However, by looking across Revitalization sites, we also find that it is more difficult to attract higher-income residents in neighborhoods that currently or historically have more households in public housing. Our findings point to two lessons for how to mitigate this trade-off. First, low-income households in distressed neighborhoods move frequently so the primary beneficiaries of neighborhood-level interventions are likely to be new residents. Unless there are effective ways to encourage the original residents to stay, efforts to maximize a program's impact should focus on these newcomers. Second, the provision of tenant-based subsidized housing (i.e., housing vouchers) can help to mitigate the displacement effects generated by rising housing prices. Furthermore, because of the high rates of residential mobility, efforts to minimize displacement effects will not generally conflict with the goal of changing the composition of neighborhoods. The program required a large upfront investment but it produced a durable change in neighborhood conditions. Our estimates, in combination with existing estimates of households' willingness-to-pay (WTP) for neighborhood amenities, suggest that the present value cumulative annual benefits from the reduction in exposure to neighborhood poverty exceed the upfront costs when considered over a time horizon of at least 14 years.

The main contribution of this paper is to estimate the effect of a large, place-based housing intervention, the HOPE VI Revitalization program, on both neighborhoods and individual residential outcomes. Several previous papers have used repeated cross-sectional data to estimate the effect of HOPE VI on neighborhoods (Zielenbach and Voith, 2010; Tach

and Emory, 2017; Sandler, 2017; Bruhn, 2018; Blanco, 2023). Our individual-level panel data allow us to decompose the neighborhood-level changes into changes in individual outcomes and thereby illuminate the tension between neighborhood revitalization and displacement. Most of the research studying the impact on individual outcomes has focused on the original residents of the HOPE VI public housing projects (Jacob, 2004; Chyn, 2018; Haltiwanger et al., 2020). We broaden this analysis by considering all subsidized renters, which helps clarify who benefits from place-based interventions. In the HOPE VI context this is especially important since most of the original residents moved away. Almagro et al. (2023) use repeated cross-sectional data to estimate a structural model and find that the HOPE VI program reduced the welfare of low-income, minority renters. Whereas they structurally model neighborhood-level changes for all low-income households, we provide reduced-form estimates of the impact on exposure to neighborhood poverty for four distinct groups of subsidized renters—which is a key input in determining the welfare impacts of the program.

More generally, we contribute to research on urban renewal policies (Baum-Snow and Marion, 2009; Collins and Shester, 2013; Busso et al., 2013; Harari et al., 2018; Rojas Ampuero, 2022; Blanco and Neri, 2023; Gechter and Tsivanidis, 2023), as well as the literature on the drivers, dynamics, and distributional impacts of neighborhood-level change (Rossi-Hansberg et al., 2010; McKinnish et al., 2010; Guerrieri et al., 2013; Boustan et al., 2019; Diamond and McQuade, 2019; Couture et al., 2019; Couture and Handbury, 2020; Qiang et al., 2020; Brummet and Reed, 2021; Pennington, 2021; Su, 2022; Lee, 2022; Asquith et al., 2023; Kennedy and Wheeler, 2023). We further advance our understanding of how changes in neighborhood conditions affect the outcomes of individuals. Chyn and Katz (2021) note that "a final frontier research area involves the estimation of the impact of place-based policies to improve low-income neighborhoods on the intended beneficiaries—the incumbent (preexisting) adult residents and their children." Our findings confirm the importance of separately estimating impacts on the incumbent residents and on the targeted places, and additionally highlight the value of considering program impacts on other groups of beneficiaries; in the case of the Revitalization program, the new residents of targeted neighborhoods.

The rest of the paper is structured as follows. Section 2 provides background on the HOPE VI Revitalization program. Section 3 presents a conceptual framework. Section 4 describes the data. Section 5 describes our empirical strategy. Section 6 presents our empirical results. Section 7 provides a brief discussion of the results and Section 8 concludes.

2 The HOPE VI Revitalization Program

The HOPE VI program was created in response to a report by the National Commission on Severely Distressed Public Housing that raised concerns about living conditions in public housing projects (Green and Lane, 1992). While there were several distinct programs included under the broader HOPE VI umbrella, 94 percent of HOPE VI funding was allocated to the Revitalization program. The FY1999 HUD appropriations bill (Public Law 105-276) that authorized HOPE VI identifies four main goals of the Revitalization program:

> (1) improving the living environment for public housing residents of severely distressed public housing projects through the demolition, rehabilitation, reconfiguration, or replacement of obsolete public housing projects (or portions thereof); (2) revitalizing sites (including remaining public housing dwelling units) on which such public housing projects are located and contributing to the improvement of the surrounding neighborhood; (3) providing housing that will avoid or decrease the concentration of very low-income families; and (4) building sustainable communities. (42 United States Code §1437v(a))

In short, the program sought to transform distressed public housing projects into economically integrated neighborhoods in which families receiving subsidized housing assistance would live alongside higher-income neighbors who paid market prices for housing.

Revitalization grants were awarded through a competitive process in which Public Housing Agencies (PHAs)—the city-level agencies authorized to administer HUD programs—could submit one application per year. Each year HUD evaluated applications based a number of factors including "capacity to undertake development, need, the amount of outside resources brought in (leveraging), resident and community involvement, community and supportive services, commitment to early education, and the relocation plan," and grants were allocated subject to funding constraints (Congressional Research Service, 2012).

The Revitalization program represented a large investment in neighborhoods. In total, the program awarded 261 grants totaling $6.3 billion between 1993 and 2010 with a mean award size of $24 million. On average, each grant leveraged an additional $42 million from non-HOPE VI funding sources and thus the full size of the neighborhood-level intervention often exceeded the listed grant amount (Gress et al., 2016). To put these numbers in perspective, the mean Revitalization project had 360 occupied units in 1993.

A challenge with interpreting existing research on the HOPE VI program is that most previous studies do not distinguish between the two different HOPE VI programs: the Revital-

ization program and the Demolition program. The key difference between the two programs is that the Demolition program sought only to demolish distressed public housing projects while the Revitalization program provided additional funding to rebuild mixed-income communities after the public housing projects were demolished. Each program awarded a similar number of grants—285 Demolition grants compared to 261 Revitalization grants—but there was a drastic difference in funding levels: the average Revitalization award was 20 times as large as the average Demolition grant.

Previous research on the composite effect of the two HOPE VI programs has either used repeated cross-sectional data observed at infrequent time intervals to study the impact on neighborhoods or has focused on the original residents. The research focusing on neighborhoods finds that the program reduced neighborhood poverty rates (Tach and Emory, 2017) and crime (Aliprantis and Hartley, 2015; Sandler, 2017), and increased housing prices (Zielenbach and Voith, 2010). Research on the original public housing residents finds that the program led families to move to lower poverty neighborhoods and improved the long-run labor market outcomes of children (Kingsley et al., 2003; Jacob, 2004; Chyn, 2018; Haltiwanger et al., 2020). We build upon this existing work by jointly estimating the effect on neighborhoods and individual residential outcomes. Our individual panel data allow us to decompose the observed neighborhood-level changes into changes in individual outcomes for different groups of individuals. By considering populations beyond the original residents, our analysis paints a more complete picture of how changes in neighborhood conditions impact the outcomes of individuals.

3 Conceptual Framework

To define the estimand of interest, consider the set of subsidized renters in a PHA that receives a Revitalization grant. Let $n(i,t)$ denote the neighborhood in which i lives in period $t \in \{before, after\}$ and $n(i,t,d)$ be the potential outcome when the PHA does ($d=1$) or does not ($d=0$) receive a Revitalization grant targeting neighborhood h. Let ω_g denote the share of individuals who belong to group G, which is one of the following mutually exclusive and exhaustive categories:

i) the original Revitalization neighborhood residents (residents for whom $n(i, before) = h$),

ii) subsidized renters who moved into Revitalization neighborhoods after an award (residents for whom $n(i, before) \neq h$ and $n(i, after, 1) = h$),

iii) subsidized renters who would have moved into a Revitalization neighborhood absent an award (residents for whom $n(i, before) \neq h$, $n(i, after, 1) \neq h$, and $n(i, after, 0) = h$), and

iv) subsidized renters who lived in other neighborhoods potentially affected by program spillovers (residents for whom $n(i, before) \neq h$, $n(i, after, 1) \neq h$, and $n(i, after, 0) \neq h$).

Lastly, let the individual-level treatment effect of the Revitalization program on the poverty rate of the neighborhood in which i lives be defined as $\Delta_i = p\big(n(i, after, 1), after, 1\big) - p\big(n(i, after, 0), after, 0\big)$, where $p(n, t, d)$ is the poverty rate of neighborhood n, in time period t, for the potential outcome when treatment status is d. Note that the program could affect exposure to neighborhood poverty by affecting the poverty rate of a given neighborhood, $p(n, t)$, or by affecting which neighborhood the individual lives in, $n(i, t)$.

The average effect of the Revitalization program on all subsidized renters in the PHA, $\mathbb{E}\big[\Delta_i\big]$, can be written as the weighted-average of the group-specific effects,

$$\mathbb{E}\big[\Delta_i\big] = \sum_g \omega_g \mathbb{E}\big[\Delta_i | G_i = g\big]. \tag{1}$$

Our empirical analysis aims to estimate all of the components of equation 1. $\mathbb{E}\big[\Delta_i\big]$ tells us whether the program enabled subsidized renters to live in lower-poverty neighborhoods, on average. $\mathbb{E}\big[\Delta_i | G_i = g\big]$ tells us which groups of subsidized renters were the winners and losers (in terms of exposure to neighborhood poverty). We also estimate how the Revitalization program affected poverty rates in targeted neighborhoods and compare these neighborhood-level impacts to the individual-level impacts described in equation 1. Section 6.1 estimates the impact on neighborhoods, Sections 6.2.1 through 6.2.4 estimate $\mathbb{E}\big[\Delta_i | G_i = g\big]$ for each of the four subgroups, and Section 6.3 uses equation 1 to estimate $\mathbb{E}\big[\Delta_i\big]$.

Even if the Revitalization program reduced poverty rates in targeted neighborhoods, it is not obvious that these neighborhood-level changes would enable subsidized renters to live in lower-poverty neighborhoods. The program could have displaced subsidized renters into other high-poverty neighborhoods, which could potentially increase their exposure to neighborhood poverty as well as increase the exposure to poverty for other residents in

those destination neighborhoods. We make this point formally in Appendix C and interpret the Revitalization program through the lens of a model of residential sorting. Our model extends the framework of Schelling (1971, 2006) and Glaeser (2008) to include public housing and heterogeneous agents and shows how improvements in the Revitalization neighborhoods could either increase or decrease the exposure to neighborhood poverty for subsidized renters depending on how subsidized households value neighborhood amenities and the extent to which they are affected by increases in housing prices.

4 Data

We combine survey and administrative data to track neighborhoods and individuals over time. The two key strengths of our data are that they include the near universe of Revitalization grants, and they contain annual data on income, place of residence, and participation in subsidized housing for nearly all individuals in the United States.

Applicants and Awardees. We use publicly available data to identify HOPE VI projects and the neighborhoods in which they were located. All applicants and awardees are publicly listed. We link these records to project-level summary files from HUD and assign each public housing project to one of three categories:

i) *Revitalization*: projects that received a HOPE VI Revitalization grant,

ii) *Failed Applicant*: projects that applied for but did not receive HOPE VI funding, and

iii) *Non-Applicant*: projects that did not apply for or receive a HOPE VI grant.[1]

We limit our sample to large, non-senior public housing projects for which we can identify the geographic location. Table A.1 presents the impact of each sample restriction; after imposing all of the restrictions, we retain 88 percent of all Revitalization awards. We impose the same restrictions on non-Revitalization projects but additionally require that they be located at least one mile away from the nearest Revitalization site. This restriction is made because

[1]The HUD data identify projects with an alpha-numeric project ID and we assign a project ID to 99 percent of Revitalization grantees, and 98 percent of HOPE VI applicants. All of the Revitalization grantees and most of the applicants that were not assigned a project ID were scattered sites, which we omit from the analysis anyways. We use data from HUDUSER's, "Picture of Subsidized Households" to identify all projects that existed in 1993, map the project names to the project IDs, and measure project-level characteristics such as the geographic location. We also identify all projects that were awarded a HOPE VI Demolition grant and we drop these projects from our sample.

the Revitalization program could have directly affected nearby neighborhoods.[2] Our final sample contains 251 Revitalization, 166 failed applicant, and 5,783 non-applicant projects.[3] Figure B.1 maps the location of each Revitalization and failed applicant project.

Neighborhoods. We use data from HUDUSER's "Picture of Subsidized Households" to identify the Census block group in which each project is located.[4] Block groups are defined by the U.S. Census Bureau and typically contain around 1,500 residents. To account for the fact that multiple projects might be located in a single block group and some projects span multiple block groups, we group together clusters of nearby public housing projects into neighborhoods defined by the connected set formed by projects and Census tracts. 90 percent of neighborhoods contain one or two block groups, and the two largest neighborhoods contain five block groups. For much of our analysis we collapse the data to these neighborhoods, of which there are 125 failed applicant and 204 Revitalization neighborhoods.[5]

Revitalization neighborhoods contain a mix of public and non-public housing units prior to an award. The average Revitalization neighborhood contained 1,059 households, 45 percent of whom lived in public housing in 1993. There is variation in the fraction living in public housing, ranging from 29 to 60 percent at the 25th and 75th percentiles, respectively.

Individuals. We use linked survey and administrative data to measure the outcomes of individuals. We rely on four main data sources. First, we use administrative data from HUD, which allow us to identify which individuals receive subsidized housing and where these individuals live. Second, we use administrative data from tax records, which provide annual measures of income and residential location for all filers. Third, we use administrative data from the U.S. Census Bureau's Master Address File (MAF), which provide additional address data for individuals not in the tax records. Fourth, we use survey data from the Decennial Census Survey and the American Community Survey, which provide information on other variables including income, rent, and home ownership status. We link these datasets

[2]Our sample excludes the 39 demonstration grants awarded between 1993 and 1995. The demonstration grants differed in their objectives (creating economically integrated neighborhoods became an explicit goal only in 1996) and their approach (later awards placed a larger emphasis on leveraging additional sources of funding). Project-level data on applicants is missing for 2009 and 2010 but there were only 80 applicants in these two years compared to 778 applicants across all other years. Furthermore, many of these applicants likely applied in previous years and therefore still appear in our data.

[3]A single Revitalization grant or application could affect multiple projects. In most cases projects affected by a single grant are clustered within the same neighborhood.

[4]We use the definition of a block group based on the 2010 Census geography.

[5]Our data include 308, 178, and 5,391 block groups that contain a Revitalization, a failed applicant, and a non-applicant public housing project, respectively.

together to construct an individual-level panel that includes one observation per person per year between 1995 and 2018 for the near universe of people living in the United States.[6]

We use adjusted gross income (AGI) to identify poor households. Specifically, we define individuals as poor if they reside in a household whose average AGI over the past five years is less than $15,000.[7] The $15,000 threshold is approximately equal to the poverty line for a three-person family in 2007, which is the middle of our sample period. While there is considerable mobility in and out of poverty from year to year, our measure captures a persistent form of income deprivation (Larrimore et al., 2020).[8] We have found similar results using AGI in a single year or calculating poverty based on the official poverty line. Unless otherwise noted, we use the term "neighborhood poverty rate" to refer to the share of individuals who meet this AGI-based definition of poverty.

We combine the data on neighborhoods and individuals to create two analysis datasets. We construct a repeated cross-sectional dataset that summarizes the population that lives in each neighborhood in each year. We use these data to measure how neighborhoods change over time as well as to study the new residents that move into the sample neighborhoods after an award or application. Second, we construct a panel of original residents that follows the individuals who lived in the targeted neighborhoods in the year before an award. We use these data to measure the outcomes of the original residents and explore how a key group of intended beneficiaries were affected by the Revitalization program. The two datasets provide annual panels tracking the neighborhoods and original residents between 1995 (one year before the first award) and 2018 (eight years after the last award). In some cases we supplement these data with additional neighborhood-level information from the publicly available summary files from the 1990 and 2000 Decennial Census Surveys and the annual data from the 2009-2017 waves of the ACS, all of which are obtained through IPUMS (Manson et al., 2021).[9]

[6] While the coverage is quite comprehensive, address data are not available for every individual in every year. We make the assumption that an individual lives in the same address until we observe a new address. For children, we use the address data from the parent who most recently claimed them as a dependent.

[7] For children, we use the AGI from the parent who most recently claimed them as a dependent.

[8] Using a five-year average of AGI has the added advantage of providing a simple way to account for the fact that we do not have tax records for 1996 and 1997.

[9] Annual neighborhood-level statistics are from the 5-year ACS estimates, which are constructed by pooling data from the 5-year period centered on the year of interest. For example, we use data from the 2015-2019 ACS surveys to estimate neighborhood characteristics in 2017. We do not use the ACS to measure neighborhood characteristics after 2017 because data from these later years are affected by the COVID-19 pandemic.

5 Empirical Strategy

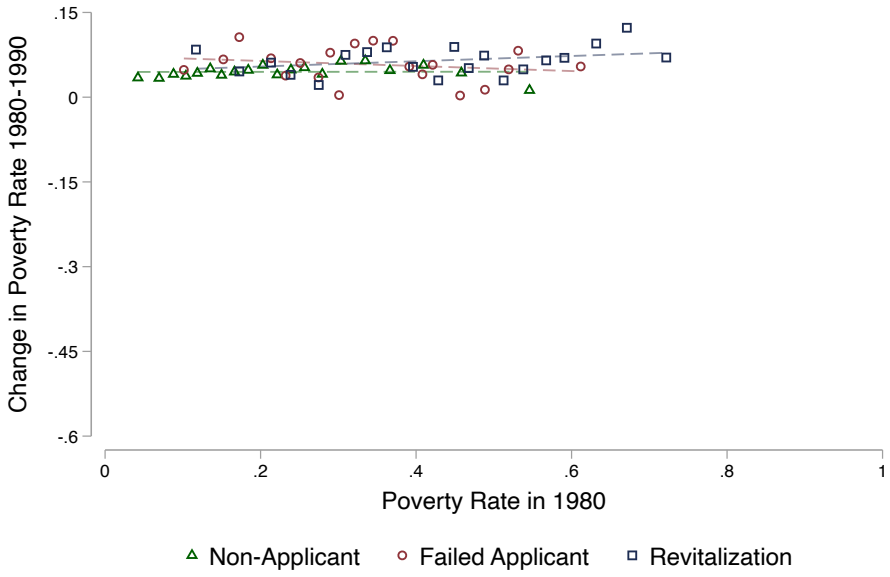
Our initial goal is to estimate the effect of the Revitalization program on the poverty rates in targeted neighborhoods. To motivate our empirical strategy, we begin by describing how poverty rates changed before and after the intervention. Figure 1(A) is a binned scatter plot of the average change in neighborhood poverty rates between 1980 and 1990 against the average neighborhood poverty rate in 1980 (all HOPE VI grants were awarded after 1990).[10] Each point corresponds to 1 of 60 groups defined by treatment status and the ventile of neighborhood poverty rate. Figure 1(A) demonstrates that treatment status and baseline poverty rates are unrelated to changes in poverty rates prior to the intervention. Figure 1(B) presents analogous results for changes in poverty rates between 1990 and 2017, which is 6 years before the first and 7 years after the last Revitalization award, respectively. Conditional on baseline poverty rates, the failed applicant and non-applicant sites experienced similar changes in poverty rates after the intervention while the Revitalization sites experienced notably larger reductions in neighborhood poverty. These results provide initial evidence that the program may have reduced poverty rates in targeted neighborhoods. The association between baseline poverty rates and subsequent changes in poverty rates among the non-Revitalization neighborhoods highlights the importance of comparing Revitalization projects to similar untreated projects. Our main empirical strategy uses the failed applicant projects as our control group but, consistent with Figure 1(B), we show that our main results are robust to using other, observably similar projects.

There are three reasons why the failed applicants are a useful comparison group. First, demand for the program far exceeded supply, so there were many projects that applied for but never received funding. Figure B.2 displays the number of applicants and awardees by grant year. On average, only 29 percent of applicants in a given year were awarded a grant. While applicants that were rejected in one year could apply again in a subsequent year, 34 percent of all applicants never received funding. Second, the average award size exceeds $20 million. This implies PHAs likely would have found it difficult to replace Revitalization funding and pursue the planned projects absent the HOPE VI grants. Third, failed applicants

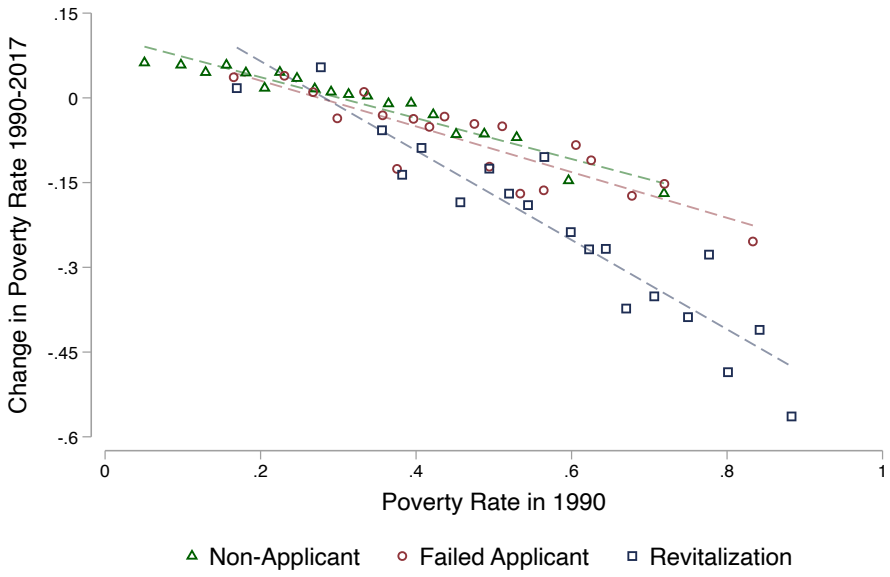
[10] We measure neighborhood poverty rate as the average poverty rate of all block groups that contain a public housing project. Because it is not possible to crosswalk the 1980 geographic codes to the 2010 block groups, Figure 1(A) measures the poverty rate at the tract level, not the block group level. We use the method developed by Logan et al. (2014) to crosswalk the 1980 Census tracts to the 2010 geography.

Figure 1: Changes in Neighborhood Poverty Rates Near Public Housing Projects

(A) Before Revitalization Program



(B) After Revitalization Program



Notes: Each figure plots the change in neighborhood poverty rates against the baseline poverty rate. Within the non-applicant, failed applicant, and Revitalization samples, projects are grouped into population-weighted ventiles based on the baseline poverty rate. Each point represents a population-weighted average of observations in a given ventile. In Panel A the baseline year is 1980 and the change is measured between 1980 and 1990. In Panel B the baseline year is 1990 and the change is measured between 1990 and 2017.

Source: Authors' calculations based on summary files of Decennial Census survey and the ACS.

share the characteristics that led them to apply for the program. The PHA-level decision to apply for Revitalization funding for a project signals interest and an expectation that the project may benefit from Revitalization activities. This could imply that applicant projects and neighborhoods are more similar, in terms of observable and unobservable characteristics, to Revitalization grantees than the broader group of non-Revitalization projects and neighborhoods. Table A.2 presents baseline characteristics for non-applicant, failed applicant, and Revitalization projects. While Revitalization projects tend to the most disadvantaged, the observable differences between the failed applicant and Revitalization projects are meaningfully smaller than the differences between the non-applicant and Revitalization projects.

While there are observable differences between the failed applicant and Revitalization neighborhoods on average, there exist failed applicant neighborhoods that are very similar to Revitalization neighborhoods. Figure B.3(A) presents the distribution of poverty rates in 1990 for the failed applicants and Revitalization neighborhoods. While average poverty rates differ between the two groups, even for the highest-poverty Revitalization projects, there exist failed applicant neighborhoods that are located in similarly poor neighborhoods.[11] Given the overlap of the two distributions, we view inverse propensity score weighting, particularly when combined with a stacked difference-in-differences estimator, as a promising way to adjust for observable differences in means between the two groups.

We compare Revitalization awards from a given grant year to all failed applicants. To facilitate this comparison we create a stacked dataset that contains one observation for each Revitalization neighborhood and 15 observations for each failed applicant neighborhood, one for each of the 15 possible grant years between 1996 and 2010 (in this way, each failed applicant neighborhood appears in the event-specific panel for all grant years). Within each grant year, we estimate a propensity score by estimating a logistic regression of receipt of a Revitalization award on the population of the neighborhood, the share of the neighborhood that was Black non-Hispanic, the share below the poverty line, the median home value, and the size of the public housing project. Our approach allows for changes in the selection process over time and aims to balance the observable characteristics of the failed applicant and Revitalization neighborhoods within each grant year. When conducting the analysis at the neighborhood-level, we multiply the inverse propensity score weights by the neighborhood population in the year before the award. We normalize the weights for the failed appli-

[11] Panels B-D of Figure B.3 show a similar degree of overlap for other relevant pre-award variables.

cant group such that within each grant year the sum of the weights across failed applicant neighborhoods is equal to the sum of the weights across the Revitalization neighborhoods.[12]

Weighting the data by the inverse estimated propensity score eliminates observable pre-Revitalization differences between the Revitalization and failed applicant neighborhoods. Figure B.4 presents balance tests in which we regress a neighborhood characteristic measured prior to the award on an indicator for receipt of a Revitalization grant. Panel A weights by population and illustrates that there are some differences between the Revitalization and failed applicant neighborhoods. Panel B uses inverse propensity score weights and shows that these weights eliminate observable differences between the two groups.

In most cases we have data on pre-treatment outcomes and we operationalize the comparison between Revitalization neighborhoods and failed applicant neighborhoods using a stacked difference-in-differences estimator. To address concerns related to the staggered timing of treatment, we follow Cengiz et al. (2019) and stack the data, creating a panel dataset that has a clean "event" for each Revitalization grant year. For each potential grant year between 1996-2010, the panel includes all failed applicants and the awardees from that year.[13] We then stack the datasets from each award year and estimate the following specification,

$$y_{nt} = \sum_{j \neq -1} \beta^j D^j_{nt} + \lambda_{gt} + \delta_{ng} + \epsilon_{nt} \tag{2}$$

where δ_{ng} is a neighborhood by grant year fixed effect, λ_{gt} is a fixed effect for grant year by year relative to award, and D^j_{nt} treatment indicator equal to one if neighborhood n received a Revitalization grant and year t is j years after the award.[14] We estimate this specification via weighted least squares using the inverse propensity score as weights and cluster standard errors at the level of the neighborhood. The main coefficients of interest are the β^j, which

[12]For results based on individual-level data, we multiply the inverse propensity score weights by the baseline population in the neighborhood divided by the number of individuals in the sample for that analysis. Thus, the sum of these weights across individuals within a project is equal to the weights used in the neighborhood-level analysis. This weighting scheme makes our results comparable across specifications since all analyses, whether based on neighborhood- or individual-level data, weight by the exact same measure: baseline population in the neighborhood.

[13]This specification effectively compares the Revitalization awardees in a given year to all failed applicants. The propensity score is estimated within grant year to adjust for observable differences between these two groups. Standard errors are clustered at the level of the neighborhood to account for the fact that we reuse the failed applicants as controls across grants years.

[14]We use the neighborhood by grant year fixed effect because we stack the data and a panel of the failed applicant neighborhoods appears in the data for each grant year.

trace out treatment effects over time relative to the year before the award.

The key identifying assumption is that the outcomes of Revitalization and failed applicant sites would follow parallel trends absent treatment. We assess the plausibility of this assumption by examining trends in the estimated pre-treatment effects and by exploring the sensitivity of the results to using alternative comparison groups, data sources, and estimators. Our estimator reweights the failed applicant sample to match the observable characteristics of the Revitalization sample, which addresses the concern that neighborhoods with different baseline levels might be on different trajectories. In practice, our results are largely robust to using population weights instead. This is because the failed applicant projects are observably similar to the Revitalization projects, even without weighting, and the treatment effects are large relative to any potential bias that could result from imbalance in observable characteristics in the year before treatment.

In cases where we lack measures of the outcome variable prior to the award, we estimate the following specification,

$$y_n = \alpha + \beta D_n + \lambda_g + \epsilon_n \tag{3}$$

where y is the outcome variable (typically measured as an average between the 10 to 15 years after the award) for neighborhood n, λ_g is a fixed effect for the grant year, and D is an indicator equal to one if the neighborhood received a Revitalization grant. We estimate this specification via weighted least squares using the inverse propensity score as weights and cluster standard errors at the level of the neighborhood. When possible, we control for pre-treatment covariates to increase precision.

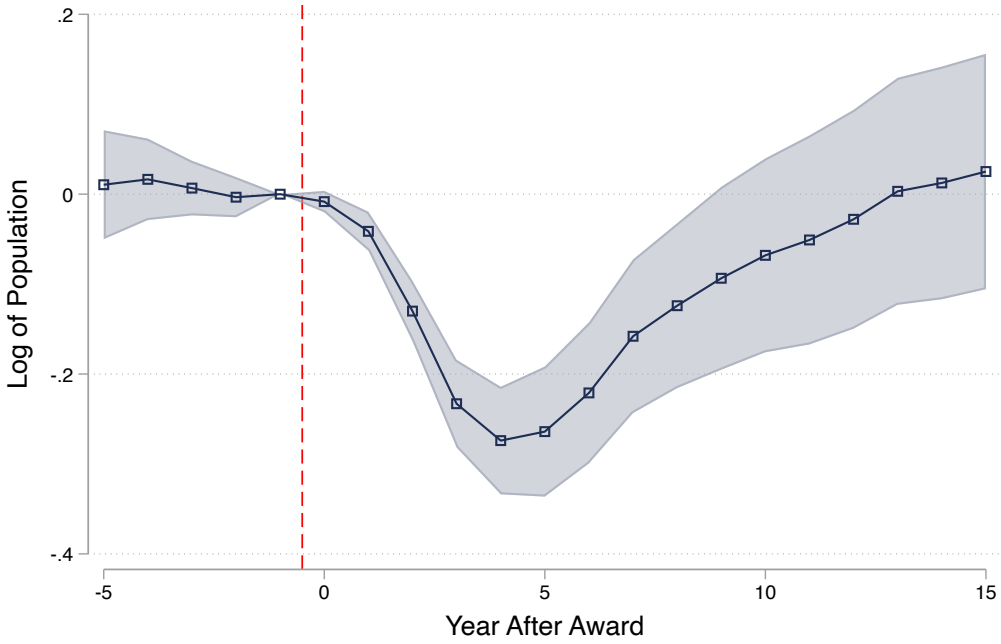
We use equation 2 to estimate the effect on the original residents but we require additional assumptions to estimate the impact on the other three groups of subsidized renters. We discuss these assumptions in more detail in the relevant subsections below.

6 Effect of the Revitalization Program

6.1 Effect on Neighborhoods

We begin by showing that the Revitalization program increased population churn in targeted neighborhoods. Figure 2 presents results from equation 2 where the outcome variable is the log of total population. The Revitalization program led to a 26 log point reduction in

Figure 2: Effect on Population of Neighborhood



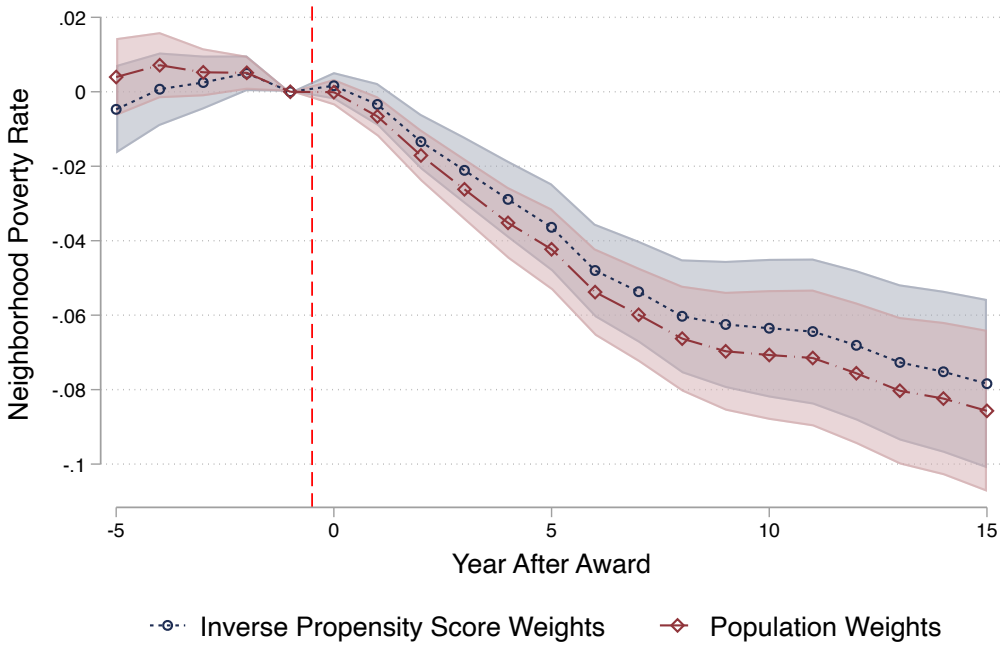
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome variable is the log of the total number of people living in the neighborhood. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

population five years after the award. But population quickly recovered over the next five years. The results suggest the following timeline: (*short-run*) in the five years following the award people moved out and housing units were demolished; (*medium-run*) in the next five years people moved back into the neighborhood as housing units were rebuilt; and (*long-run*) around ten years after the award construction was largely complete and the population returned to the level where it would have been in the absence of the Revitalization award.[15] Figure 2 also suggests that neighborhood population in Revitalization and failed applicant neighborhoods were on similar paths prior to the Revitalizations: the pre-Revitalization coefficients are never statistically significantly different from zero and are always close to zero in magnitude.

The Revitalization program led to a large, persistent reduction in neighborhood poverty

[15]Figure B.5 presents the effect on the physical housing stock. These results suggest a similar timeline, with a reduction in total housing units in the first five years and the construction of new housing units taking place over the subsequent five years. These estimates are less precise as the housing stock variables are measured from public data in 1990, 2000, and annual data are only available starting in 2007.

Figure 3: Effect on Neighborhood Poverty



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The two series present estimates from specifications that weight by the inverse propensity score and the baseline population. The outcome is the proportion of current residents who are poor. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

rates. The blue circles in Figure 3 show that the program led to an 8 percentage point reduction in the share of residents who are poor 15 years after an award. The red diamonds represent estimates from a specification in which we use population weights instead of inverse propensity score weights. The insensitivity of the estimates to which weights are used, along with a failure to reject the null of no difference in neighborhood poverty between one and five years prior to the awards offer support for the assumption that outcomes would have evolved along similar paths in the absence of the Revitalization program.

Table 1 demonstrates the robustness of the estimated effect on neighborhood poverty rates across alternative estimators, comparison groups, and data sources. We regress the change in block group poverty rate between 1990 and 2017 on an indicator for receiving a Revitalization grant and a vector of baseline covariates. This specification is analogous to the estimator proposed by Dube et al. (2023), which, like the stacked event-study estimator, accounts for issues that arise from staggered treatment adoption and heterogeneous effects.

Table 1: Effect on Neighborhood Poverty Using Alternative Estimator, Data, and Comparison Groups

	Change in Block Group Poverty Rate Between 1990 and 2017				
	(1)	(2)	(3)	(4)	(5)
A. With Covariates					
Revitalization	-0.077	-0.118	-0.093	-0.101	-0.066
	(0.016)	(0.008)	(0.005)	(0.012)	(0.006)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Covariates	baseline	baseline	baseline	baseline+fe	baseline+fe
Comparison group	failed applicants	non-applicants	non-public housing	non-applicants near Revitalization	non-public housing near Revitalization
Observations	485	5,694	209,685	1,130	25,512
B. Without Covariates					
Revitalization	-0.132	-0.202	-0.222	-0.191	-0.228
	(0.020)	(0.008)	(0.005)	(0.012)	(0.006)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Covariates	none	none	none	fe	fe
Comparison group	failed applicants	non-applicants	non-public housing	non-applicants near Revitalization	non-public housing near Revitalization
Observations	485	5,694	209,722	1,130	25,522

Notes: Each column presents estimates from a separate regression in which the change in Census block group poverty rate between 1990 and 2017 is regressed on an indicator for receiving a Revitalization grant. The comparison groups in columns 1-5 are block groups that contain failed applicant projects, projects that did not apply for HOPE VI funding, no public housing projects, projects that did not apply for HOPE VI funding and are located within 1-5 miles of a Revitalization site, and no public housing projects and are located within 1-5 miles of a Revitalization site. The vector of baseline covariates include the following characteristics of the block group measured in 1990: poverty rate, share of residents that are White, share of residents that are Black, median rent, median home value, share of households receiving public assistance income, share of residents with a college degree, unemployment rate, share of residents that are new renters or owners, share of units that are owner occupied, share of housing building before 1960, total population, total housing, and share of units vacant. Columns 4 and 5 include fixed effects (fe) for the closest Revitalization site. Each regression is estimated via weighted least squares, using block group population in 1990 as the weights. Standard errors are presented in parentheses and p-values in brackets.
Source: Authors' calculations based on summary files of Decennial Census survey and the ACS.

The outcome variable and covariates are measured using publicly available data from the 2017 ACS or the 1990 Decennial Census. Column 1 of Panel A presents estimates using the failed applicant comparison group and shows that we find similar effects using the alternative estimator and data: the Revitalization program led to a 7.7 percentage point reduction in neighborhood poverty rates 7-21 years after a Revitalization.[16] Columns 2 and 3 compare the Revitalization sites to block groups that contain projects that never applied for HOPE VI funding and block groups that do not contain public housing projects, respectively. Both specifications show similarly large impacts on neighborhood poverty rates. Columns 4 and 5 present estimates with these same two comparison groups but limit the sample to block groups between one and five miles of a Revitalization site; the specifications also include fixed effects for the closest HOPE VI site. These estimates also show large impacts on poverty rates when comparing HOPE VI sites to similar, nearby neighborhoods. The specifications in panel B do not control for baseline differences and the estimates are substantially larger. Taken together, Table 1 shows that we find similar effects using alternative comparison groups, as long as we control for pre-award differences between Revitalization and comparison neighborhoods.

While not directly comparable, our estimates of the impact on neighborhood poverty rates are qualitatively similar to those in Tach and Emory (2017). Tach and Emory (2017) pool together Demolition and Revitalization grants and estimate the combined effect of the two HOPE VI programs on the change in poverty rates between 1990 and 2010. They find that the program led to a 11 percentage point reduction in neighborhood poverty rates and point towards the potential displacement of the original, low-income public housing residents as an explanation for the neighborhood-level changes. As we discuss in the next paragraph, our individual-level panel data allow us to show that the Revitalization program reduced poverty rates, not by displacing the original residents, but by affecting the set of households that moved in after the award.

Poverty rates fell in Revitalization neighborhoods primarily because fewer poor, subsidized households and more non-poor, unsubsidized households moved in after awards. Table 2 presents estimates from equation 3 where the outcome variable is the average number of

[16] As discussed in Section 4, we classify households with an AGI below $15,000 as poor. Figure B.7 presents estimates from equation 2 where the outcome is the survey-based measure of neighborhood poverty rates. We impute missing values between Census surveys by assuming poverty rates do not change unless we have data that indicates otherwise. The survey-based poverty measure yields similar results: the program led to a 11 percentage point reduction in poverty rates 15 years after the award.

Table 2: Effect on Size of Sub-Populations

	By Income		By Income and Tenure				By Income, Tenure, and Subsidized Housing							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Revitalization	-269	156	-74	-195	-42	199	-43	-31	-168	-27	-20	-23	-2	201
	(74)	(65)	(15)	(71)	(10)	(65)	(11)	(10)	(53)	(41)	(7)	(9)	(33)	(54)
	[0.000]	[0.017]	[0.000]	[0.006]	[0.000]	[0.002]	[0.000]	[0.001]	[0.002]	[0.520]	[0.008]	[0.012]	[0.958]	[0.000]
Mean	1580	1100	285	1290	224	879	108	177	696	595	52	172	335	544
Poor	yes	no	yes	yes	no	no	yes	yes	yes	yes	no	no	no	no
Original resident			yes	no	yes	no	yes	yes	no	no	yes	yes	no	no
Subsidized housing							yes	no	yes	no	yes	no	yes	no
Observations	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000

Notes: Each column presents estimates from a separate regression in which an outcome variable is regressed on an indicator for the Revitalization award. The outcome variable differs across columns and is the size of the population defined by poverty, tenure, and subsidized housing status. Regressions are estimated via weighted-least squares using the inverse propensity score. All regressions control for the year of first award as well as the number of poor and non-poor households who lived in the neighborhood in the year before the award. Standard errors are clustered at the neighborhood and are presented in parentheses and p-values are presented in brackets.
Source: Authors' calculations based on linked administrative data.

people (in groups defined by poverty, tenure, and subsidy status) who live in the neighborhood 10 to 15 years after the award.[17] To increase precision, the specifications control for the number of poor and non-poor individuals in the neighborhood in the year before the award. Columns 1 and 2 indicate that the Revitalization program decreased the number of poor residents by 269 and increased the number of non-poor residents by 156, on average.[18] Columns 3 through 6 illustrate that both the reduction in poor residents and the increase in non-poor residents is driven by a change in the composition of *new residents*, as opposed to differences in out-migration for original residents. Specifically, the program reduced the number of new, poor residents by 195 and increased the number of new, non-poor residents by 199. Columns 7 through 14 further break these results out by subsidized housing status. The decline in the population of poor households is driven by fewer new residents with subsidized housing (column 9) and, to a lesser extent, a decline in the number of poor, original residents in subsidized housing. The growth in the population of non-poor individuals appears to be exclusively driven by new, non-poor residents without subsidized housing (column 14).

The program reduced the poverty rate in targeted neighborhoods, but did so at the cost of reducing access to these neighborhood for subsidized households. Columns 7 through 14 of Table 2 imply that the program reduced the size of the population with subsidized housing by 20 percent and increased the size of the population without subsidized housing by 8 percent.[19] Figure B.6 presents estimates from equation 2 and shows a long-run decline in the subsidized population of similar magnitude. However, a reduction in the number of subsidized renters in the Revitalization neighborhoods need not imply a reduction in subsidized units in the broader housing market. Indeed, Section 6.3 presents evidence that at the city-level, the program reduced the stock of public housing but this was offset by an increase in the provision of housing vouchers.

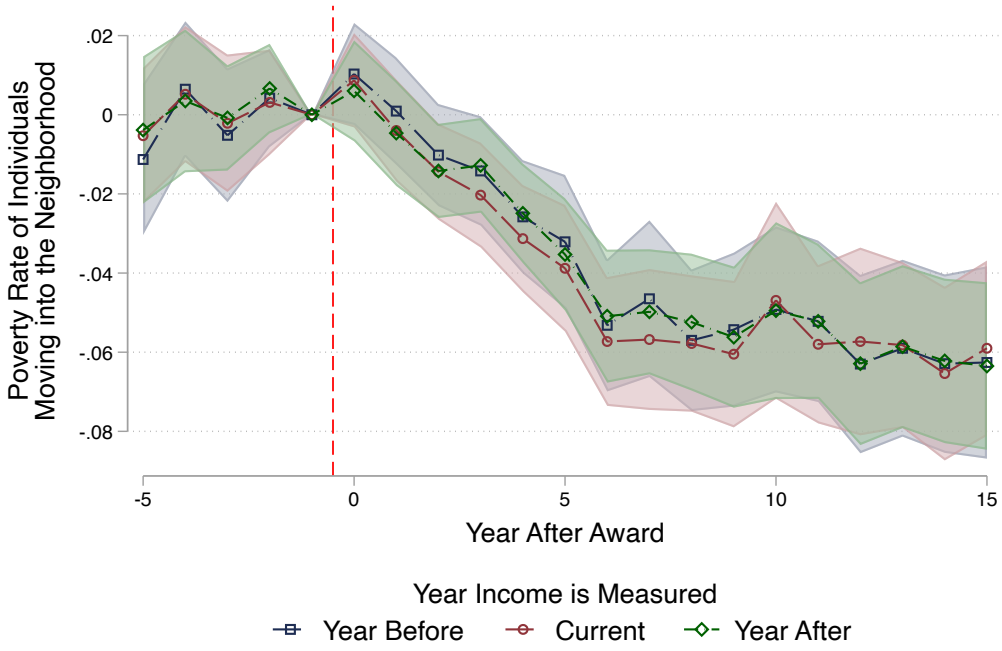
The program reduced poverty rates by attracting residents who would have had higher incomes regardless of where they lived as opposed to increasing the income of new residents. For each neighborhood and year, we calculate the poverty rate for the population of individu-

[17] We use equation 3 for this analysis because we estimate the impact on the size and characteristics of the population that moved in after, and this population is not defined before the award.

[18] Figure B.8 shows the same finding using equation 2 to estimate the effect on log population by poverty status. In the long-run, the program led to a 10 log point reduction in the number of poor residents and a 20 log point increase in the number of non-poor residents.

[19] We arrive at these calculations by taking the sum of the treatment effects divided by the sample mean size of the populations: -0.20=(-43-168-20-2)/(108+696+52+335) and 0.08=(-31-27-23+201)/(177+595+172+544).

Figure 4: Effect on Poverty Rate of Newcomers



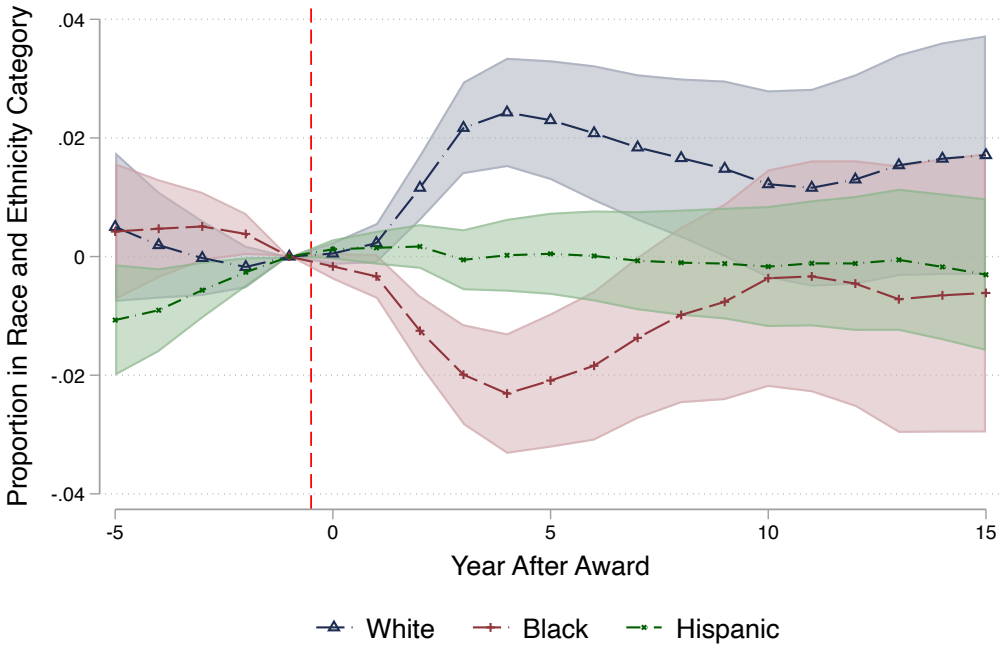
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. We identify the population of individuals who move in during a given year and the three series represent estimates from three separate regressions in which we measure the poverty rate of this population using their income in the previous, current, or subsequent year. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

als who move into the neighborhood in that year using their income in the previous, current, or subsequent year.[20] Figure 4 presents estimates from equation 2, using these three measures of poverty as the outcome variable. The red circles represent estimates when measuring the income of the new neighborhood residents in the year of the move and show that the poverty rate of the flow of households moving into the Revitalization neighborhoods drops by 6 percentage points in the long run. The blue squares and green diamonds represent estimates using the poverty rate measured using individual income in the year before the move or in the year after the move, respectively; both estimates are indistinguishable from those based on the contemporaneous measure of income. The higher-income residents who moved into the revitalized sites had higher incomes prior to moving into these neighborhoods.

Figure 5 presents results showing how the Revitalization program affected the racial and

[20]In contrast to our main measure of poverty, these outcomes are based on the individual's income in a single year, as opposed to the five-year average.

Figure 5: Effect on Racial and Ethnic Composition of Neighborhood



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the proportion of the population who is White non-Hispanic, Black non-Hispanic, or Hispanic. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

ethnic composition of the neighborhoods. Many HOPE VI projects were predominately Black non-Hispanic, which explains why the Black non-Hispanic population share in Revitalization neighborhoods declined in the short-term as the public projects were demolished; the share of neighborhood residents who were White non-Hispanic responded in the opposite way: increasing immediately following a Revitalization grant and remaining persistently higher up to 10 years after a demolition. The share of Black non-Hispanic residents had largely recovered by 15 years after a Revitalization; we fail to reject that there is no difference between Revitalization and applicant neighborhoods in terms of the proportion of residents who were White non-Hispanic or Black non-Hispanic 15 years post-Revitalization. We find no evidence that the Revitalization program affected the proportion of neighborhood residents who were Hispanic in any post-event year.

The Revitalization program led to a substantial increase in housing costs, but had no impact on rates of home ownership. We measure housing-related variables using responses to

Table 3: Effect on Housing Prices and Home Ownership

	Log Rent			Log Home Value			Log Monthly Morgage			Owner	Renter
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Revitalization	0.249	0.192	0.136	0.246	0.136	0.161	0.125	0.044	0.101	-0.014	0.014
	(0.062)	(0.061)	(0.044)	(0.074)	(0.067)	(0.069)	(0.052)	(0.048)	(0.044)	(0.023)	(0.023)
	[0.000]	[0.002]	[0.002]	[0.001]	[0.042]	[0.021]	[0.018]	[0.357]	[0.021]	[0.537]	[0.537]
Housing Characteristics		X	X		X	X		X	X		
Exclude New Housing			X			X			X		
Mean	6.560	6.560	6.730	11.700	11.700	11.700	6.760	6.760	6.690	0.348	0.652
Standard deviation	0.062	0.061	0.044	0.074	0.067	0.069	0.052	0.048	0.044	0.023	0.023
Observations	30,000	31,000	12,000	33,000	32,000	23,000	18,000	18,000	12,000	2,000	2,000

Notes: Each column presents estimates from a separate regression in which an outcome variable is regressed on an indicator for the Revitalization award. Regressions are estimated via weighted-least squares using the inverse propensity score. All regressions control for the year of first award and the calendar year as well as the vacancy rate, median home value, neighborhood poverty rate, and share of population that is Black in the year before the award. When indicated some regressions further control for housing characteristics (building type, year built, persons per room) and limit to house units built before the award. In columns 1-9 the unit of observation is the housing unit. In columns 10 and 11 the data are collapsed to the project level. Standard errors are clustered at the neighborhood and are presented in parentheses and p-values are presented in brackets. We also report the mean and standard deviations for the failed applicant neighborhoods.
Source: Authors' calculations based on linked survey and administrative data.

the ACS in the 10 to 15 years after the award.[21] Since we do not have ACS data in the pre-award period, we use equation 3 to estimate the effect of the program the outcomes from the ACS. Columns 1 to 9 of Table 3 show the effect on rent, home values, and monthly mortgage payments. For each outcome we present results from a baseline model, which controls for pre-award neighborhood characteristics; a modified specification that also controls for observable housing unit characteristics (building type, year built, persons per room), which is our preferred specification; and a specification that limits the sample to units that were built prior to the award. Across all outcomes and specifications we find positive effects on housing prices. The robustness of the price effects to controlling for housing characteristics and limiting the sample to pre-existing housing units, suggests that the program made the neighborhoods more appealing places to live rather than just improving the physical characteristics of the housing stock. Columns 10 and 11 show that the program had no impact on home ownership rates.

6.2 Effect on Individual-Level Residential Outcomes

We next investigate whether the reduction in poverty rates in the Revitalization neighborhoods led subsidized renters to live in lower poverty neighborhoods. Sections 6.2.1 through 6.2.4 consider impacts on the four groups of subsidized renters defined in Section 3.

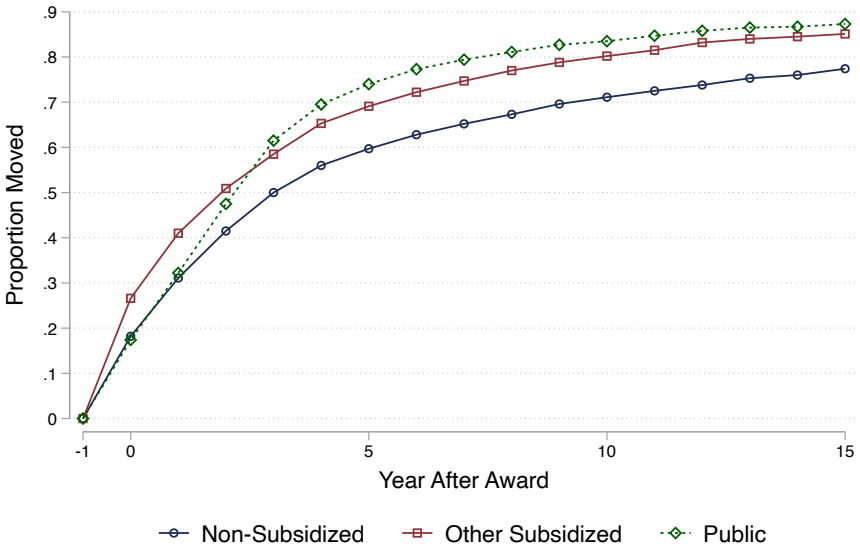
6.2.1 Original Residents

Many of the original residents of the Revitalization neighborhoods moved away and were not exposed to the changed neighborhood conditions. Figure 6(A) plots the proportion of original residents of the Revitalization neighborhoods—i.e., residents of the neighborhood in the year before the award—who had moved away between 0 and 15 years after an award by housing subsidy type. Residents of both public and non-public housing exhibited high rates of residential mobility. Within five years of an award, over 70 percent of the original residents of the public housing projects and over 60 percent of the non-public housing residents in the area had moved away. While we show below that the program does increase the propensity of original residents to move, Figure B.9 demonstrates that there were similarly high rates of mobility in the failed applicant neighborhoods: within five years of an award, 56 percent of

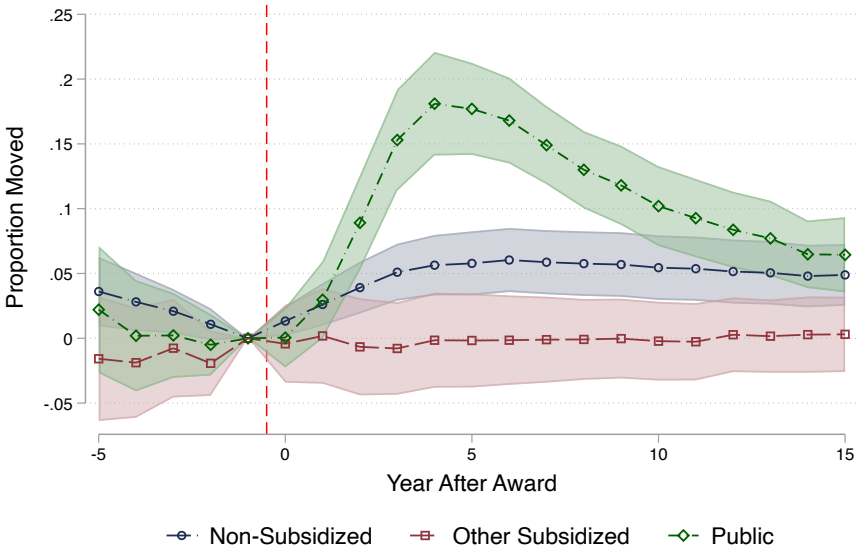
[21] When measuring housing prices, we exclude households who receive subsidized housing. Respondents to the ACS often report the rent they pay (the tenant payment) as opposed to their contract rent. Because HOPE VI reduces the share of units that are subsidized, using all responses to the ACS would lead us to overestimate the effect on prices. Indeed, when we use all respondents to the ACS, we find increases in rent that are 43 percent larger than the estimates in Table 3.

Figure 6: Residential Mobility of the Original Residents

(A) Rates of Residential Mobility in Revitalization Neighborhoods



(B) Effect of the Revitalization Program



Notes: Panel A plots the proportion of the original residents of the HOPE VI neighborhoods who moved to a different Census block group by a given year after the award. Panel B plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the proportion of the original residents who moved. The shaded regions denote the 95 percent confidence intervals. All results are presented separately by original housing status (i.e., non-subsidized, other subsidized, or public housing).

Source: Authors' calculations based on linked administrative data.

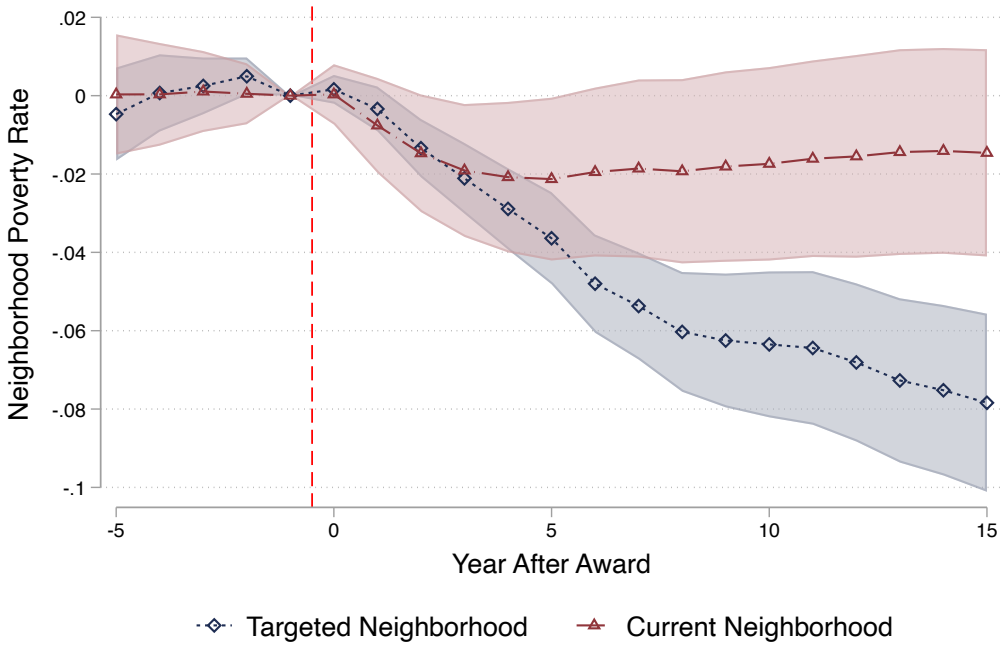
the original residents of the failed applicant public housing projects had moved away. These descriptive statistics foreshadow a main finding in this section: residents of high-poverty neighborhoods containing public housing projects move often, which limits their exposure to changes in neighborhood conditions.

The program induced the original neighborhood residents living in public housing and in non-subsidized housing to move away, but had no impact on the mobility of households participating in other subsidized housing programs. Figure 6(B) presents estimates from equation 2 where the sample includes individuals who lived in the neighborhood in the year before the award. The outcome is the proportion of individuals who had moved by a given year, defined relative to the Revitalization award year. Five years after an award, the original residents of the Revitalization public housing projects were 18 percentage points more likely to have moved to a different neighborhood than residents from failed applicant public housing projects. Over the following decade, the size of this difference declines as more households in the failed applicant projects move away. Fifteen years post-award, the original residents of Revitalization public housing projects are 6 percentage points more likely to have departed the neighborhood than their failed applicant counterparts. While this shows that HOPE VI displaced some of the original public housing residents, 78.6 percent of failed applicant public housing residents also departed their original neighborhood within 15 years. Together this suggests that the HOPE VI displacement effect was approximately 8 percent of the comparison group mean over the long-term.

Figure 6(B) shows that the original Revitalization neighborhood residents without access to subsidized housing were also about 5 percentage points more likely to have moved within five years after an award and this difference persists through 15 years after the award. However, we find no effect on the residential mobility patterns of the original residents who had access to other forms of subsidized housing. One potential explanation is that these households were shielded from the increases in housing costs shown in Table 3.

Figure B.10 presents the effect of the program on housing subsidy type for the original public housing project residents. Five years after a Revitalization award, the original residents of Revitalization public housing projects were 15 percentage points less likely to be living in public housing relative to the original residents of failed applicant public housing projects. This decline is partially offset by a 9 percentage point increase in the probability of receiving another form of housing assistance, primarily in the form of housing vouchers. On

Figure 7: Effect on Exposure to Neighborhood Poverty for Original Residents



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the poverty rate of the original or current neighborhood. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

net, the program led to a 6 percentage point reduction in the receipt of any subsidized housing five years after the award. These impacts on subsidized housing participation decline in size over time: by 15 years after an award, the Revitalization program led to a 4 percentage point increase in the probability of receiving any housing subsidy. These dynamics could be explained by the short-run displacement of households from public housing, with the households offered other forms of subsidized housing preferring their new programs to the original public housing projects and thus being less likely to exit subsidized housing entirely. The contrast between the short- and longer-term results could also reflect the time and effort households have to expend to identify a landlord who is willing to accept housing vouchers (Ellen, 2020).

Relative to the impact on the targeted neighborhoods, the Revitalization program had a much smaller effect on exposure to neighborhood poverty for the original residents. The red series in Figure 7 presents the effect of the program on neighborhood poverty based on the observed neighborhoods the original residents live in after the award (which may or

may not be a different neighborhood). The Revitalization program led to a 1.5 percentage point decrease in the poverty rate of the neighborhoods in which the original residents lived 15 years after the award.[22] For comparison, the blue series reproduces the estimates from Figure 3 of the effect of the program on poverty rates in targeted neighborhoods. The reduction in poverty rates in targeted neighborhoods is 5.4 times as large as the reduction in exposure to neighborhood poverty rates for the original residents. Figure B.11 illustrates how reductions in neighborhood poverty differ for groups of original residents defined by their housing subsidy in the year before the award. Residents of non-subsidized, public, and other subsidized housing experience similar reductions in exposure to neighborhood poverty.

Consistent with Chyn (2018) and Haltiwanger et al. (2020), we find no evidence that the program affected the income of the adults living in the neighborhoods prior to the award. Figure B.12 presents estimates from equation 2 where the outcome variable is the poverty rate of the original residents. For all time periods, the estimates are economically small and statistically insignificant.

To summarize, most of the original residents moved away within a few years of the Revitalization awards and therefore were not exposed to the changing neighborhood conditions. The high rates of out-migration were not driven solely by Revitalization-induced displacement. Instead, they are a shared feature of low-income populations in high-poverty neighborhoods. Thus, the likely beneficiaries of interventions that target distressed neighborhoods are the new residents who move in after the neighborhoods change rather than the incumbent residents. Still, it is important to emphasize that the Revitalization program did displace some of the original Revitalization neighborhood residents. While we find evidence that these families ended up living in slightly lower-poverty neighborhoods, these moves also likely imposed disruption costs on affected individuals and families.[23] While estimating the magnitude of these costs is outside the scope of this paper, it is important to acknowledge that these Revitalization-induced moves could have generated significant disruptions in the lives of affected individuals.

[22]These estimates are consistent with those from Haltiwanger et al. (2020), who find that children who resided in public housing projects demolished under HOPE VI moved to neighborhoods with only slightly lower poverty rates.

[23]However, we also note evidence from Chyn (2018) and Haltiwanger et al. (2020) which suggests that the children who lived public housing projects demolished under HOPE VI earn more in adulthood as a result of the program.

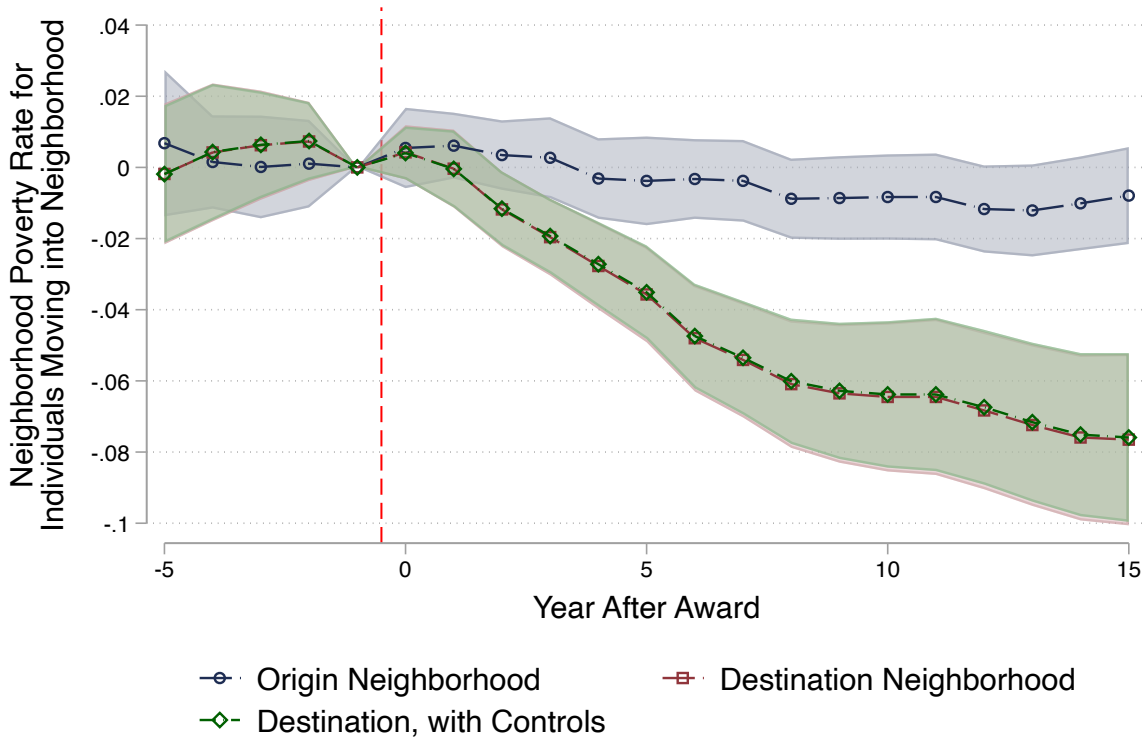
6.2.2 New Residents

The reduction in poverty rates in revitalized neighborhoods does not necessarily translate into a reduction in exposure to neighborhood poverty for new residents. The program could have attracted individuals who, absent the intervention, would have chosen to live in neighborhoods with similar poverty rates to the revitalized neighborhoods. In this case, the program would have had no impact on exposure to neighborhood poverty for new residents. To assess the potential importance of this type of selection, we study subsidized renters who move into the HOPE VI and failed applicant neighborhoods after an award and estimate the difference between the poverty rates in their *origin neighborhoods*—i.e., the poverty rates in the neighborhoods that the newcomers lived in before moving into the HOPE VI or failed applicant neighborhoods. Intuitively, the origin neighborhood is likely to be informative of where the new residents of the revitalized units would have lived absent the intervention. If individuals who move into the HOPE VI neighborhoods after an award tend to move from neighborhoods with lower poverty rates than those who move into failed applicant neighborhoods, it suggests that the program attracted new residents who likely would have lived in different, lower-poverty neighborhoods absent the award.[24]

We find that subsidized households who moved into the revitalized neighborhoods came from neighborhoods with similar poverty rates to the subsidized households who moved into failed applicant neighborhoods. We construct a sample of subsidized households who move into a failed applicant or Revitalization neighborhood between 5 years before an award and 15 years after an award and estimate equation 2 on individual-level panel data where the outcome is the poverty rate in the origin neighborhood (i.e., the neighborhood the individual lived in before moving to the Revitalization or failed applicant neighborhood). The blue circles in Figure 8 show these estimates which help to quantify selection into the targeted neighborhoods after an award. The results indicate that the new residents of the revitalized neighborhoods moved from neighborhoods that had slightly lower, but never statistically different poverty rates: origin neighborhood poverty rates are 0.8 percentage points lower 15

[24]To see the connection to the conceptual framework in Section 3, consider an individual i who moves into the HOPE VI neighborhood h after the award, $n(i, after, 1) = h$. The concern is that i would have chosen to live in a different neighborhood absent the award, $n(i, after, 0) = k \neq h$, with a poverty rate similar to the revitalized neighborhood $p(k, after, 0) = p(h, after, 1)$. In this way, the program could have reduced poverty rates in neighborhood h, $p(h, after, 1) < p(h, after, 0)$ but had no impact i's exposure to neighborhood poverty, $\Delta_i = 0$. Our analysis is motivated by the idea that the origin neighborhoods are likely informative about the poverty rate of the unobserved counterfactual neighborhoods, $n(i, after, 0)$.

Figure 8: Effect on Exposure to Neighborhood Poverty for Newcomers in Subsidized Housing



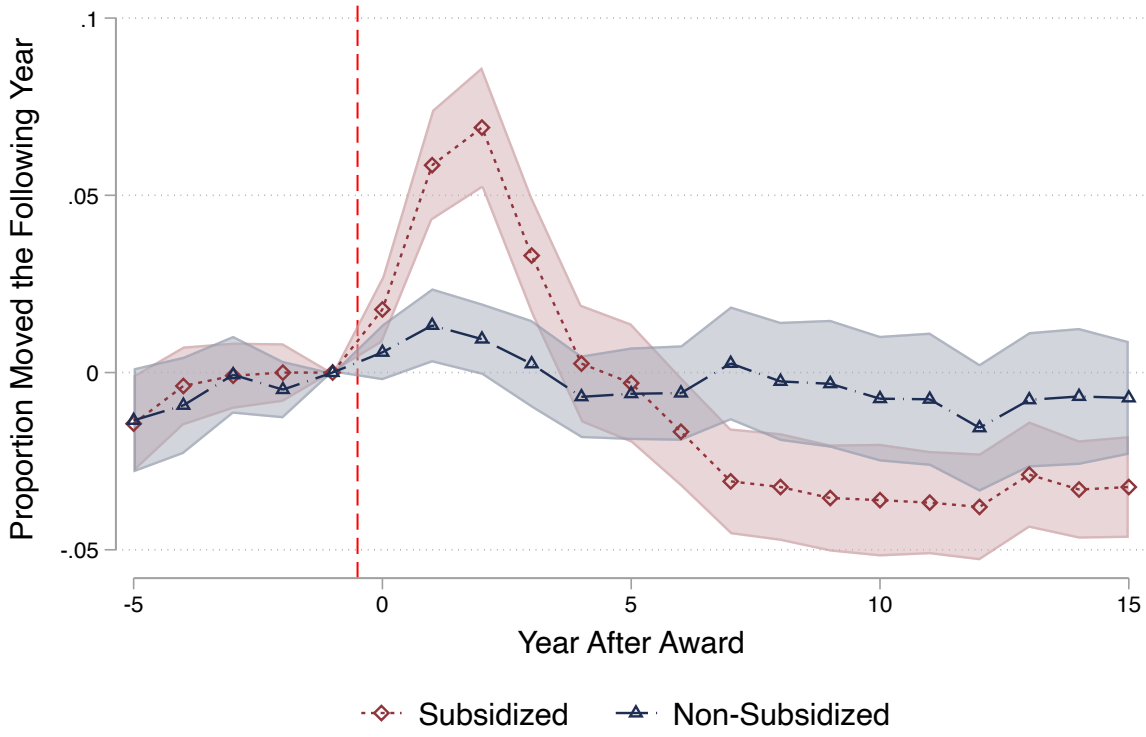
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2 but estimated on individual-level panel data. The sample includes individuals who move into a Revitalization or Failed applicants neighborhood and have subsidized housing. The outcome is either the neighborhood poverty rate in the destination or origin neighborhood. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

years after the award.[25] For comparison, the red squares in Figure 8 present the estimated effects on the poverty rate of the destination neighborhoods (these results simply replicate the findings in Figure 3), and show that families who move into Revitalization neighborhoods after the award move into lower poverty neighborhoods than the families that move into failed applicant neighborhoods.

To further quantify the role of selection, we estimate the effect on the destination neighborhood's poverty rate using a modified version of equation 2, which controls for the poverty rate in the origin neighborhood, the income of the individual before the move, and a quadratic

[25]Furthermore, there are no differences in origin neighborhood poverty rates prior to the Revitalization award year as we might have expected to see if the neighborhood change were being driven by something other than the Revitalization grants.

Figure 9: Effect on Out-Migration



Notes: This figures plots estimates from the specification described in equation 2. The outcome variable is proportion of current residents who move to a different neighborhood in the following year. The shaded region denotes the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

in age. The green diamonds in Figure 8 display these estimates. The results are almost identical to the unadjusted estimates (the red squares): 15 years after the award the adjusted estimate is just 0.06 percentage points (or 1 percent) smaller. The adjusted estimates represent the causal effect of HOPE VI on exposure to neighborhood poverty for the new residents if the covariates fully capture the differences in the outside housing options for the subsidized families who move into the HOPE VI and failed applicant neighborhoods. We view the estimates in Figure 8 as providing strong support for the idea that the reduction in poverty in targeted neighborhoods translated into a reduction in exposure to poverty for the new subsidized households.

Figure B.13 presents analogous results for non-subsidized households. Here we find more evidence of selection: individuals without subsidized housing who move into Revitalization neighborhoods 15 years after the award move from neighborhoods where the poverty rate is

1.3 percentage points lower than those who move into failed applicant neighborhoods.

Figure 9 presents the effect of the Revitalization program on out-migration. We estimate equation 2 where the outcome variable is the proportion of current residents who move to a different neighborhood in the following year. These out-migration rates are calculated separately for subsidized and non-subsidized households. For subsidized households, the rate of out-migration spikes in the four years immediately following the award, during the period in which the demolitions occurred. However, in the long-run, there is a reduction in out-migration rates for the households who continued living in the neighborhoods up to that point: subsidized households living in Revitalization neighborhoods 10 to 15 years after the award are 3 percentage points less likely to move compared to subsidized households in failed applicant neighborhoods. This is a 14 percent reduction relative to the mean out-migration rate in failed applicant neighborhoods. A possible explanation for the lower rates of out-migration is that the remaining residents of revitalized neighborhoods are more satisfied with their housing situations. For non-subsidized households we find much smaller displacement effects in the short-run and no evidence of a difference in out-migration rates in the long-run.

6.2.3 Residents Who Would Have Moved in Absent the Award

There exist subsidized renters who would have moved into the Revitalization neighborhoods absent the award, but who ended up living in a different neighborhood. The program reduced the size of the subsidized housing population in targeted neighborhoods by 20 percent in the long run (see Table 2 and Figure B.6) but did not reduce the citywide supply of subsidized housing (Section 6.3 shows that the reduction in public housing was offset by an expansion in housing vouchers). While we cannot identify the individuals that would have moved to the Revitalization neighborhoods absent the program, there is some empirical evidence that they likely ended up in lower poverty neighborhoods as a result of the Revitalization program. Revitalization neighborhoods were amongst the poorest in the city before the award. In 1990, 86 percent of Revitalization neighborhoods were in the top decile of their within-county poverty rate distribution and the 25th percentile and median Revitalization neighborhood were in the 95th percentile and the 98th percentile of their within-county poverty rate distribution, respectively. For households who would have moved to Revitalization neighborhoods absent the program but instead moved to alternative, new neighborhoods, there were a limited number of neighborhoods they could have moved where their poverty rate would not have decreased.

To assess how poverty rates might have changed for households who would have moved to Revitalization neighborhoods, but who instead stayed in their original neighborhoods, we can examine how neighborhood poverty changed for failed applicant in-migrants during the study period. To do so, we identify all individuals with subsidized housing who moved into a failed applicant site in the 10 to 15 years after the award. On average, the poverty rate in the failed applicant neighborhood is 14 percentage points higher than the poverty rate in their original neighborhood. Using the move-in patterns from failed applicant neighborhoods as the counterfactual for what would have been observed in Revitalization neighborhoods suggests that the subsidized renters who would have moved into Revitalization neighborhoods but stayed in their original neighborhoods as a result of the program likely also ended up in lower-poverty neighborhoods. Thus, for households who would have moved into Revitalization neighborhoods in the absence of the program, regardless of whether they stayed in their original neighborhood or moved to a new neighborhood, their exposure to poverty likely decreased.

6.2.4 Spillovers

If the program shaped the spatial distribution of poverty by affecting where poor adults lived (as opposed to increasing the income of poor individuals), then the reduction in poverty rates in Revitalization sites must be offset by an increase in poverty rates in other neighborhoods. More specifically, Table 2 illustrates that the Revitalization program reduced the number of poor households in targeted neighborhoods by 17 percent (.17 = 269/1,580). These poor households could have increased poverty rates in the neighborhoods to which they were displaced, and therefore increased exposure to poverty for subsidized households living in these neighborhoods. Our goal is to estimate an upper bound for this "migration spillover" effect. To do so, we estimate the number of poor households who were displaced using Table 2 and then allocate these displaced households in a way that is both consistent with observed migration flows and that maximizes the potential increase in average neighborhood poverty rates for subsidized renters.

Spillover effects could be driven by two types of poor households: i) original residents who moved away because of the program and ii) residents who, absent the program, would have moved into the Revitalization sites but instead end up in other neighborhoods. For the former group, we study the migration flows of original residents out of the Revitalization neighborhoods, since the displaced households are a subset of those who move away. For the

latter group, we have no way of identifying who would have moved into the Revitalization neighborhoods absent the award and we therefore study the migration flows into the failed applicant neighborhoods.

We start by describing our approach to estimating the spillover effects attributable to the displaced original residents. For each Revitalization neighborhood we proceed as follows. First, we estimate the size of the displaced population as being equal to the number of poor, original residents who remain in the neighborhood 10 years after the award multiplied by 0.35, which is based on the estimates from Column 3 of Table 2.[26] Second, we identify all poor, original Revitalization residents who lived in a different neighborhood 10 years after the award and count the number of people who moved to each of the destination neighborhoods. 97 percent of the migration flows between Revitalization and destination neighborhoods consisted of fewer than 10 people. Third, we rank destination neighborhoods by the number of subsidized renters. The average Revitalization neighborhood contains 5.6 times more subsidized renters than the average destination neighborhood. Fourth, we calculate a counterfactual poverty rate in the destination neighborhood with the most subsidized renters by removing the displaced poor individuals from this neighborhood and assuming that they are replaced by non-poor individuals. If the size of the displaced population exceeds the number of people who moved to this neighborhood, then we remove the remaining displaced households from the second-ranked neighborhood, and so on. This fourth step provides an estimate of how much lower poverty rates would be in the destination neighborhoods absent the arrival of the displaced households.[27]

We follow a similar approach to estimate the spillover effects attributable to households who would have moved in after the award. For each failed applicant neighborhood we proceed as follows. First, we estimate the size of the displaced population as being equal to the

[26]Column 3 of Table 2 shows that the Revitalization program reduced the number of poor, original residents who remained in the Revitalization neighborhoods by 26 percent (0.26=74/285). Thus, the size of this population would be 1.35 times larger (1.35=1/(1-0.26)) absent the program, and the size of the displaced population is $0.35 \times p = 1.35 \times p - p$, where p is the number of remaining, poor, original residents.

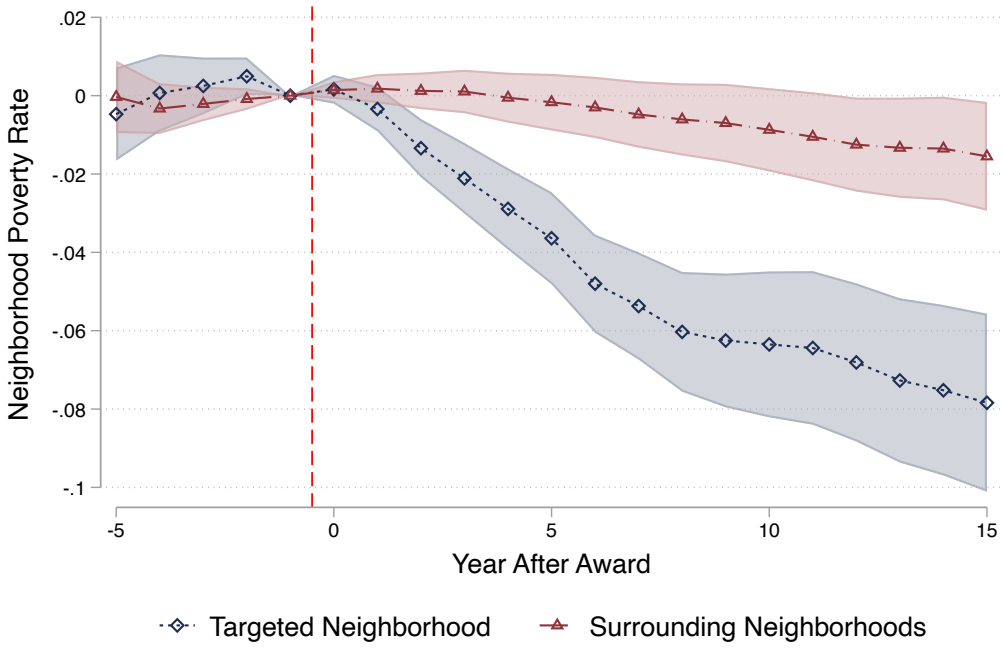
[27]This process is likely to provide an upper bound on the possible spillover effects on destination neighborhood poverty rates for at least two reasons. First, we allocate the poor, displaced households in as concentrated a way as possible. That is, rather than spreading the poor, displaced residents evenly across all possible destination neighborhoods, we allocate as many as possible to one neighborhood (the neighborhood that received the most new residents from the Revitalization). This increases the potential impact on poverty rates from displaced residents. Similarly, we assume that the poor, displaced residents always replace non-poor residents. In practice, this is unlikely to be the case and will result in larger potential impacts on neighborhood poverty in the destination neighborhoods.

number of new, poor residents who lived in the neighborhood ten years after the award multiplied by 0.15, which is based on the estimates from Column 4 of Table 2 (0.15=195/1,290). Second, we identify all poor, new residents and count the number of people who moved from each origin neighborhood to the failed applicant neighborhood. 95 percent of the migration flows between origin and failed applicant neighborhoods consisted of fewer than 10 people. Third, we rank origin neighborhoods by the number of subsidized renters. The average failed applicant neighborhood contains 31 times more subsidized renters compared to the average origin neighborhood. Fourth, we calculate a counterfactual poverty rate in the origin neighborhood with the most subsidized renters by allocating the displaced poor individuals to this neighborhood assuming that they replace non-poor individuals. If the size of the displaced population exceeds the number of people who moved from the origin neighborhood, then we allocate the remaining displaced households to the second-ranked origin neighborhood, and so on. This last step provides an estimate of how much greater poverty rates would be in the origin neighborhoods had these households not moved to the failed applicant neighborhoods. As was the case for spillovers from the displaced original residents (and for the same reasons), this likely overstates the potential spillovers on poverty rates.

To summarize the spillover effects from the displaced original residents, we take the weighted-average of the increase in neighborhood poverty rates among the set of destination neighborhoods that had a non-zero change in poverty, weighting by the size of the subsidized population in the destination neighborhood. We then take a weighted-average across projects, weighting by the baseline population in the Revitalization neighborhood. We find that the displacement of the original residents could have increased poverty rates by 0.30 percentage points in neighborhoods that received these households. Analogously, the displacement of households who would have moved in absent the award could have increased poverty rates by 0.19 percentage points in the neighborhoods that these households would have lived in absent the award.

Column 6 of Table 2 also shows that the program increased the number of non-poor households who moved in after the award by 23 percent (0.23=199/879). Poverty rates could have risen in the neighborhoods from which these households moved if they were replaced by poor households. Following the same method described for poor households, we find that the displacement of non-poor households who would have moved in absent the award could have increased poverty rates by 0.27 percentage points in the neighborhoods

Figure 10: Effect on Poverty Rates in Surrounding Neighborhoods



Notes: This figures plots estimates from the specification described in equation 2. The outcome variable is the poverty rate in the target neighborhoods or the poverty rate in the contiguous Census block groups. The shaded region denotes the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

that these households would have lived in absent the award. Column 5 of Table 2 shows that the program reduced the number of non-poor original residents, suggesting that spillover effects from this group would actually reduce exposure to neighborhood poverty.

Taken together, the results suggest that households who were displaced by the Revitalization program were dispersed across many neighborhoods and that these neighborhoods had fewer subsidized households than the Revitalization neighborhoods. Because of this, the increases in poverty rates in other neighborhoods throughout the city were small in magnitude and had little effect on poverty exposure for subsidized renters, particularly when compared to the reduction in poverty rates in Revitalization neighborhoods.

We are also able to estimate how the Revitalization program affected poverty rates in neighborhoods that are spatially close to targeted neighborhoods. To estimate the effect of the program on surrounding neighborhoods we estimate equation 2 where the outcome variable is the poverty rate in the contiguous Census block groups to the Revitalization and failed applicant neighborhoods. Figure 10 plots the results. The Revitalization program led

to a 1.6 percentage point reduction in the neighborhood poverty rate in Census block groups that were contiguous to Revitalization neighborhoods 15 years after an award. For comparison, the figure also presents the effect on the neighborhoods that contain the Revitalization projects. The results show that, while the program did decrease poverty in adjacent neighborhoods, the impacts were more than four times larger in targeted neighborhoods.[28] Table A.3 shows that the Revitalization program increased home values and monthly mortgage payments by a similar amount in the surrounding neighborhoods and in the targeted neighborhoods. The impact on rent, however, is substantially smaller in adjacent neighborhoods: around one-third of the size of the effect on rent in Revitalization neighborhoods. Still, the increase in home values provides some evidence that the surrounding neighborhoods became more appealing places to live after the Revitalization program.[29]

6.3 Aggregate Effects

We estimate the effect of the Revitalization program on the exposure to neighborhood poverty for all subsidized renters, by taking the weighted average of the group-specific effects presented in Sections 6.2.1 through 6.2.4. The weights are a function of the share of subsidized units in the PHA that are targeted by the Revitalization program. See Appendix D for details.

Figure 11(A) presents the results from the decomposition described in equation 1 in the case where a PHA revitalizes half of their subsidized housing units.[30] The height of the first four bars represents the group-specific estimate of $\omega_g \mathbb{E}\left[\Delta_i | G_i = g\right]$ and the bar on the right presets the cumulative effect. Our estimates imply that PHAs that revitalized half of their subsidized units reduced the average neighborhood poverty rate for all subsidized renters by 4.1 percentage points.[31] Reductions in exposure to poverty for new, subsidized residents of

[28] Figure B.14(A) uses publicly available data to examine changes in poverty rates between 1990 and 2017 in neighborhoods within 3 miles of a Revitalization or failed applicant site. These results suggest that the effects were quite local and were concentrated in the neighborhoods directly targeted by the intervention, fading away quickly as distance from the neighborhoods increases.

[29] Figure B.14(B) uses publicly available data to examine changes in housing prices between 1990 and 2017 in neighborhoods within 3 miles of a Revitalization or failed applicant site. Consistent with the results in Table A.3, impacts on rent are limited to the targeted neighborhoods but we find positive effects on home values in neighborhoods located within a mile of the Revitalization or failed applicant sites.

[30] Among PHAs that received Revitalization funding, the average percent of units affected by HOPE VI funding was 22 percent and the 5th and 95th percentiles were 4 percent and 48 percent, respectively. In other words, there were a some PHAs that revitalized close to half of their subsidized housing units.

[31] These estimates do not include effects from the spatial spillovers described in Figure 10. If subsidized households were more likely to live nearby the Revitalization neighborhoods relative to other neighborhoods in the city then these spatial spillovers would also reduce exposure to poverty. In this case, our estimate

the revitalized neighborhoods explain 68 percent of the reduction in average neighborhood poverty rates.

As a complimentary analysis, we also show that subsidized households experienced a larger reduction in exposure to neighborhood poverty in PHAs that revitalized more public housing. We construct a PHA-level dataset and estimate the following specification:[32]

$$y_h = \alpha + \beta D_h + \lambda S_h + \phi X_h + \delta D_h \times S_h + \theta S_h \times X_h + \epsilon_h \tag{4}$$

where h denotes the PHA, D_h is equal to one if any public housing project received a Revitalization grant and is zero if any project applied for Revitalization funding but no project received HOPE VI funding, S_h is the share of subsidized units in 1997 that were targeted by HOPE VI (awarded or applied for), and X_h is the average poverty rate of the HOPE VI and failed applicant sites in 1990.[33] The sample includes PHAs that received Revitalization funding or applied for but did not receive any HOPE VI funding. The main coefficient of interest is δ, which captures the effect of revitalizing a larger share of subsidized units. Intuitively, equation 4 compares PHAs that were awarded HOPE VI funding to PHAs that applied to revitalize a similar share of units but were not awarded funding.

Table A.4 presents the coefficient estimates from equation 4. The outcome in column 1 is the change in the average census tract poverty rate for subsidized households between 1997 and 2018. The estimates imply that revitalizing half of the subsidized units is associated with an 8.1 percentage point reduction in exposure to poverty ($0.081 = -0.003 - 0.168/2$). We estimate a more flexible specification by replacing the linear interaction between D_h and S_h with the interaction between D_h and indicators for whether the PHA was in different deciles of S_h. Figure 11(B) shows that the estimates from this less parametric PHA-level regression (the diamonds), equation 4 (the dashed line), and the aggregated estimates from Section 6.2 (the solid line) all suggest similar aggregate associations between the Revitalization program

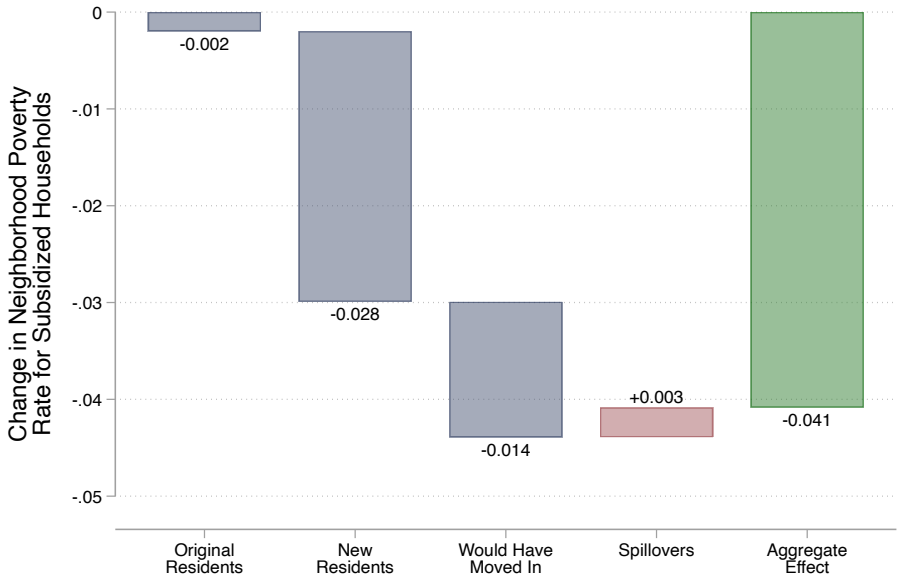
understate the effect of the program.

[32]This PHA-level analysis uses data from HUD User's Picture of Subsidized Households and we focus on changes between 1997 (which is the earliest year in which all the necessary variables are available) and 2018.

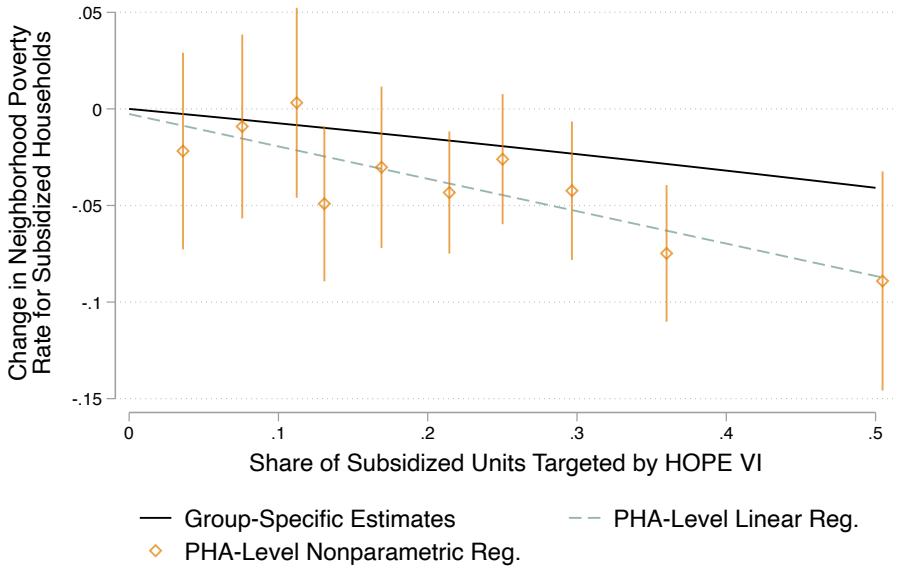
[33]We control for baseline poverty rates, since this is a key potential confounder. We estimate that the program reduced poverty rates by 7.7 percentage points when regressing block group poverty rate in 2017 on the Revitalization indicator and a vector of 15 baseline covariates (see column 1 of Table 1). If we estimate the same regression but only control for baseline poverty rates the estimate is 6.9 percentage points. If we include no covariates, the estimate drops to 3.5 percentage points. Following Feigenberg et al. (2023) we include the interaction between S_h and X_h.

Figure 11: Analysis of Public Housing Authorities

(A) Aggregation of Group-Specific Estimates



(B) Comparison to PHA-Level Regression



Notes: The height of first five bars in Panel A represents estimates of $\omega_g \mathbb{E}[\Delta_i | G_i = g]$ from equation 1 in the case where the PHA revitalized half of the subsidized housing units. The bar on the right presents the aggregate effect ($\mathbb{E}[\Delta_i]$ from equation 1). Panel B compares the aggregate effects base on the group-specific estimates to those obtained from the PHA-level regression described in equation 4. The figure presents the estimated effects as a function of the share of subsidized units that were targeted by HOPE VI.

Source: Authors' calculations based linked administrative data for the group-specific estimates and the 1997 and 2018 vintages of HUD User's Picture of Subsidized Households for the PHA-level regressions.

and exposure to neighborhood poverty.[34] Returning to Table A.4, the outcome in column 2 is the component of changes in exposure to poverty (outcome in column 1) attributable to changes in poverty rates in revitalized sites.[35] The estimates suggest that reductions in neighborhood poverty in revitalized sites explain 60 percent of the total reduction in neighborhood poverty (0.60=0.101/0.168), similar to our findings based on equation 1 (68 percent compared to 60 percent).

The outcome variables in columns 2 to 4 of Table A.4 are the change in the share of subsidized units in public housing, the change in total public housing stock, and the change in county-level poverty rates. These estimates suggest that HOPE VI shifted subsidized units from public to voucher housing but did not reduce the overall supply of subsidized housing. Furthermore, there is no evidence that Revitalizations reduced the overall poverty rates in the city, which is consistent with the idea that the program altered where poor households lived but did not affect the incomes of individual adults.[36]

6.4 Heterogeneity Across Revitalization Sites

To shed light on the factors associated with the successful transition to economically integrated neighborhoods, we exploit observable differences across Revitalization sites. To create economically integrated communities, the Revitalization program had to attract higher-income residents to move into the market-rate units. Thus, for each Revitalization site we calculate the poverty rate among households that move into the market-rate units that were built after the award. Within the Revitalization sample, we then regress the poverty rate of households in these new market-rate units against various site-level characteristics.

There is a tension between attracting higher income residents and providing broader access to the neighborhoods. This is partly a mechanical relationship: more unrestricted market-rate units imply fewer units can be provided for poor households, either through public housing or by requiring that landlords reserve units for low-income residents. However,

[34]The diamond markers in Figure 11(B) plot the estimated coefficient on the interaction between D_h and deciles of S_h against the average value of S_h for that decile.

[35]We can write the average poverty rate for subsidized households in a given PHA at time t as, $p_t = \omega_t p_t^r + (1-\omega_t)p_t^n$, where ω_t is the share of units in revitalized neighborhoods and p^r and p^n denote the average poverty rates in revitalized and other neighborhoods, respectively. Then we can write the change as, $p_{t+1} - p_t = \omega_t(p_{t+1}^r - p_t^r) + p_{t+1}^r(\omega_{t+1} - \omega_t) + (1-\omega_{t+1})p_{t+1}^n - (1-\omega_t)p_t^n$. The outcome in column 1 of Table A.4 is $p_{t+1} - p_t$ and the outcome in column 2 is $\omega_t(p_{t+1}^r - p_t^r)$.

[36]It is possible that the program could have improved long-term outcomes for children growing up in subsidized housing or near the Revitalized neighborhoods, but looking at these intergenerational effects is outside the scope of our paper.

Table 4: Heterogeneity Across Revitalization Sites

	Poverty Rate, Residents of New Market-Rate Units				
	(1)	(2)	(3)	(4)	(5)
Public housing	0.273				0.141
	(0.044)				(0.037)
	[0.000]				[0.000]
Poverty rate, public housing residents		0.204			0.109
		(0.072)			(0.054)
		[0.005]			[0.047]
Poverty rate, target neighborhood			0.378		0.256
			(0.034)		(0.040)
			[0.000]		[0.000]
Poverty rate, surrounding neighborhoods				0.404	0.174
				(0.048)	(0.050)
				[0.000]	[0.001]
Observations	251	251	251	251	251

Notes: Each column presents estimates from a separate regression. The sample includes only the Revitalization sites and the unit of observation is a site. The dependent variable is the poverty rate among individuals who move into market-rate units that were constructed after the award. The independent variable in columns 1-4 is the share of new units that are public housing, the share of public housing residents that are poor, the poverty rate in the targeted neighborhood prior the award, and the poverty rate in the surrounding neighborhoods prior to the award, respectively. Regressions are estimated via weighted-least squares, weighting by the baseline population. Standard errors are presented in parentheses and p-values are presented in brackets.
Source: Authors' calculations based on linked administrative data.

columns 1 and 2 of Table 4 highlight an additional dynamic whereby providing greater access to the neighborhoods makes it more difficult to attract higher income residents to the existing market-rate units. Specifically, column 1 shows that a 10 percentage point increase in the share of units that are preserved as public housing is associated with a 2.7 percentage point increase in the poverty rate of the new residents of the market-rate units. Similarly, column 2 shows that a 10 percentage point increase in the poverty rate of public housing residents is associated with a 2.0 percentage point increase in the poverty rate of the new residents of the market-rate units. Thus, Revitalization sites with a greater proportion of public housing units and with poorer public housing residents tended to attract lower-income households to the market-rate units.

There is also a tradeoff between attracting higher-income residents and targeting the most disadvantaged neighborhoods. The independent variable in columns 3 and 4 of Table 4 is the pre-award poverty rate of the targeted and surrounding neighborhoods, respectively. Column 3 implies that a 10 percentage point increase in the poverty rate of the neighborhood

prior to the award is associated with a 3.8 percentage point increase in the poverty rate of the new residents of the market-rate units after the award. In other words, neighborhoods that were originally poorer, tended to attract poorer residents to the new market-rate units after the award. The poverty rate of the surrounding neighborhoods is similarly important. The results suggest that creating economically integrated communities is most difficult in the neighborhoods that are most disadvantaged to begin with. Column 5 estimates a multivariate regression and shows that all four variables have an independent and economically meaningful association with the income composition of the new resident of the market-rate units. These patterns are broadly consistent with research showing that individuals' valuations of a neighborhood depend both on the presence of subsidized housing and on the income levels of the residents (Diamond and McQuade, 2019; Bayer et al., 2022; Li, 2023).[37]

6.5 Additional Empirical Results

This section briefly summarizes four additional results. See Appendix E for a more detailed discussion. First, the reduction in poverty rates in targeted neighborhoods is driven by the in-migration of moderate-income residents (as oppose to high-income residents). Second, there are similar reductions in poverty rates among households with and without children. This shows that the reductions in poverty rates were not driven by an influx of childless adults, which is a concern often raised by the gentrification literature (McKinnish et al., 2010). Third, the program slightly reduced exposure to poverty for the original residents and this is attributable to the fact that the program forced some households to move and these households ended up living in neighborhoods with lower poverty rates than their pre-Revitalization neighborhoods. Fourth, of the original residents of the public housing projects, poorer households were more likely to be displaced. This is because only low-income residents with limited outside options tend to stay in distressed public housing projects and the demolitions forced most households to move. For original residents without access to subsidized housing, we find that both poor and non-poor households were displaced at similar rates.

[37]The results in Table 4 do not contradict those in Figure 1. Larger projects tend to be located in poorer neighborhoods. Thus, a larger share of units in the neighborhood are directly redeveloped through the Revitalization program, which explains the negative slope in Figure 1. Table 4 shows that poorer households tend to move into the newly constructed market-rate units in neighborhoods that currently or historically have more poor households in public housing. The denominator in Figure 1 includes all housing units in the neighborhood whereas the denominator in Table 4 is limited to the newly constructed market-rate units.

7 Discussion

Did the benefits of the program justify the costs? We use our estimates to quantify the benefits and costs for the average PHA, which contained 8,904 units in 2018 and received two Revitalization grants for a total of $47.8 million to revitalize 22 percent its subsidized units.

The aggregate effects in Section 6.3 imply that a PHA that revitalized 22 percent of the subsidized housing stock reduced average neighborhood poverty rates among all subsidized renters by 1.7 percentage points. Using MTO-driven experimental variation in housing prices to identify households' marginal utility of consumption along with structural estimates of households' WTP for neighborhood amenities, Galiani et al. (2015) present results showing that a similarly low-income sample of subsidized renters have an annual WTP for a one percentage point decrease in their neighborhood poverty rate of $282.[38] Together, this suggests that subsidized renters in Revitalization PHAs would be willing to pay $479 more for housing in neighborhoods with poverty rates that are 1.7 percentage point lower ($479 = 1.7 \times 282$).

The upfront costs of the program are substantial, costing $5,368 per subsidized unit in the PHA ($5,368 = 47,800,000/8,904$). However, the program produced durable reductions in neighborhood poverty for subsidized renters that lasted substantially longer than a single year—we observe poverty reductions that extend at least to 15 years post-Revitalization, the last year we consider due to data limitations. Figure B.18 plots the present discounted value (PDV) of the cumulative annual welfare gains per subsidized unit as a function of the number of years over which the benefits accrue, assuming a 3 percent annual discount rate. The figures illustrates that the PDV welfare gains will exceed the upfront costs if the reductions in exposure to poverty persist for at least 14 years.[39] Thus, when considered over a sufficiently long horizon, the Revitalization program produced meaningful welfare gains for subsidized households, even if the HOPE VI program costs had been passed along to subsidized households through rent increases.

Our estimates of the costs and benefits only incorporate the financial costs and the

[38] These WTP estimates correspond to what the model in Galiani et al. (2015) predicts WTP would be at the sample average value for all observable characteristics that determine household WTP for neighborhood amenities.

[39] The PDV of 14 years of cumulative welfare gains from the reduction in exposure to neighborhood poverty is $5,411 = 479 \times (1 + 0.03)^{-14}$.

benefits from a reduction in exposure to neighborhoods poverty, respectively. While these factors are key inputs to any cost-benefit analysis, the program could have imposed other costs and produced other benefits not captured by our analysis.

8 Conclusion

Reducing residential segregation and exposure to neighborhood poverty is a central goal for housing policymakers. While past research has demonstrated the promise of programs that enable low-income households to move to less segregated neighborhoods, there remain questions about the scalability of this approach. Conversely, owing largely to data constraints, there is limited rigorous empirical evidence on the potential of place-based policies for reducing exposure to poverty for low-income individuals and subsidized renters, in particular. In this paper, we use individual-level administrative data to investigate the interplay between neighborhood-level transformation and individual-level residential outcomes in the context of a large, place-based policy: the HOPE VI Revitalization program.

We find that, as intended, the Revitalization program led to a large, persistent reduction in poverty rates in targeted neighborhoods, which enabled subsidized renters to live in lower-poverty neighborhoods. Fifteen years after a Revitalization award, the program reduced poverty rates by 8 percentage points in targeted neighborhoods by reducing the stock of public housing and attracting higher-income residents into the market-rate units. To understand how the Revitalization program affected subsidized renters, we separately estimate the impact of the program on exposure to neighborhood poverty for distinct groups of subsidized renters. The new residents of Revitalization neighborhoods experience the largest reductions in exposure to neighborhood poverty while the original neighborhood residents experience poverty reductions that are less than one-fifth of the size, largely due to their high rates of residential mobility. Our estimates imply that cities that revitalized half of their public housing stock reduced the average neighborhood poverty rate among all subsidized renters by 4.1 percentage points.

Our results suggest that place-based policies can be a useful tool for reducing exposure to neighborhood poverty for subsidized renters. However, high-rates of residential mobility imply that place-based policies may be an ineffective way to target specific individuals (e.g., the original neighborhood residents) while still being an effective way to target broader

populations of interest (e.g., subsidized renters). The provision of housing vouchers to the original neighborhood residents offers one promising approach for attenuating price-driven displacement that might occur after the implementation of a place-based policy.

While reducing residential segregation is a central objective of housing policymakers, the Revitalization program also sought to create living conditions that residents would value and benefit from. We present evidence that the program reduced rates of out-migration and increased housing prices, suggesting that the revitalized neighborhoods became more appealing places to live. Future work should aim to more completely quantify the improvements in neighborhood conditions and detail the welfare gains and losses for different populations. For example, determining whether the program improved outcomes for children who grew up in revitalized neighborhoods is a promising avenue for future research.

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Appendix A Additional Tables

Table A.1: Sample Restrictions

	Non-Applicant		Failed Applicant		Revitalization	
	count	percent	count	percent	count	percent
Full sample	16,300	100%	244	100%	286	100%
Located in state	15,932	98%	242	99%	286	100%
Not in indian housing	13,233	81%	242	99%	286	100%
In picture of subsized housing	13,233	81%	233	95%	272	95%
Not scattered site or vacant	12,618	77%	220	90%	271	95%
At least 25 units in 1993	8,913	55%	210	86%	266	93%
Not senior housing	6,946	43%	204	84%	262	92%
Non-missing location	6,084	37%	198	81%	251	88%
At least one mile from Revitalization	5,783	35%	166	68%	251	88%

Notes: The column headers define the sample (the three samples are mutually exclusive). Each row presents the count of projects that remain after imposing the sample restriction as well as the percent of the full sample.
Source: Authors' calculations based on project-level summary files from HUD and the publicly available list of awardees of and applicants to HOPE VI funding.

Table A.2: Baseline Characteristics

	Non-Applicant		Failed Applicant		Revitalization	
	mean	s.d.	mean	s.d.	mean	s.d.
A. Project						
Occupied units	430	960	293	200	667	756
Percent minority	61.6	38.9	77.7	33.0	77.9	35.6
Percent majority income earned	21.1	15.2	19.9	11.2	14.1	10.5
Average household size	2.3	1.1	2.7	1.0	2.4	1.1
Percent 62 or older	26.4	21.4	15.0	11.8	13.1	11.7
Percent with disability	12.9	11.1	10.9	7.5	10.0	8.9
Percent single parent	35.5	25.0	47.4	23.4	40.3	27.2
Percent with female head	69.0	25.7	75.4	24.6	71.4	31.5
Percent crowded housing	6.8	8.5	7.4	6.8	8.0	7.1
Average rent	273	145	248	123	189	130
Average income (thousands)	13.1	6.9	11.6	5.3	8.9	5.9
Observations	5,783		166		251	
B. Census block group						
Percent Black	31.9	33.8	48.3	36.2	72.0	32.0
Median rent	606	260	501	207	451	222
Median home value (thousands)	119	103	111	113	109	107
Percent with public assistance	19.2	13.0	31.3	16.8	38.2	17.2
Percent unemployed	12.1	8.2	19.4	12.1	24.0	14.1
Percent below poverty	30.8	17.2	45.0	19.0	55.0	20.6
Number of people (thousands)	1.5	0.6	1.6	0.6	1.9	0.8
Observations	5,391		178		308	

Notes: The columns define one of three mutually exclusive samples including non-HOPE VI, failed applicant, and Revitalization neighborhoods. Each row presents statistics for a different variable. In panel A the variables are measured at the project level in 1993. In panel B the variables are measured at the block group level in 1990. In panels A and B we weight by the population of the project and block group, respectively.
Source: Authors' calculations based on project-level summary files from HUD and summary files from the 1990 Decennial Census.

Table A.3: Effect on Housing Prices and Home Ownership in Surrounding Neighborhods

	Log Rent			Log Home Value			Log Monthly Morgage			Owner	Renter
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Revitalization	0.031	0.053	0.034	0.141	0.143	0.154	0.108	0.125	0.135	-0.033	0.033
	(0.032)	(0.025)	(0.021)	(0.048)	(0.044)	(0.045)	(0.038)	(0.032)	(0.033)	(0.022)	(0.022)
	[0.320]	[0.037]	[0.095]	[0.004]	[0.001]	[0.001]	[0.005]	[0.000]	[0.000]	[0.135]	[0.135]
Housing Characteristics		X	X		X	X		X	X		
Exclude New Housing			X			X			X		
Mean	6.810	6.810	6.890	12.000	12.000	12.000	6.890	6.890	6.850	0.525	0.475
Standard deviation	0.032	0.025	0.021	0.048	0.044	0.045	0.038	0.032	0.033	0.022	0.022
Observations	157,000	157,000	73,000	217,000	212,000	157,000	125,000	125,000	86,000	2,000	2,000

Notes: Each column presents estimates from a separate regression in which an outcome variable is regressed on an indicator for the Revitalization award. Regressions are estimated via weighted-least squares using the inverse propensity score. All regressions control for the year of first award and the calendar year as well as the vacancy rate, median home value, neighborhood poverty rate, and share of population that is Black in the year before the award. When indicated some regressions further control for housing characteristics (building type, year built, persons per room) and limit to house units built before the award. In columns 1-9 the unit of observation is the housing unit. In columns 10 and 11 the data are collapsed to the project level. Standard errors are clustered at the neighborhood and are presented in parentheses and p-values are presented in brackets. We also report the mean and standard deviations for the failed applicant neighborhoods.
Source: Authors' calculations based on linked survey and administrative data.

Table A.4: Analysis of Public Housing Authorities

	Change in Outcome from 1997 to 2018				
	Census Tract Poverty Rate	Poverty Rate in Revitalized Sites	Share Subsidized Units in Public Housing	Log Subsidized Units	County Poverty Rate
	(1)	(2)	(3)	(4)	(5)
Revitalization	-0.003	0.006	0.035	-0.020	-0.005
	(0.021)	(0.010)	(0.054)	(0.087)	(0.010)
	[0.900]	[0.541]	[0.516]	[0.816]	[0.613]
Units Targeted	0.158	0.250	0.280	-0.505	-0.014
	(0.077)	(0.037)	(0.197)	(0.318)	(0.036)
	[0.043]	[0.000]	[0.157]	[0.114]	[0.703]
Revitalization × Units Targeted	-0.168	-0.101	-0.790	0.360	0.048
	(0.074)	(0.035)	(0.184)	(0.297)	(0.033)
	[0.024]	[0.004]	[0.000]	[0.227]	[0.156]
Baseline Poverty	-0.193	0.007	-0.013	-0.294	-0.059
	(0.058)	(0.027)	(0.146)	(0.237)	(0.027)
	[0.001]	[0.789]	[0.932]	[0.215]	[0.029]
Baseline Poverty × Units Targeted	-0.594	-0.604	-0.456	0.919	-0.044
	(0.189)	(0.090)	(0.476)	(0.770)	(0.086)
	[0.002]	[0.000]	[0.339]	[0.234]	[0.610]
Observations	193	193	195	195	195

Notes: Each column presents estimates from a separate regression in which an outcome is regressed on an indicator for receiving Revitalization funding, the average poverty rate of targeted neighborhoods in 1990, the share of subsidized units targeted by HOPE VI, and the interaction between the share of subsidized units and the other two variables. The outcome variables in columns 1-4 include the change between 1997 and 2018 in the: average census tract poverty rate of subsidized households, the component of column 1 attributable to changes in poverty rates in the revitalized neighborhoods, share of subsidized units in public housing, total number of subsidized units, and county-level poverty rates. Each observation represents a PHA and the sample includes Revitalization PHAs (any public housing project received a Revitalization grant) and Failed Applicant PHAs (any public housing project applied for Revitalization funding but no project received HOPE VI funding). Each regression is estimated via weighted least squares, using the total number of subsidized units targeted by HOPE VI as the weights. Standard errors are presented in parentheses and p-values are presented in brackets.
Source: Authors' calculations based the 1997 and 2018 vintages of HUD User's Picture of Subsidized Households.

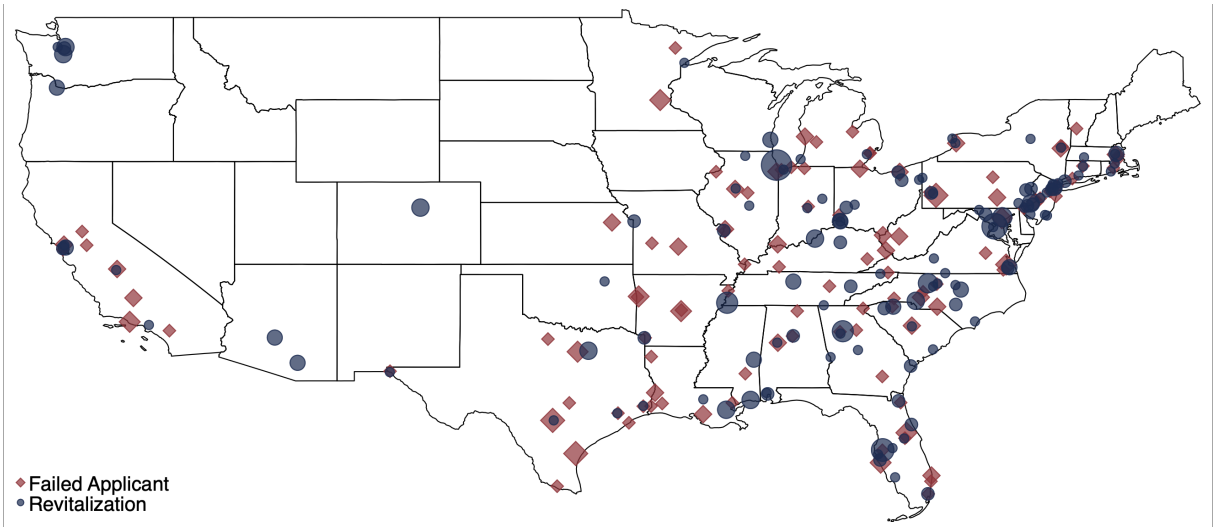
Table A.5: Residential Mobility and Poverty, Original Residents

	Public (1)	Other subsidized (2)	Non-subsidized (3)
A. Moved in five years			
Revitalization × poor	-0.072	-0.015	0.038
	(0.011)	(0.019)	(0.007)
	[0.000]	[0.454]	[0.000]
Failed applicant × poor	-0.171	-0.025	0.040
	(0.017)	(0.016)	(0.010)
	[0.000]	[0.454]	[0.000]
Difference	0.099	0.010	-0.002
	[0.000]	[0.678]	[0.877]
Failed applicant mean	0.554	0.689	0.535
Observations (thousands)	348	136	1,416
B. Moved in ten years			
Revitalization × poor	-0.035	0.009	0.051
	(0.009)	(0.014)	(0.006)
	[0.000]	[0.507]	[0.000]
Failed applicant × poor	-0.086	0.001	0.065
	(0.018)	(0.011)	(0.008)
	[0.000]	[0.507]	[0.000]
Difference	0.051	0.009	-0.014
	[0.010]	[0.629]	[0.163]
Failed applicant mean	0.759	0.835	0.698
Observations (thousands)	348	136	1,416

Notes: The table presents estimates from equation E.1. Columns 1-3 present estimates based on a sample of individuals who live in the neighborhood in the year before the award and are in public housing, other subsidized housing, and non-subsidized housing, respectively. The outcome in panels A and B is an indicator equal to one if the individuals moved within five and ten years, respectively. All regressions include a fixed effect for the neighborhood by grant year and standard errors are clustered at the level of the neighborhood. The table also presents the difference between the two coefficients of interest. Standard errors are presented in parentheses and p-values are presented in brackets.
Source: Authors' calculations based on linked administrative data.

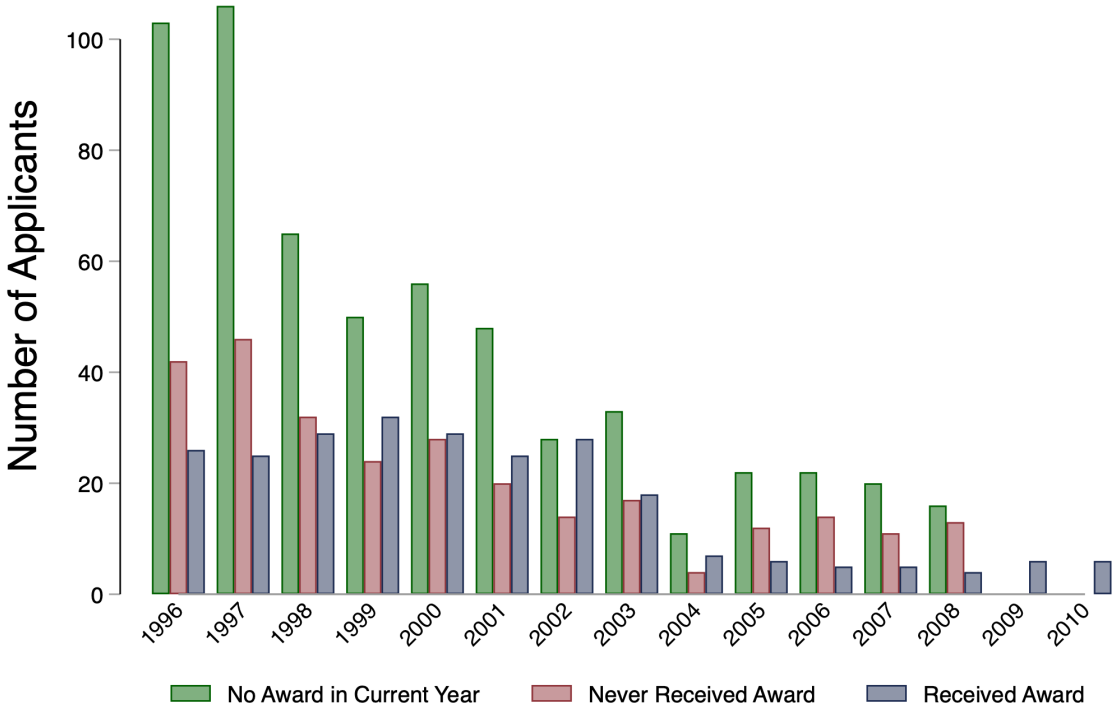
Appendix B Additional Figures

Figure B.1: Geographic Distribution of Applicants and Awardees



Notes: The blue circles and red diamonds represent the location of HOPE VI Revitalization and failed applicant sites, respectively. The size of the markers is proportional to the number of units in the project.
Source: Authors' calculations based on project-level summary files from HUD.

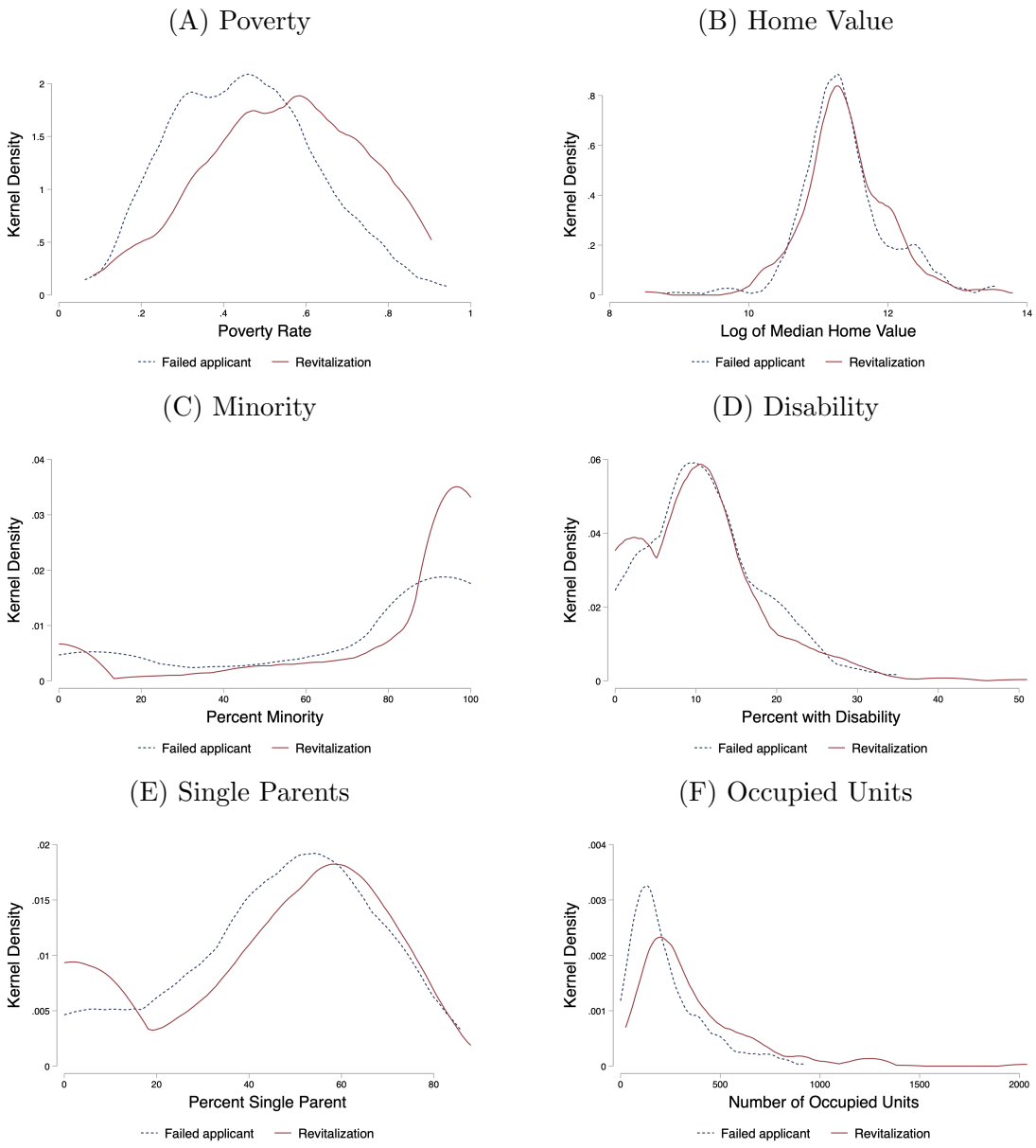
Figure B.2: Number of Awardees and Failed Applicants by Year



Notes: The figure presents the number of public housing projects per grant year for projects that applied for and: (1) did not receive funding in that year, (2) did not receive funding in any year, and (3) received a HOPE VI Revitalization grant in that year. If a project received more than one HOPE VI grant, then we report the earliest year. Projects not awarded a grant in one year could apply in a subsequent year. We do not observe application data for 2009 and 2010.

Source: Authors' calculations based on the publicly available list of awardees of and applicants to HOPE VI funding.

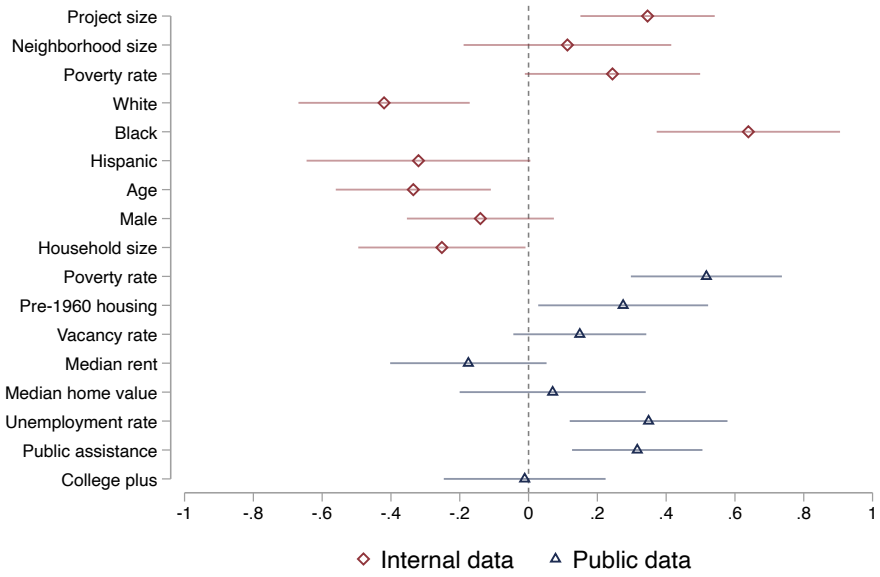
Figure B.3: Distribution of Baseline Characteristics



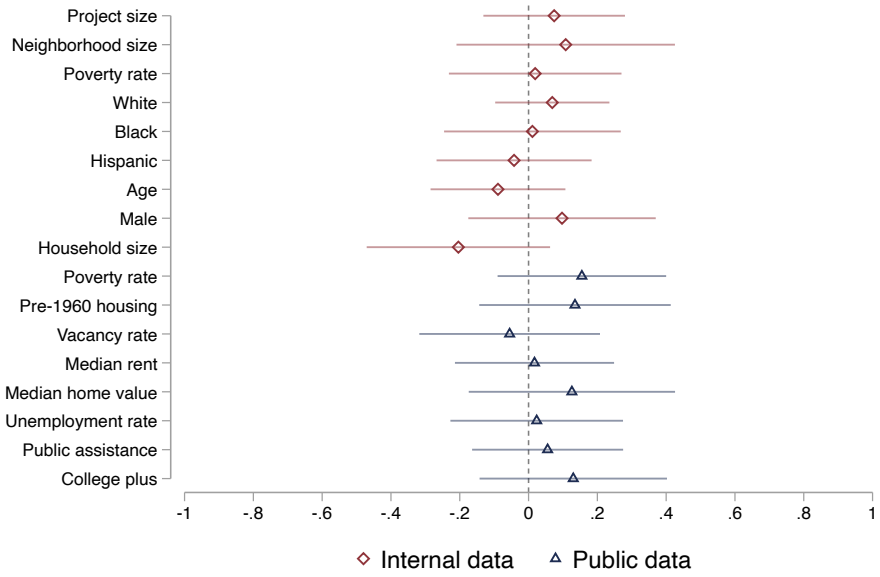
Notes: Each figure presents a kernel density plots of characteristics measured prior to the award. Panels A and B summarize characteristics of the block group and are based on data from the 1990 Decennial Census. Panels C-F summarize characteristics of the projects as measured in the 1993 vintage of HUD User's Picture of Subsidized Households. Distributions are presented separately by treatment status.
Source: Authors' calculations based on summary files of 1990 Decennial Census survey and project-level summary files from HUD.

Figure B.4: Balance of Baseline Characteristics

(A) Population Weights



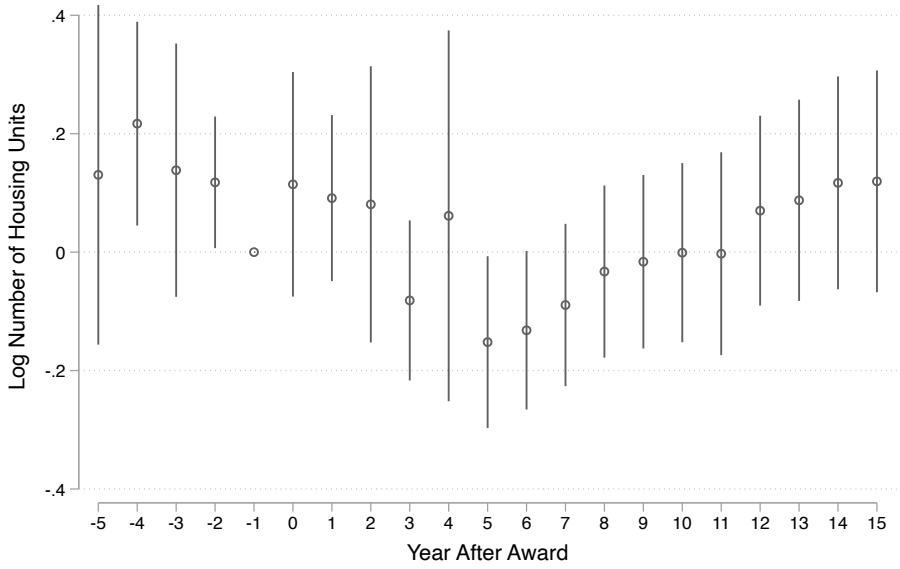
(B) Inverse Propensity Score Weights



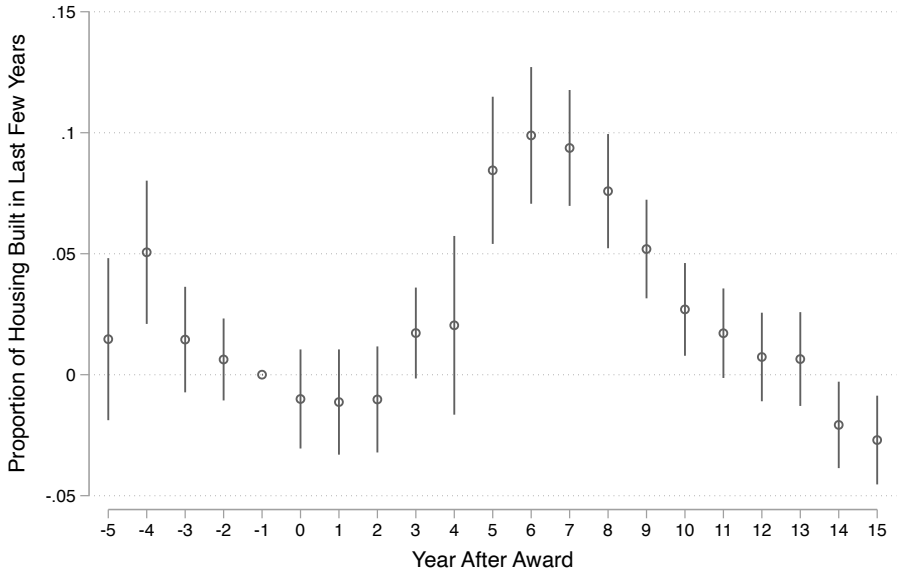
Notes: Each point represents an estimate from a separate regression in which we regress a characteristic of the neighborhood measured prior to the award (standardized by mean and s.d.) against a treatment dummy. In panels A and B we weight by population and the inverse propensity score, respectively. The red diamonds denote variables constructed using our internal data and the blue triangles denote variables based on publicly available data. Standard errors are clustered at the level of the neighborhood and the horizontal bars denote the 95 percent confidence interval.
Source: Authors' calculations based on linked administrative data.

Figure B.5: Effect on Housing Stock

(A) Total Housing

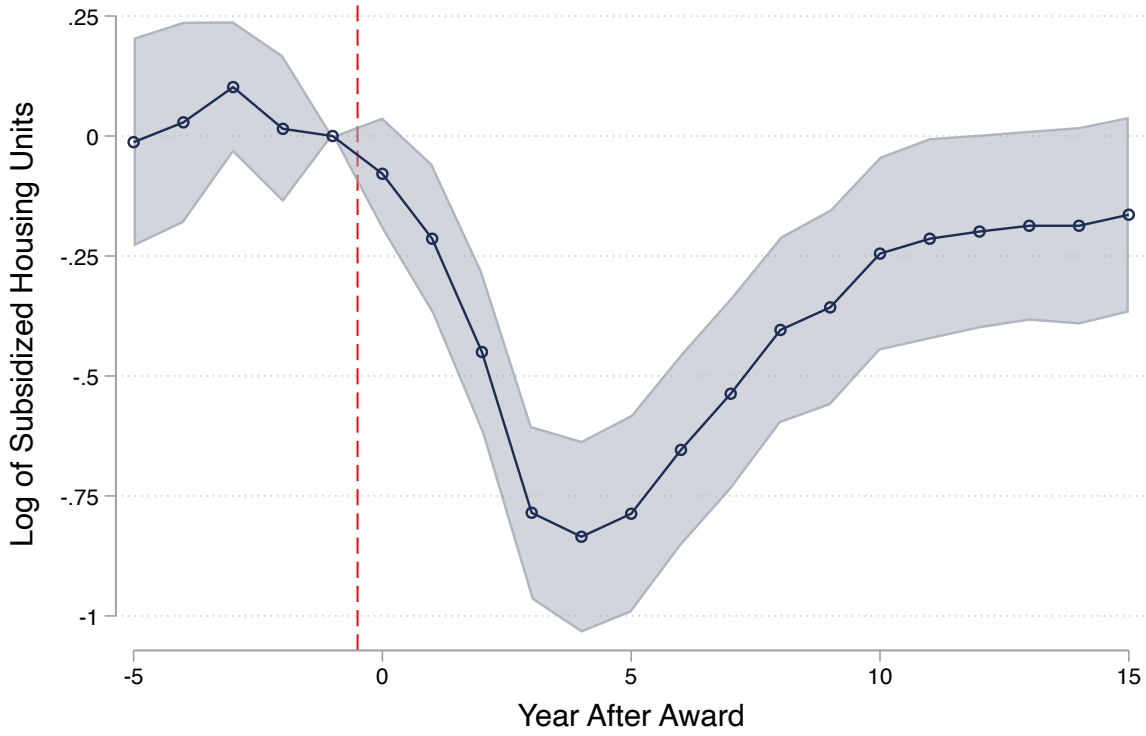


(B) New Housing



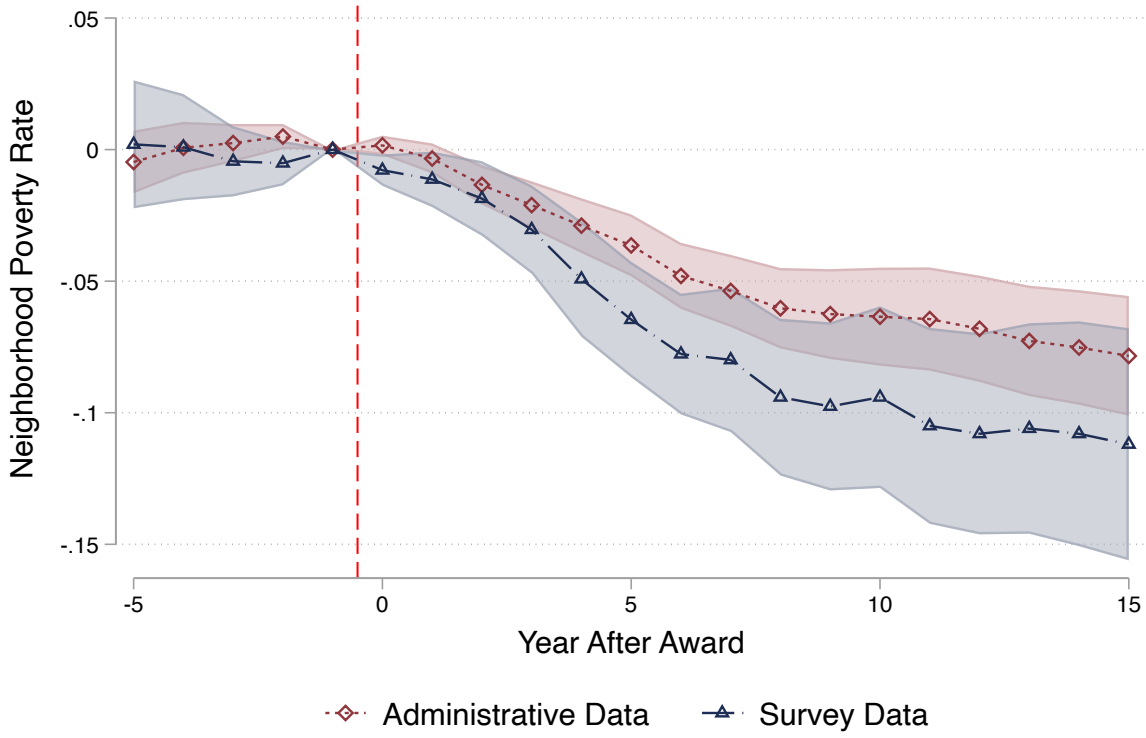
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcomes are the total housing stock and the proportion of housing built within the past few years. The vertical bars denote the 95 percent confidence intervals.
Source: Authors' calculations based on summary files of Decennial Census surveys and the ACS.

Figure B.6: Effect on Number of Subsidized Housing Units



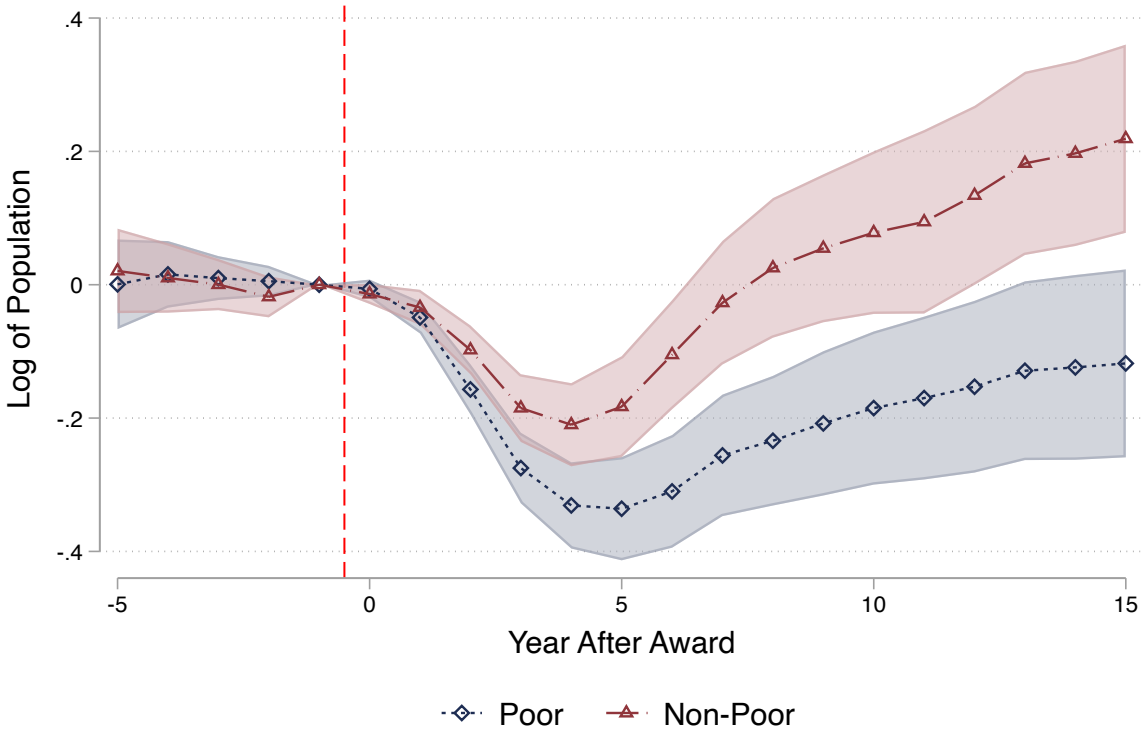
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the log of the total number of subsidized housing units in the neighborhood. The vertical bars denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

Figure B.7: Effect on Alternative Measures of Poverty Rates



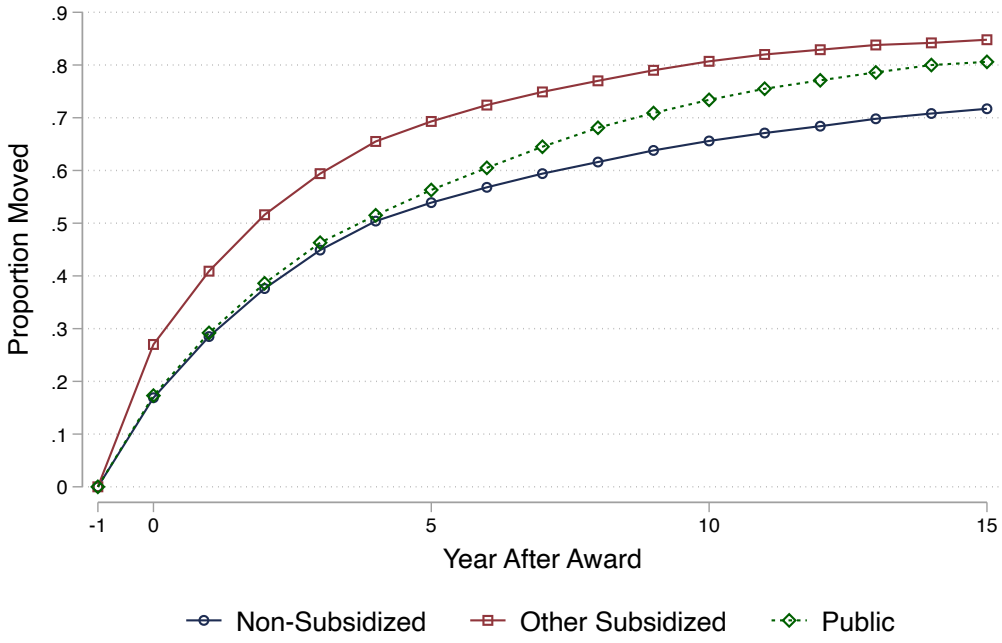
Notes: This figures plots estimates from the specification described in equation 2. The outcome variable is the either the share of the population with an AGI below $15,000 (based on the adminstrative data) or the share of the population whose income falls below the poverty line (based on survey data). The shaded region denotes the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

Figure B.8: Effect on Population by Poverty Status



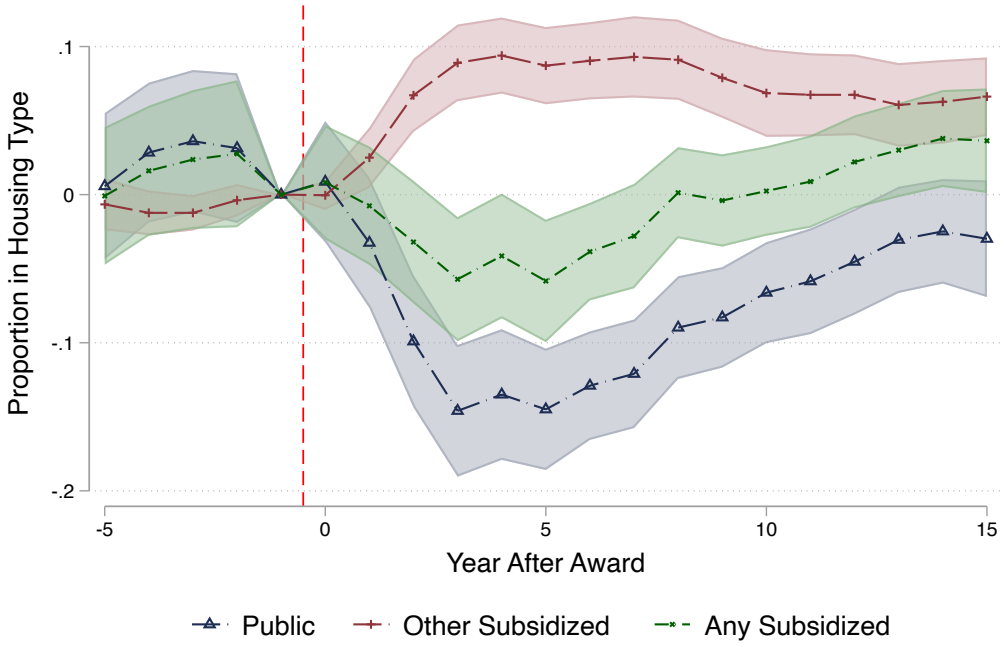
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the log number of poor or non-poor individuals in the neighborhood. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

Figure B.9: Residential Mobility of the Original Residents, Failed Applicants



Notes: This figures plots the proportion of the original residents of the failed applicant neighborhoods who moved to a different Census block group by a given year after the award.
Source: Authors' calculations based on linked administrative data.

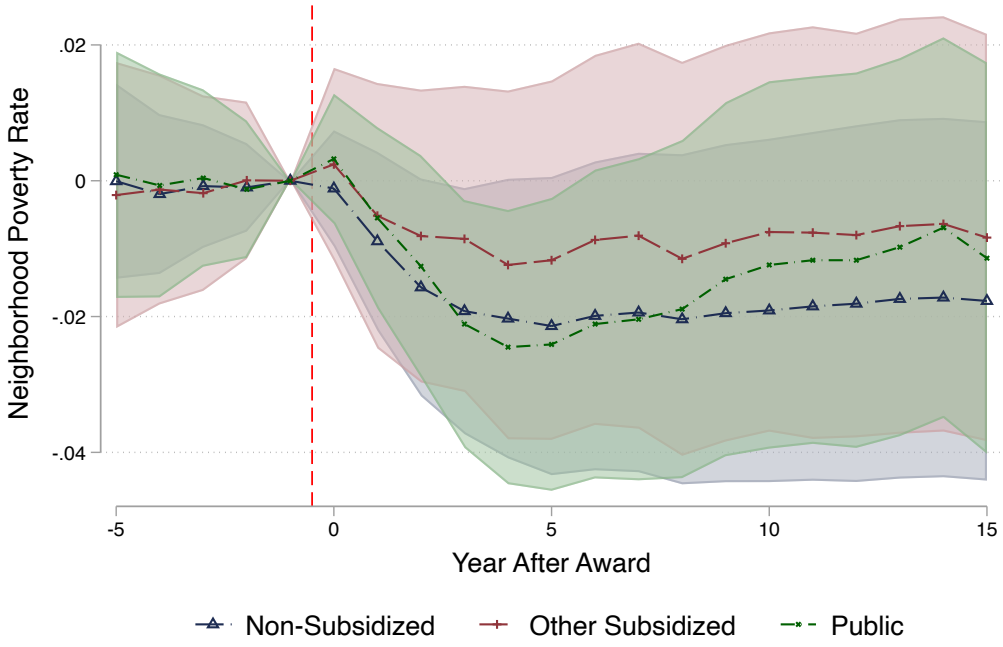
Figure B.10: Effect on Subsidy Status, Original Residents of Public Housing



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the proportion of the original residents of the public housing project that were living in public, other subsidized, or non-subsidized housing. The shaded regions denote the 95 percent confidence intervals.

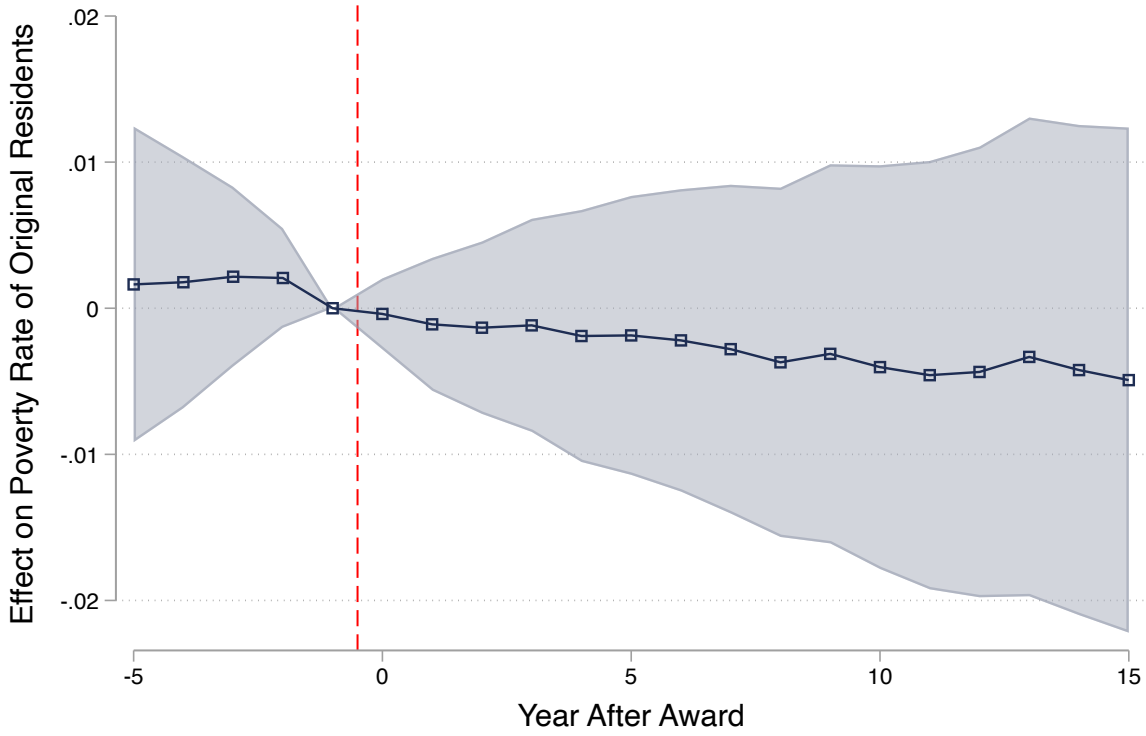
Source: Authors' calculations based on linked administrative data.

Figure B.11: Effect on Exposure to Poverty for Original Residents, By Subsidy Status



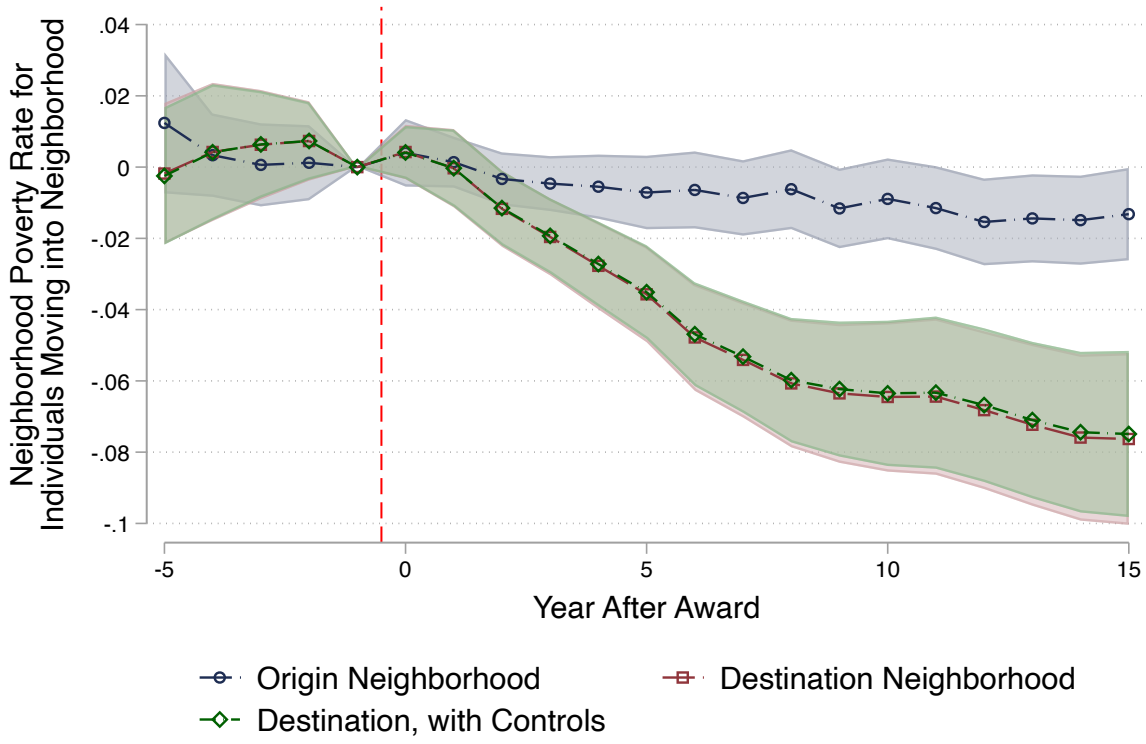
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the poverty rate of the current neighborhood, and results are estimated separately by subsidized housing status. The shaded regions denote the 95 percent confidence intervals. Source: Authors' calculations based on linked administrative data.

Figure B.12: Effect on Income of Original Residents



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the proportion of the original residents who are poor. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

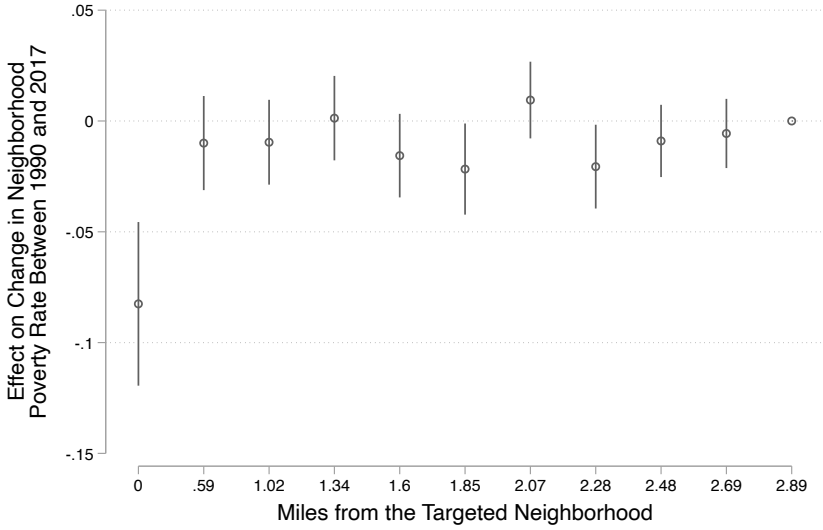
Figure B.13: Effect on Exposure to Neighborhood Poverty for Newcomers in Non-Subsidized Housing



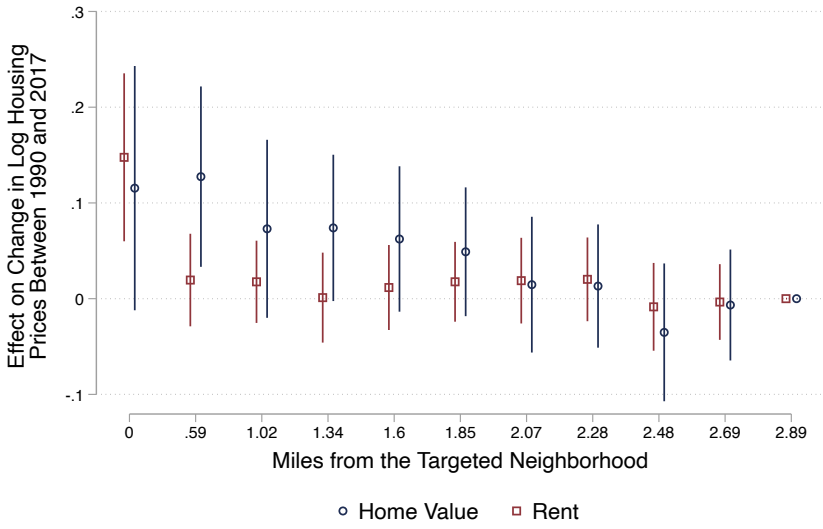
Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2 but estimated on individual-level panel data. The sample includes individuals who move into a Revitalization or Failed applicants neighborhood and do not have subsidized housing. The outcome is either the neighborhood poverty rate in the destination or origin neighborhood. The shaded regions denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

Figure B.14: Effect on Surrounding Neighborhoods

(A) Neighborhood Poverty



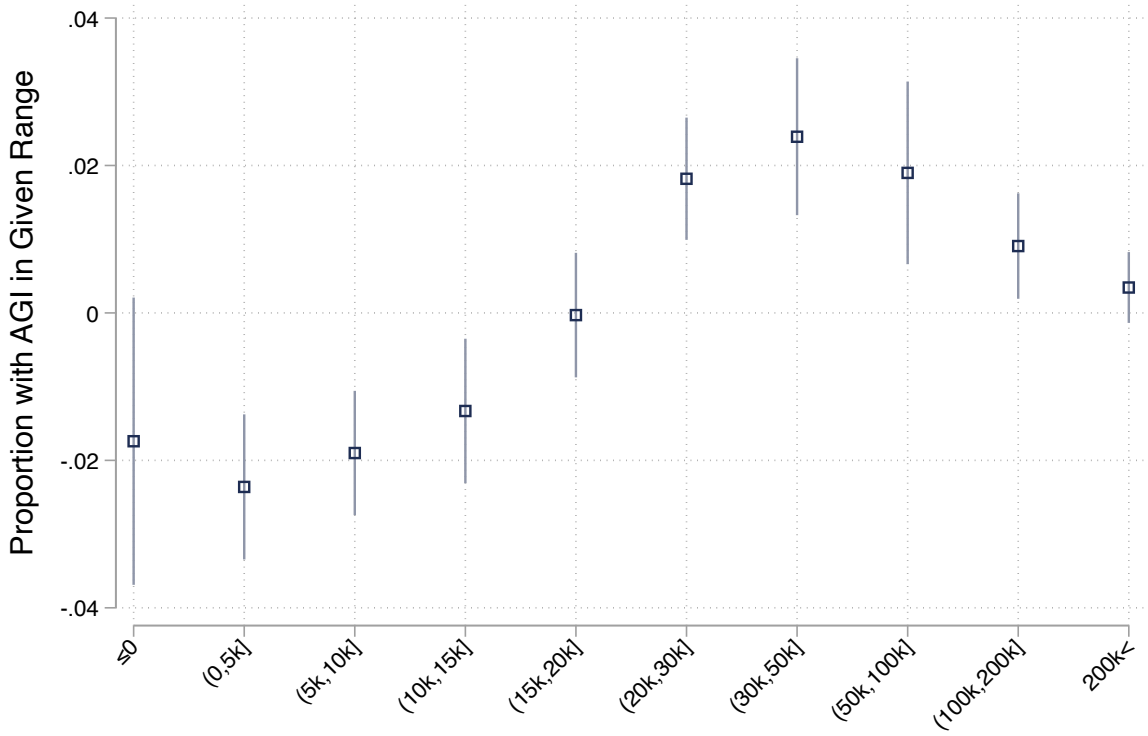
(B) Housing Prices



Notes: For each Revitalization and failed applicant site we identify all block groups within 3 miles and group them into deciles based on distance from the targeted neighborhoods. We then regress an outcome variable on the interaction between the distance and treatment, a project fixed effect, and a vector of baseline covariates measured in 1990 (log median home value, log median rent, poverty rate, share Black, and an indicator for whether the block group contains public housing). The outcome variable in panel A is the change in change in poverty rate between 1990 and 2017 and the the outcome variables in panel B are the change in log median home value or log median rent between 1990 and 2017. We estimate this specification via weighted least squares using the population in targeted neighborhoods in 1990 as weights and cluster standard errors at the level of the neighborhood. The vertical bars denote the 95 percent confidence intervals.

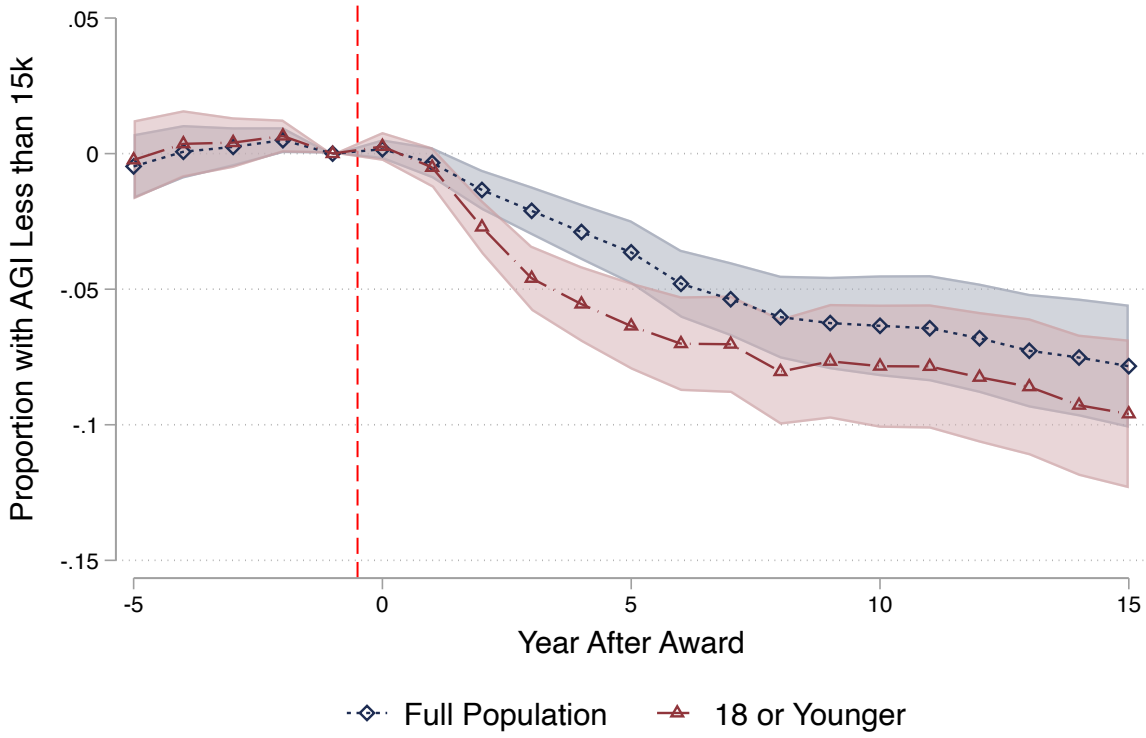
Source: Authors' calculations based on summary files of Decennial Census surveys and the ACS.

Figure B.15: Effect on Income Distribution in Neighborhood



Notes: This figures plots estimates from the equation 3. Each point represents an estimate from a separate regression in which the outcome variable is the proportion of individuals living in the neighborhood 10 to 15 years after the award whose AGI falls within the range defined by the horizontal axis. The vertical bars denote the 95 percent confidence intervals.
Source: Authors' calculations based on linked administrative data.

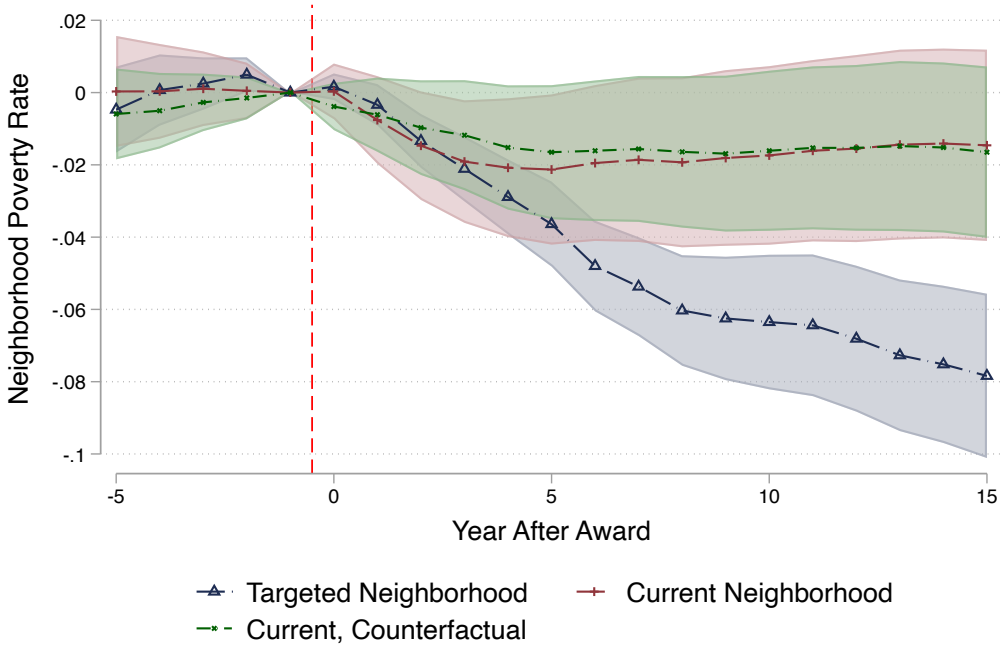
Figure B.16: Effect on Neighborhood Poverty, Families with Children



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome is the poverty rate for all individuals in the neighborhood (diamond markers) or the poverty rate for those 18 and younger (triangle markers). The shaded regions denote the 95 percent confidence intervals.

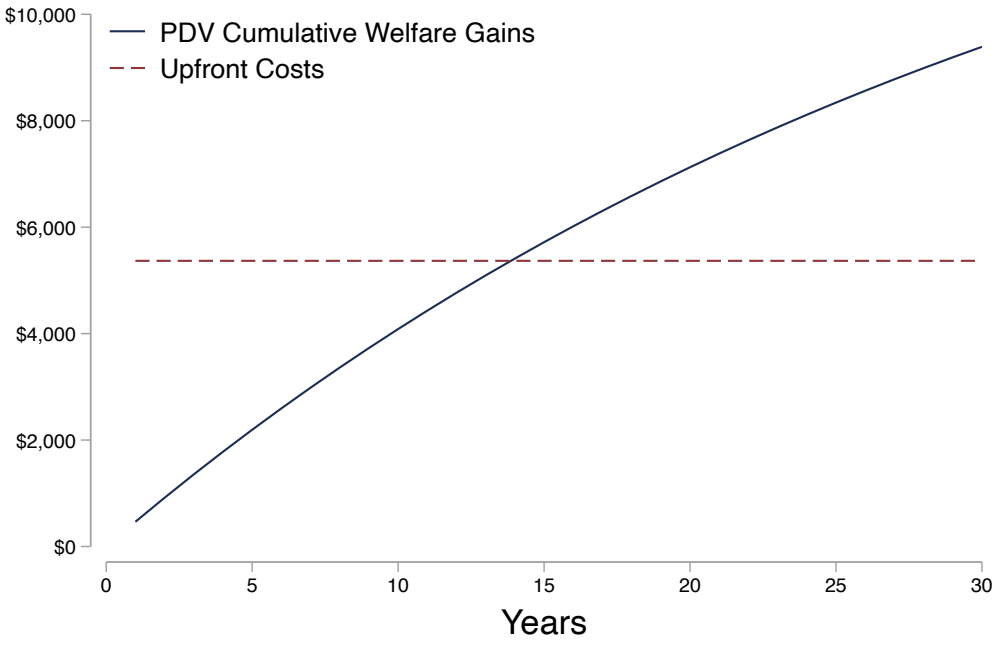
Source: Authors' calculations based on linked administrative data.

Figure B.17: Reconciling Effects on Targeted Neighborhoods and Original Residents



Notes: This figures plots estimates from the stacked difference-in-differences specification described in equation 2. The outcome in is the poverty rate of the original neighborhood, current neighborhood, or the counterfactual current neighborhood. The shaded regions denote the 95 percent confidence intervals. Source: Authors' calculations based on linked administrative data.

Figure B.18: Cumulative Welfare Gains vs Upfront Costs



Notes: This figures plots the present discounted value (PDV) of the cumulative welfare gains per subsidized unit as a function of the number of years over which these gains accrue. The red dashed line represents the upfront cost per subsidized units.

Appendix C Theory

Consider a city that consists of two neighborhoods, the central city (C) and the suburbs (B), which both have a fixed, homogeneous housing stock of equal size. There are two periods (t and $t+1$). The population is fixed and equal to the size of the housing stock. There are two types of households: low-income (l) and high-income (h). All low-income and no high-income households have subsidized housing.[40] The poverty rate of neighborhood j is P_{jt} (i.e., the share of households that are low-income) and it is defined in equilibrium, while the poverty rate of the city is fixed at P.[41]

The Revitalization program sought to reduce the average neighborhood poverty rate for subsidized renters ($\bar{P}_t^l$), where $\bar{P}_t^l \equiv P_{Ct} \times \omega_{Ct} + P_{Bt} \times \omega_{Bt}$ and $\omega_{jt} = \frac{P_{jt}}{P_{Ct}+P_{Bt}}$, taking the city-level poverty rate as given. Figure C.1 depicts the relationship between segregation and exposure to poverty by plotting $\bar{P}_t^l$ against the difference between the neighborhood-level poverty rates, $P_{Ct} - P_{Bt}$. Distributing poor households evenly throughout the city minimizes exposure to neighborhood poverty for subsidized households.

Low-income households either live in public housing or receive housing vouchers and join high-income households in their search for housing in the private market.[42] In each neighborhood a share of units, H_{jt}, are reserved for public housing. Each household i in the private market chooses a neighborhood j to maximize their utility, given by:

$$\begin{aligned} u_{ijt}^h &= y^h - r_{jt} + A_{jt} - P_{jt} + \epsilon_{ijt} \\ u_{ijt}^l &= y^l - \phi r_{jt} + \delta A_{jt} - \alpha P_{jt} + \epsilon_{ijt}, \end{aligned} \tag{C.1}$$

where y is income; r_{jt} is the cost of housing; A_{jt} is the amenity value of neighborhood j; P_{jt} is the neighborhood poverty rate; and ϵ_{ijt} represents household-level heterogeneity in neighborhood valuations, which is assumed to be independently, identically distributed extreme value. $0 < \phi < 1$ captures the fact that low-income households who are not in public housing have housing vouchers and therefore pay less than full market rent. While housing subsidies typically require households to contribute a fixed percentage of their income to rent, a positive value of ϕ could captures other dimensions of the cost of living (e.g., more expensive groceries, etc.). $\delta > 0$ and $\alpha > 0$ allow low-income households to value neighborhood amenities and neighborhood poverty differently than high-income households. A spatial equilibrium is a vector of prices, $\{r_{Ct}^*, r_{Bt}^*\}$, and allocations, $\{P_{Ct}^*, P_{Bt}^*\}$, such that no household in the private market could be made better off by moving neighborhoods.

To model the city before the program we consider a unique, interior, stable equilibrium where there is no public housing in the suburbs and the city center has a higher poverty rate than the suburbs.[43] There are two cases in which such an equilibrium exists, *Case 1:* $A_{Ct} > A_{Bt}$ and $\delta > \phi$; and *Case 2:* $A_{Ct} < A_{Bt}$ and $\delta < \phi$. We model the Revitalization

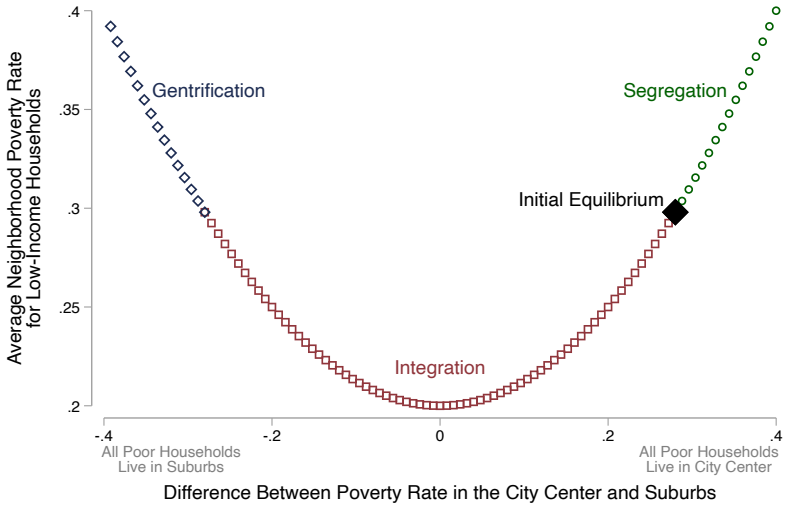
[40] In practice, recent estimates suggest that just one in four income-eligible households receives federal rental assistance. See https://www.cbpp.org/research/housing/more-housing-vouchers-most-important-step-to-help-more-people-afford-stable-homes.

[41] We drop the time subscript for variables that are time invariant.

[42] We assume that public housing is rationed and sufficiently appealing such that low-income households would always chose to accept public housing over searching for housing in the private market.

[43] Formally, the equilibrium satisfies $0 = H_B$, $0 < H_{Ct} < P_{Ct}^*$, and $0 < P_{Bt}^* < P_{Ct}^* < 2P$.

Figure C.1: Segregation and Exposure to Neighborhood Poverty



Notes: This figure plots $\bar{P}_t^l$ on the vertical axis against $P_{Ct} - P_{Bt}$ on the horizontal axis under the assumption that $P = 0.2$. The solid diamond depicts the initial equilibrium. The hollow diamond, square, and circle markers depict the three possible equilibria after the Revitalization intervention.
Source: Simulated data.

program as increasing neighborhood amenities ($A_{Ct} < A_{Ct+t}$) and reducing the stock of public housing ($H_{Ct} > H_{Ct+1}$), keeping fixed the the city-wide poverty rate. In equilibrium, neighborhood poverty rates are pinned down by: $(\delta - \phi)(A_B - A_{Ct}) = 2(\alpha - \phi)(P - P^*_{Ct}) + log(\frac{P^*_{Bt}}{P^*_{Ct}}) - \phi log(\frac{1-P^*_{Bt}}{1-P^*_{Ct}})$. Taking the derivative of P^*_{Ct} with respect to A_{Ct} yields, $\frac{dP^*_{Ct}}{dA_{Ct}} = \frac{\phi-\delta}{2}\left[\phi\left(\frac{(1-P^*_{Ct})(1-P^*_{Bt})-(1-P)}{(1-P^*_{Ct})(1-P^*_{Bt})}\right) - \left(\alpha + \frac{P}{P^*_{Ct}P^*_{Bt}}\right)\right]^{-1}$. The conditions of case 1 imply that $\frac{dP^*_{Ct}}{dA_{Ct}} > 0$ and the conditions of case 2 imply that $\frac{dP^*_{Ct}}{dA_{Ct}} < 0$. See Appendix C.1 for proofs.

The Revitalization program produces three possible equilibria. First, case 1 implies that $\bar{P}_t^l < \bar{P}_{t+1}^l$. The program attracts low-income households to the city center because they value the amenities and housing vouchers prevent them from paying the full cost. We refer to this case as the *Segregation* equilibrium, which is depicted by the green circles in Figure C.1. Second, case 2 in addition to $A_B \geq A_{Ct+1}$ or $H_{Ct+1} \geq 2p - P^*_{Ct}$ implies that $\bar{P}_t^l > \bar{P}_{t+1}^l$. An increase in amenities attracts high-income households to the city center because they value the amenities more. We refer to this case as the *Integration* equilibrium, which is depicted by the red squares in Figure C.1. Third, case 2 in addition to $A_B < A_{Ct+1}$ and $H_{Ct+1} < 2p - P^*_{Ct}$ implies that $\bar{P}_t^l < \bar{P}_{t+1}^l$. In this case the poverty rate in the suburbs after the award is higher than the poverty rate in city center before the award ($P^*_{Bt+1} > P^*_{Ct}$) because the improvement in amenities attracts high-income households and the reduction in public housing allows the low-income households to be priced out. We refer to this scenario as the *Gentrification* equilibrium, which is depicted by the blue diamonds in Figure C.1. The program reduces poverty rates in the city center, but increases poverty rates in the suburbs enough to increase the average, city-wide neighborhood poverty rate for low-income

households.

This model illustrates why the effect of the Revitalization program on neighborhood poverty for subsidized renters is theoretically ambiguous. The program could increase exposure to neighborhood poverty by attracting poor households to the revitalized sites (segregation equilibrium) or relocating too many poor households to the suburbs (gentrification equilibrium). Whether these unintended consequences occur depends on how low-income households value neighborhood amenities (δ) and the extent to which they pay for them (ϕ). The program will be successful only if it attracts high-income households into the revitalized neighborhoods while maintaining a sufficient amount of affordable units for low-income households (integration equilibrium).

C.1 Proofs

The logit choice probability that household of type k selects neighborhood j is

$$\mathbb{P}^k_{jt} = \frac{exp\{\bar{u}^k_{ijt}\}}{exp\{\bar{u}^k_{iBt}\} + exp\{\bar{u}^k_{iCt}\}}, \tag{C.2}$$

where $\bar{u}^k_{ijt} \equiv u^k_{ijt} - \epsilon_{ijt}$. In equilibrium, the choice probabilities, $\mathbb{P}^k_{jt}$ must be consistent with the poverty rates that enter the utility function, P_{jt}. Without loss of generality assume the size of the population in each neighborhood is 1. Then a spatial equilibrium requires that,

$$P_{jt} = \mathbb{P}^l_{jt} 2P = 1 - \mathbb{P}^h_{jt} 2(1-P). \tag{C.3}$$

Combining the identity $(P_{Ct} + P_{Bt})/2 = P$ with equations C.2 and C.3 yields,

$$\begin{aligned} log(\mathbb{P}^l_{Bt}) - log(\mathbb{P}^l_{Ct}) &= -\phi(r_{Bt} - r_{Ct}) + \delta(A_{Bt} - A_{Ct}) - \alpha(P_{Bt} - P_{Ct}) \\ log(\frac{2P - P_{Ct}}{P_{Ct}}) &= -\phi(r_{Bt} - r_{Ct}) + \delta(A_{Bt} - A_{Ct}) - \alpha 2(P - P_{Ct}) \end{aligned} \tag{C.4}$$

and

$$\begin{aligned} log(\mathbb{P}^h_{Bt}) - log(\mathbb{P}^h_{Ct}) &= -(r_{Bt} - r_{Ct}) + (A_{Bt} - A_{Ct}) - (P_{Bt} - P_{Ct}) \\ log\big(\frac{2(1-P) - (1-P_{Ct})}{1 - P_{Ct}}\big) &= -(r_{Bt} - r_{Ct}) + (A_{Bt} - A_{Ct}) - 2(P - P_{Ct}). \end{aligned} \tag{C.5}$$

Rearranging terms in equations C.4 and C.5, we can write the price differential between neighborhoods B and C based on the difference in choice probabilities for household type k, $f^k(P_{Ct}) \equiv r_{Bt} - r_{Ct}$, as a function of the poverty rate in C,

$$\begin{aligned} f^l(P_{Ct}) &= \frac{\delta}{\phi}(A_B - A_{Ct}) - 2\frac{\alpha}{\phi}(P - P_{Ct}) - \frac{1}{\phi} log(\frac{2P - P_{Ct}}{P_{Ct}}) \\ f^h(P_{Ct}) &= (A_B - A_{Ct}) - 2(P - P_{Ct}) - log\big(\frac{2(1-P) - (1-P_{Ct})}{1 - P_{Ct}}\big) \end{aligned} \tag{C.6}$$

Equation C.6 is a system of two equations and two unknowns, which pins down the equilibrium neighborhood poverty rate, P_{Ct}, and relative prices, $r_{Bt} - r_{Ct}$.[44]

[44] Because we do not model housing supply, we can only pin down relative prices in equilibrium.

We consider a unique, interior, stable equilibrium in which there is public housing in C but not B and C has a higher poverty rate at time t. Let P^*_{jt} denote the equilibrium poverty rate in neighborhood j. Then the equilibrium satisfies the following conditions: $0 = H_B$, $0 < H_{Ct} < P^*_{Ct}$, and $0 < P^*_{Bt} < P^*_{Ct} < 2P$. Let $g(P_{Ct}) \equiv f^h(P_{Ct}) - f^l(P_{Ct})$, then the equilibrium level of price differentials, $r_{Bt} - r_{Ct}$, and the spatial distribution of poverty, P_{Ct} and P_{Bt}, is defined by the condition: $g(P^*_{Ct}) = 0$.

We prove the existence of a unique, interior, stable equilibrium by showing that two conditions are met: i) $\lim_{P_{Ct}\to 0} g(P_{Ct}) > 0$ and ii) $dg(P_{Ct})/dP_{Ct} < 0$. To illustrate the intuition behind why these conditions define an equilibrium, Figure C.2(a) plots $f^k(P_{Ct})$ and Figure C.2(b) plots $g(P_{Ct})$. If both conditions are met, then there is a unique poverty rate, P^*_{Ct} such that $g(P^*_{Ct}) = 0$. Furthermore, the fact that $g(P_{Ct})$ is downward sloping in Figure C.2(b) implies that the equilibrium is stable. To see why, consider a case in which poverty rates in C are below the equilibrium value and the price differential satisfies the constraint for the low-income households. In this scenario, C is too expensive for the high-income households and they will move to B, which will drive down poverty rates in C. If the price differential shifts to satisfy $f^l(P_{Ct})$, then poverty rates in C will fall until $g(P_{Ct}) = 0$. For i), note that $\lim_{P_{Ct}\to 0} \frac{1}{\phi} log(\frac{2P - P_{Ct}}{P_{Ct}}) = \infty$ for $\phi > 0$, which implies that $\lim_{P_{Ct}\to 0} g(P_{Ct}) > 0$. For ii), note that

$$\frac{dg(P_{Ct})}{dP_{Ct}} = \frac{\phi - \alpha}{\phi} - \frac{2(1-P)}{(1-P_{Bt})(1-P_{Ct})} - \frac{P}{\phi P_{Bt} P_{Ct}} < 0. \tag{C.7}$$

Under the assumption that $\alpha > 0$ and $\phi > 0$, the inequality in equation C.7 always holds because $\frac{\phi-\alpha}{\phi} \leq 1 < \frac{1}{1-P} \leq \frac{(1-P)}{(1-P_{Bt})(1-P_{Ct})}$ and $\frac{P}{\phi P_{Bt} P_{Ct}} > 0$.

Under what conditions will $P^*_{Bt} < P^*_{Ct}$? We can rewrite $g(P^*_{Ct}) = 0$ as,

$$\frac{\delta - \phi}{\phi}(A_B - A_{Ct}) = -\frac{1}{\phi}\big[\alpha(P^*_{Ct} - P^*_{Bt}) + log(\frac{P^*_{Ct}}{P^*_{Bt}})\big] + \big[(1 - P^*_{Bt}) - (1 - P^*_{Ct}) + log(\frac{1 - P^*_{Bt}}{1 - P^*_{Ct}})\big]. \tag{C.8}$$

When $P^*_{Bt} < P^*_{Ct}$ the right hand side of equation C.8 is always negative because $\alpha(P^*_{Ct} - P^*_{Bt}) + log(\frac{P^*_{Ct}}{P^*_{Bt}}) > 0$ and $(1 - P^*_{Bt}) - (1 - P^*_{Ct}) + log(\frac{1-P^*_{Bt}}{1-P^*_{Ct}}) < 0$. There are two conditions under which the left hand side is also negative: case i) $A_B < A_{Ct}$ and $\phi < \delta$ and case ii) $A_B > A_{Ct}$ and $\phi > \delta$. These are the two cases in which there exists an equilibrium that satisfies the above conditions (i.e., the equilibrium is a unique, interior, stable equilibrium in which there is public housing in C but not B and C has a higher poverty rate at time t).

Our main comparative static asks how poverty rates in the city will change if the amenity value increases. Using implicit differentiation with the condition $g(P^*_{Ct}) = 0$, yields,

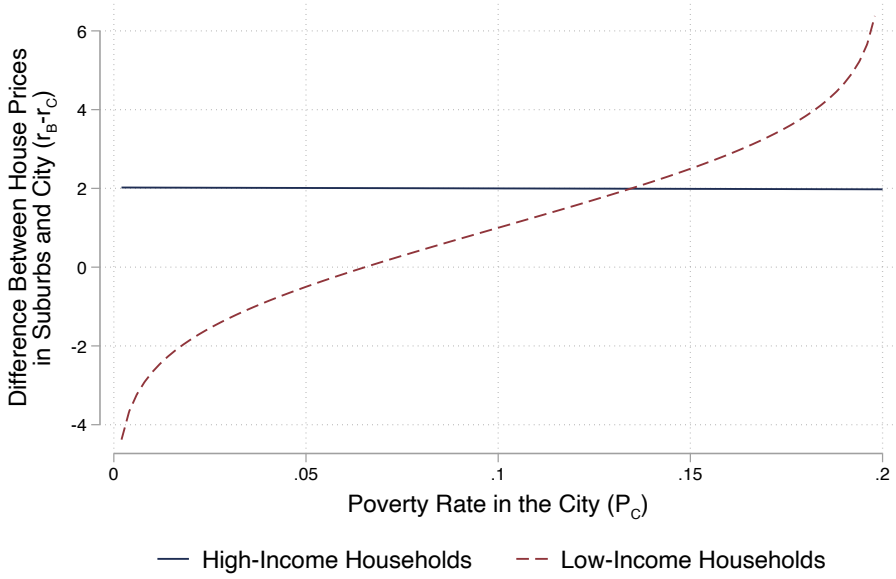
$$\frac{dP^*_{Ct}}{dA_{Ct}} = \frac{\phi - \delta}{2}\big[\phi\big(\frac{(1 - P^*_{Ct})(1 - P^*_{Bt}) - (1 - P)}{(1 - P^*_{Ct})(1 - P^*_{Bt})}\big) - \big(\alpha + \frac{P}{P^*_{Ct} P^*_{Bt}}\big)\big]^{-1}. \tag{C.9}$$

Note that $\phi\big(\frac{(1-P^*_{Ct})(1-P^*_{Bt})-(1-P)}{(1-P^*_{Ct})(1-P^*_{Bt})}\big) < 0$ because $(1 - P^*_{Ct}) < (1 - P) < (1 - P^*_{Bt})$ and $\big(\alpha + \frac{P}{P^*_{Ct} P^*_{Bt}} > 0$. Thus, $\frac{dP^*_{Ct}}{dA_{Ct}} > 0$ if $\phi < \delta$ and $\frac{dP^*_{Ct}}{dA_{Ct}} < 0$ if $\phi > \delta$.[45]

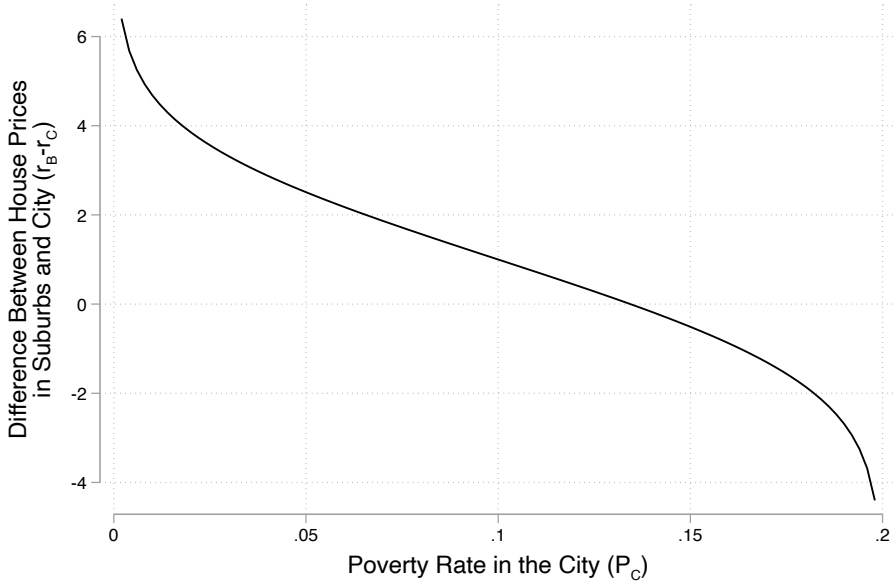
[45] If $\phi > \delta$ and the increase in A_{Ct} is sufficiently large such that $P^*_{Bt} > P^*_{Ct}$, then $\frac{dP^*_{Ct}}{dA_{Ct}} < 0$ still holds

Figure C.2: Equilibrium

(A) High- and Low-Income Households



(B) Difference



Notes: Panel A plots $f^l(P_{Ct})$ and $f^h(P_{Ct})$, which describes the relationship between relative prices, $r_{Bt} - r_{Ct}$, and poverty rates in the city, P_{Ct}. Panel B plots $g(P_{Ct})$, which is defined as $g(P_{Ct}) \equiv f^h(P_{Ct}) - f^l(P_{Ct})$.

Source: The figure is based on simulated data under the assumptions that $P = 0.4$, $\phi = 0.9$, $\delta = 0.5$, $\alpha = 0.8$, and $(A_B - A_{Ct}) = 4$.

Appendix D Aggregate Effects

We use the reduced-form estimates presented in Sections 6.2.1 through 6.2.4 to i) estimate the effect of the Revitalization program on the average neighborhood poverty rate for all subsidized renters in the PHA and ii) decompose this effect into components attributable to different groups. We consider a modified version of equation 1, in which the weights are a function of the share of subsidized housing units in the PHA that are targeted by the Revitalization program. Specifically,

$$\mathbb{E}\big[\Delta_i|s] = \sum_g \omega_g(s)\mathbb{E}\big[\Delta_i|G_i = g], \tag{D.1}$$

where s is the share of subsidized housing units in the PHA that are targeted by the Revitalization program; $\mathbb{E}\big[\Delta_i|G_i = g]$ is the effect for group g 15 years after the award; $\omega_g(s)$ is the share of subsidized renters who belong to group g, which is a function of s; and $\mathbb{E}\big[\Delta_i|s]$ is the effect of the Revitalization program on the average neighborhood poverty rate for subsidized renters, which is a function of s. Note that we partition the sample into mutually exclusive and exhaustive groups, which implies that $\sum_g \omega_g(s) = 1$ and $\omega_g(s) \in [0, 1]$ for all g and $s \in [0, 1]$. The subsections below describes how we estimate $\mathbb{E}\big[\Delta_i|G_i = g]$ and $\omega_g(s)$ for each group g.

D.1 Original Residents

In Section 3 household type (i.e., low- or high-income household) is time invariant. But in reality, there is a substantial amount of churn in and out of subsidized housing. This distinction is only relevant for the original residents, who are the only group defined by where they lived before the award. For the effect on exposure to poverty, we assume that the effects we estimate for all original residents are equal to those that remain in subsidized housing 15 years after the award. Therefore, the estimates in Figure 7 imply that the program led the original residents to live in neighborhoods where the poverty rate was 1.46 percentage points lower 15 years after the award. For the weights, we find that 27.1 percent of the original residents of the Revitalization projects resided in subsidized housing 15 years after the award and assume that there is not change in the total number of subsidized households over time. Thus, $\mathbb{E}\big[\Delta_i|G_i = 1] = -0.0146$ and $\omega_1(s) = 0.271 \times s$.

D.2 New Residents

Figure 3 shows that the program reduced the poverty rate in targeted neighborhoods by 7.8 percentage points 15 years after the award. Figure 8(A) shows that the new subsidized renters captured 99 percent of this effect. Table 2 shows that the program led to a 20 percent reduction in the number of subsidized units in the revitalized neighborhoods. Furthermore, Table 2 shows that 90 percent of the residents of revitalized neighborhoods were new residents (as opposed to original residents).[46] Thus, $\mathbb{E}\big[\Delta_i|G_i = 2] = -0.078 \times 0.99$ and $\omega_2(s) = (1 - 0.2) \times 0.9 \times s$.

because $(1 - P^*_{Bt}) < (1 - P) < (1 - P^*_{Ct})$.

[46] We arrive at this number using the estimates in columns 7, 9, 11, and 13 from Table 2. We estimate the size of the population in the Revitalization neighborhood as the failed applicant average plus the coefficient estimate: $0.9 = (696 - 168 + 335 - 2)/(108 - 43 + 696 - 168 + 52 - 20 + 335 - 2)$.

D.3 Residents Who Would Have Moved in Absent the Award

On average, individuals who move into a failed applicant neighborhoods in the 10 to 15 years after the award come from neighborhoods in which the poverty rate is 14 percentage points lower. Table 2 shows that the program led to a 20 percent reduction in the number of subsidized units in the revitalized neighborhoods. Thus, $\mathbb{E}\big[\Delta_i|G_i = 3] = -0.14$ and $\omega_3(s) = 0.2 \times s$.

D.4 Spillovers

The share of subsidized renters who live in other neighborhoods and are not directly affected by the program (i.e., are not in groups 1 through 3) is equal to: $1 - [\omega_1(s) + \omega_2(s) + \omega_3(s)]$. These other households can be organized into a group that is and is not affected by the program due to spillover effects on their neighborhoods. Let $g = 4$ and $g = 5$ be the group that is and is not affected by spillover effects, respectively and let c be a constant such that $c \times s = \omega_1(s) + \omega_2(s) + \omega_3(s)$. We assume that $\omega_4(s) = 2 \times s \times (1 - c \times s)$, which implies that no one is affected by spillover effects when no or all units are revitalized ($\omega_4(0) = 0$ and $\omega_4(1) = 0$) and all units not directly affected by the program are affected by spillover effects when half the units are revitalized ($\omega_4(s) = 1 - \frac{1}{2}c = 1 - [\omega_1(s) + \omega_2(s) + \omega_3(s)]$). Section 6.2.3 argues that the displacement of the poor original residents, poor new residents, and non-poor new residents increase poverty rates for subsidized renters living in in other neighborhoods by 0.296, 0.194, and 0.270 percentage points, respectively. To provide an upper bound we assume the spillover effects from these three groups of displaced households all affect the same neighborhoods and therefore sum the effects from all three groups. Thus, $\mathbb{E}\big[\Delta_i|G_i = 4] = 0.0076$, $\omega_4(s) = 2 \times s \times (1 - c \times s)$, $\Delta_5 = 0$, and $\omega_5(s) = 1 - [\omega_1(s) + \omega_2(s) + \omega_3(s) + \omega_4(s)]$.

Appendix E Discussion of Additional Results

E.1 Effect on Income Distribution

The reduction in poverty rates in targeted neighborhoods is driven by the in-migration of moderate-income residents. For each neighborhood, we calculate the proportion of individuals whose AGI falls within narrow ranges 10 to 15 years after the awards and estimate the effect of the program on these proportions using equation 3. Figure B.15 presents the estimates. The program led to a reduction in the proportion of families in all income categories below $15,000. Conversely, the program led to an increase in higher-income households, but the effects are largest for households with an AGI between $20,000 and $100,000.

E.2 Effect on Poverty Rate of Households with Children

The reduction in poverty was not driven by an influx of higher-income adults without children. The program was motivated, in part, by a desire to improve living conditions for children and it would thus be problematic if the changes in poverty rates were driven by childless adults. We calculate the proportion of children whose parents are poor and Figure B.16 illustrates that the reduction in the proportion of poor families with children, is slightly larger than the reduction in the overall poverty rate.

E.3 Reduction in Exposure to Poverty for Original Residents

To help reconcile the program impacts on the targeted neighborhoods and the original residents of those neighborhoods we construct counterfactual estimates of what the poverty rates in the Revitalization neighborhoods might have been absent the program. Specifically, for each year after 1990 we regress current poverty rate on the ventile of the neighborhood poverty rate in 1990. We estimate this specification on the sample of failed application neighborhoods, and then use the estimated coefficients to construct a predicted poverty rate in both the failed applicant and Revitalization neighborhoods. We then estimate a specification where we replace the true neighborhood poverty rate with this counterfactual poverty rate for individuals who remain in their original neighborhood. Any impacts on this counterfactual measure of neighborhood poverty will solely reflect reductions due to moves made by the original residents to lower-poverty neighborhoods. The results are presented in the green series of Figure B.17 and are almost identical to the red series based on the actual neighborhood poverty rates. The similarity between the estimates suggests that the reductions in exposure to neighborhood poverty for original residents is attributable to the fact that the program led some households to move to lower poverty neighborhoods. This makes sense, given that the vast majority of original residents move within 10 years, leaving little room for the reductions in poverty rates in the targeted neighborhoods to translate into benefits for the original residents.

E.4 Residential Mobility of Original Residents

Of the original residents, were lower income households more likely to be displaced? To investigate this question we estimate the following specification using individual data,

$$m_i = \beta x_i \times D_n + \phi x_i \times (1 - D_n) + \lambda_{ng} + u_i \tag{E.1}$$

where i is the individual, n is the neighborhood, m is an indicator equal to one if i moved to a new neighborhood within five or ten years, x is an indicator equal to one if AGI is less

than \$15,000, λ_{ng} is a neighborhood by grant year fixed effect, D_n is equal to one if the neighborhood received a Revitalization grant, and standard errors are clustered at the level of the neighborhood. The coefficients β and ϕ describe how household income is correlated with residential mobility in Revitalization and failed applicant neighborhoods, respectively. We estimate this specification for three different samples defined by whether the household was originally in public housing, other subsidized housing, or non-subsidized housing in the year before the award.

Columns 1-3 of Table A.5 presents estimates of β and ϕ obtained from equation E.1 for the sample of individuals who lived in the neighborhood in the year before the award and were in public, other subsidized, and non-subsidized housing, respectively. Panel A of column 1 shows that in failed applicant projects, poor households are 17 percentage points less likely to be living in a different neighborhood five years later compared non-poor households (panel B presents results for mobility patterns ten years after the award). In distressed public housing projects, only low-income residents with limited outside options tend to stay. Within Revitalization projects, poor households are only 7 percentage points less likely to move. The fact that there is a weaker relationship between poverty and residential mobility within the Revitalization neighborhoods is attributable to the fact that most of the units were demolished and almost all residents were forced to move. Columns 2 and 3 show that, for individuals in other subsidized and non-subsidized housing, there is a similar association between poverty and residential mobility in the Revitalization and failed applicant neighborhoods. These latter results suggest that the program did not lead to a reduction in neighborhood poverty rates by disproportionately pricing out low-income households who originally resided in the neighborhoods.