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Does Large-Scale Neighborhood Reinvestment Work? Effects of Public–Private Real Estate Investment on Local Sales Prices, Rental Prices, and Crime Rates

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Abstract

During the 1990s, the U.S. Department of Housing and Urban Development awarded more than \$6 billion in competitive grants called HOPE VI to spur neighborhood redevelopment. We add to HOPE VI research by examining the impacts of a large set of public-private real estate investments, including HOPE VI, made over a 16-year period in a distressed Pittsburgh neighborhood called the Hill District. Specifically, we estimate the effects of the \$468 million additional public-private investments that Hill District received compared to a demographically similar neighborhood on sale prices, rental prices, and crime. We find large and statistically significant impacts of the public-private investments on residential sales prices, commercial sales prices, and on rental prices, but only a marginally significant yet meaningful decline in non-violent arrests. For each additional \$10 million of public-private investment, we find a 0.95 percent increase in residential sales prices, 2.7 percent increase in commercial sales prices, and 0.55 percent increase in rental prices. Because there was an accumulated difference over 16 years of \$468 million in the amount of public-private investment across the two neighborhoods we examine, these percentage increases amount to large changes in real estate prices over that time. Commercial real estate investors and homeowners benefited the most, followed by residential landlords. Our analyses imply cities should anticipate the potential impacts of major neighborhood investment on low-income households, especially unsubsidized renters that most directly experience the brunt of rising rents.

Keywords

community development; public housing; real estate; HOPE VI

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INTRODUCTION

To revitalize distressed neighborhoods, cities often elicit private investment by offering public subsidies from a range of local, state, and federal sources and regulatory relief (Fainstein, 2001). A prime example of the public-private investment approach to create neighborhood revitalization on a large scale was the U.S. Department of Housing and Urban Redevelopment's (HUD's) HOPE VI grant program. In fiscal years 1993-2010, HUD competitively awarded to public housing authorities hundreds of HOPE VI grants summing to \$6.5 billion. The grant recipients used the HOPE VI grant monies to leverage private and additional public dollars to replace distressed public housing with mixed-income and sometimes mixed-use redevelopment. Two key questions for local planning officials, investors, and politicians are whether significant public-private investments like a HOPE VI in a given neighborhood succeed in raising area housing prices and reducing crime.

Using as our starting point a 1993 HOPE VI grant to redevelop public housing within the distressed Pittsburgh neighborhood called Hill District, we examine whether the substantial, combined public-private investments in Hill District that included, but far exceeded the initial HOPE VI grant, (a) increased that neighborhood's residential and commercial sales prices, (b) increased residential rental prices, and (c) reduced crime. We do so by contrasting changes in the outcomes in Hill District relative to a comparable Pittsburgh neighborhood, Homewood, which experienced a far lower level of public-private investment over the same time period we examine. While HOPE VI's investments have been studied before, we make four new contributions to the HOPE VI and urban redevelopment literature.

1. We take a more generalizable, longer view of the constellation of public real estate investments made over 16 years that far exceeded any one HOPE VI redevelopment. In doing so, we answer for local and state public agencies whether their combined set of investments make a difference for real estate prices and crime over the longer run.
2. We illustrate that an analysis of the HOPE VI investments alone—as has been done in prior HOPE VI studies—likely overstates the effects of those investments on real estate prices and crime, since HOPE VI is often part of a larger set of public-private investments occurring at the same time, as was the case in this study.
3. By leveraging each of over 50 different public-private investments in the neighborhood, our analyses examine the return to each additional \$1 million of the combined public and private investments to crime rates and real estate prices, rather than only examining the effect of a specific, and thus less generalizable, amount of cumulative investments. This is to inform public administrators about the returns they might expect when investing at different scales than was done in the setting we examine.
4. We study not just residential prices, but also commercial prices, which has not been done in prior HOPE VI studies. Property tax on commercial properties is another important source of revenue for local governments.

To examine the effects of public-private investment on a large scale, we assembled a dataset of the total development costs (including public and private resources) of each demolition and redevelopment phase in receipt of public funds that occurred within the Hill District and within our comparison neighborhood, Homewood, over the period of 1990–2015. We chose these years to include the approximately 10 years prior to the date when the first newly redeveloped homes were ready for occupancy from the first major investment in the Hill District (i.e., the 1993 HOPE VI grant), up to 2015, which was the most recent year for which we could collect all types of outcome data at the time we conducted our analysis. The list of real estate investments in which public funds were a source is at Table A.1 of the Appendix. Before describing our methods of analysis and data in more detail, we first provide context about HOPE VI, about relevant prior research, and about the two Pittsburgh neighborhoods we compare.

OVERVIEW OF HOPE VI

In 1992, the National Commission on Severely Distressed Public Housing identified in its report to Congress that 86,000 public housing rental homes—six percent of all public housing rental homes in the U.S.—were “nearly unlivable,” calling it a “national disgrace.” The report called for more funding to public housing authorities to holistically address both the social and physical blight of dilapidated public housing developments that concentrated very low-income families.

In response, Congress allocated funds to the United States Department of Housing and Urban Development (HUD) that evolved into competitive grants for which local public housing authorities could apply to redevelop severely distressed public housing. The annual grant competition was called HOPE VI. During fiscal years 1993 through 2010, HUD awarded a combined total of approximately \$6.5 billion in either demolition or revitalization grants to public housing authorities. In all, HUD awarded 549 HOPE VI grants, ranging in size from \$80,000 for some of the smallest demolition-only grants to \$50 million for the largest revitalization grants that typically involved both demolition and significant new construction.¹ Depending on the type of grant received, the public housing authorities typically partnered with real estate developers to demolish, rehabilitate, and build new mixed-income development² that paired the HOPE VI grant funds with significant additional private and public funding such as from Low Income Housing Tax Credits.

PRIOR RESEARCH ABOUT HOPE VI EFFECTS ON LOCAL REAL ESTATE PRICES

We identified only two prior studies of the effect of HOPE VI investments on real estate prices that, like this study, had a quasi-experimental design, and we did not find any HOPE VI study that examined the effect of the HOPE VI investment on commercial prices. Among the two quasi-experimental design studies, Brown (2009) found positive effects of the HOPE

¹The source of HOPE VI facts is HUD’s HOPE VI website accessed on October 12, 2017 at https://www.hud.gov/program_offices/public_indian_housing/programs/ph/hope6.

²A working definition of mixed-income development is the “deliberate effort to construct and/or own a multifamily development that has the mixing of income groups as a fundamental part of its financial and operational plans.” (Brophy and Smith, 1997:5).

VI grant on residential prices, while Castells (2010) found null effects. We identified an additional nine studies that lacked quasi-experimental design; four of them found statistically significant increases in property values through pre-post comparison of the HOPE VI neighborhood (Holin et al., 2003; Bair & Fitzgerald, 2005; Zielenbach & Voith, 2010; Zielenbach et al., 2010), and an additional five studies included only descriptive analyses and did not establish statistical significance of HOPE VI investments (Cloud & Roll, 2011; Turbov & Piper, 2005; Turner et al., 2007; Zielenbach, 2003a, 2003b; overview in Popkin et al., 2004).

Looking beyond residential prices, studies of HOPE VI have found heterogeneous effects on a series of other outcomes. On the whole, these studies have found that HOPE VI has reduced neighborhood poverty and the proportion of African-American residents (Tach & Emory, 2017); increased resident perceptions of safety (see Levy, McDade, Bertumen, 2013) and reduced crime relative to citywide averages (Zielenbach, 2002; Holin et al., 2003).

Estimating the effects of a HOPE VI grant in isolation, however, is challenging, since HOPE VI is a large, but often not the only, public investment occurring at a given time in a distressed neighborhood. Although we do supplemental analyses to look at the effect of just the HOPE VI total development costs on prices and crime, our preferred approach is to consider the full bundle of development in which there are public resources—commercial, residential, HOPE VI or otherwise—to examine the more real-world scenario where a city makes numerous complimentary investments in a neighborhood like Hill District that was targeted for redevelopment. We explain these investments next.

OVERVIEW OF THE TWO NEIGHBORHOODS AND THEIR CITY

We examine two Pittsburgh neighborhoods—Hill District, which is a neighborhood that underwent major redevelopment, and Homewood, a sociodemographically similar neighborhood that received considerably lesser investment—over the 25-year period of 1990-2015. These neighborhoods³ are the subject of a larger, ongoing study of resident health outcomes and diet (Dubowitz, Ghosh-Dastidar, et al. 2015, Dubowitz, Zenk, et al. 2015).

In the decade leading up to when the major reinvestments started in the Hill District, the two neighborhoods shared many similarities, as shown in Table 1.⁴ They were similar in population and geographic size and they had similar household income levels and racial composition (by head of household). Both neighborhoods experienced population decline over the decade leading up to the large investments of public-private funding in Hill District. By 2000, the percentage of homes that were occupied had decreased in both neighborhoods, but they remained within a percentage point of each other.

³Our definition of the Hill District includes the city-defined neighborhoods of Bedford Dwellings, Crawford-Roberts, Middle Hill, Terrace Village, and Upper Hill. Our definition of Homewood includes the city-defined neighborhoods of Homewood North, Homewood South, Homewood West, and Larimer.

⁴Because Table 1 uses population census data about the neighborhoods and there is thus no sampling, differences presented in Table 1 are presumed to be the actual differences between the Hill District and Homewood. Because of this, we do not present any standard errors or inference towards differences between the neighborhoods in Table 1. However, to provide context about whether the differences are meaningful, we present the mean and standard deviations of the outcomes across the census tracts of the entire county in which the two neighborhoods are located (Allegheny County).

Although the neighborhoods share many similarities, there were two dimensions on which the neighborhoods notably differed, and both reflect the fact that there were large public housing developments in Hill District and not in Homewood. First, a little less than half of Homewood households owned homes in 1990 compared to approximately one-quarter of Hill District households. Second, the poverty rate was higher in Hill District than in Homewood.

While similar to each other, in some cases the two neighborhoods differed starkly from their county as a whole. Specifically, these two neighborhoods had a greater percentage of African American and of female-led and of older heads of households than the county overall. They also had lower household incomes and higher percentages of households in poverty and with public assistance. It is these characteristics which made these neighborhoods targets of public investments in real estate.

The two neighborhoods are part of a city that has been generally economically stable to improving since 2000. Pittsburgh experienced job growth in the professional and business services, hospitality, and education and health services sector since 2000 (HUD, 2016). And, according to the Census, although Pittsburgh's population has declined from about 335,000 in 2000 to 304,000 in 2015, the median household income has remained relatively stable (around \$41,000 in 2015 dollars) and the median home sales price increased from \$86,300 in 2000 to \$108,400 in 2015.

Because of the presence of distressed public housing, the Hill District neighborhood underwent major revitalization during the period of 1999-2015. Two HOPE VI grants, the first awarded in 1993 and the second in 1996, anchored the dozens of real estate projects in which the city, state, county, or federal government invested in Hill District. These investments were part of a larger strategy by the City of Pittsburgh and the Housing Authority of the City of Pittsburgh (HACP) to enact wholesale revitalization of the neighborhood.

The Hill District was the primary neighborhood in Pittsburgh for city investment to revitalize subsidized housing for three main reasons. The first reason was that Hill District had the greatest concentration of subsidized rental housing of all Pittsburgh neighborhoods (Murphy, 2004). And by the late 1990s, Pittsburgh's public housing—which had been built in large tracts in the 1940s and 1950s—was in dire need of redevelopment. An independent assessment in 1998 of Pittsburgh's subsidized rental housing determined that a quarter to a third of all HACP's housing stock was beyond repair (McNulty, 1998). Thus, modernization or redevelopment of Pittsburgh subsidized housing stock would, by definition, concentrate in the Hill District.

The other two reasons for Hill District redevelopment were mechanisms that provided HACP unusual latitude to replace the aging public housing homes. In 1999, HACP obtained a designation from HUD that only 26 out of the nation's 3,400 housing authorities had. The designation was called Moving to Work⁵, which gave the housing authority regulatory

⁵For more information, see http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/programs/ph/mtw/history

flexibility to move its funds across funding stream silos and provided these Public Housing Agencies (PHA) much greater ability to engage in redevelopment activities. Meanwhile, HUD had launched the HOPE VI grant program in 1993, which, as described in the section prior, created a large new grant vehicle that had not existed before for housing authorities to fund redevelopment of dilapidated public housing. The serendipitous combination of the new HOPE VI program and HACP's Moving to Work status enabled HACP, in partnership with other city and state agencies, to pursue large-scale redevelopment of the Hill District that summed to more than half a billion dollars.

Unlike the Hill District, Homewood had a smaller share of the city's subsidized housing stock and thus was not positioned for the major public investment needed to revamp HACP's subsidized housing portfolio. There were no HOPE VI grants to revitalize Homewood public housing and HACP did not undertake any significant investment in Homewood's subsidized housing during 1990-2015. But that is not to say that *no* investment occurred in Homewood; it just occurred at a much smaller scale than in Hill District during the years we examine.

Table 2 aggregates the number and total development costs of residential and commercial projects in receipt of some public funding that occurred during 1990-2015 in the two neighborhoods. Since 1999 was the first year that newly rebuilt homes were ready for occupancy from the first major federal grant in the Hill District, we identify this the initiating year of the collection of public-private investments that we define as "the intervention." Public investment has continued since. The collection of public-private investments in Hill District more than doubled the total developments costs of the two HOPE VI grants that occurred in the Hill District. The coordinated investment effort by Pittsburgh public agencies in Hill District underlines the importance of including a more expansive understanding of public real estate investment than merely the HOPE VI grants alone.

Figure 1 shows the cumulative public investment in the Hill District and Homewood. This provides more nuance to the differences shown in Table 2, demonstrating that the ultimate disparities in the levels of public investment reflect more of a difference in trajectories than in isolated investments.

As we explain in the methodology section next, we compare the spill-over effects of the public-private investments on home prices, residential rent prices, and crime in Hill District compared to home prices and crime in Homewood, which did not receive a comparable scale of public-private investments. By comparing two initially similar Pittsburgh neighborhoods with differing levels of investment over a period of 25 years, we offer a more comprehensive comparison of the collective effects of redevelopment on prices and crime over time.

METHODOLOGY

To estimate the effects of a large bundle of public investments on neighborhood residential and commercial sales prices, rental prices, and crime, we use a difference-in-difference regression approach. In our preferred model, the treatment is not binary (which is the most common specification for difference-in-difference models), but is instead a continuous

variable that measures the cumulative total value of all public-private investments in the given neighborhood from 1990 to the given date of the outcome (e.g., sale of a house). By including sub-neighborhood fixed effects and year fixed effects, the model estimates how changes in the intensity of treatment (i.e., the cumulative dollars of public-private investment in the particular neighborhood to date) induces changes in a given outcome. It becomes a difference-in-difference model by controlling for sub-neighborhood (in Hill District and Homewood) and year fixed effects, covering the years prior to and then throughout the years of major public-private investments. Equation (1) presents the empirical model, capturing the effect of treatment for each additional \$1 million of cumulative investment to date.

$$Y_{ijt} = \alpha + \lambda Cumulative\ Invest_{jt} + \psi_j + \gamma_t + X_{ijt}\theta + \varepsilon_{ijt} \quad (1)$$

Y_{ijt} is the outcome in neighborhood j in year t . We look at four sets of outcomes: (1) sales prices of residential properties, (2) sales prices of commercial properties, (3) rental prices of residences, and (4) crime rates. We separate the residential and commercial sales because of the distinct nature of each and the likely difference in hedonic prices for property characteristics.

Depending on the outcome, i has a different interpretation, as described below. *Cumulative Invest_{jt}* is the primary variable of interest, and captures the continuous treatment intensity, which is the cumulative level of public-private real estate investment since 1990 up to year t in neighborhood j . We include in the regression sub-neighborhood fixed effects ψ_j which controls for persistent differences in the environments of the nine different sub-neighborhoods (which loosely correspond to census tracts) in Hill District and Homewood. We also include year fixed effects γ_t , which control for regional or national shifts in the environment, such as would happen due to year-to-year changes in real estate prices across Pittsburgh and the country. X_{ijt} captures neighborhood or property characteristics, and serve as important control variables to improve the comparability of real estate or crime in Hill District and Homewood. We describe these controls in the Data section.

As with all difference-in-difference models, the key assumption is one of parallel trends. In other words, we assume that, after adjusting for observable covariates, if the two neighborhoods had similar amounts of cumulative public-private investments, they would experience a similar change in the average outcome. If this assumption holds, the differences we observe between Hill District and Homewood in real estate prices and crime were due to the difference in cumulative public-private investment in Hill District versus Homewood. In other words, the coefficient on the cumulative investment would capture the causal impact of a marginal increase of \$1 million in public-private real estate investment. While we cannot prove the parallel trend assumptions, we have two forms of evidence to support the assumption. First, Table 1 shows that the two neighborhoods had similar trends in demographic characteristics in the pre-years leading up to the first HOPE VI grant. Second, as we discuss in the sensitivity analyses section, an event study analysis shows no statistically significant differences in the outcome (net of control variables) prior to 1999, and then statistically significant separation in several of the later years.

While we employ the same underlying empirical strategy for each of the four outcomes we examine, we implement the strategy slightly differently depending on how the data are organized. The organizing principle is we used the most granular data available for each analysis. For residential and commercial sales prices, our analysis is at the transaction level—i.e., each sold property. For rental prices, we compare Hill District and Homewood outcomes at the census block group level within rental price range and unit size blocks by year, as discussed in the Data section. For crime, there is no index i , since the most detailed crime data we have for the 1990-2016 time period is at the sub-neighborhood (j) level.

Because the physical properties of a building factor into the price of a building, we control for available physical properties when the outcome is sales or rental prices. We control for such factors as the size of the building, its age, and building type in our attempt to isolate that portion of the home's sale or rent price that reflects the value of the neighborhood characteristics. A complete list of controls is provided in the sections below describing the sales and rental price data. Inclusion of these covariates ensures that we are comparing the change in prices holding property characteristics constant, and removing any effect in the outcomes due to different types of properties being transacted between the two neighborhoods before and after. To isolate the effects of public-private investment on crime, we controlled for neighborhood demographics as described in the data section.

For comparison to our continuous treatment intensity measure, we also estimate a binary difference-in-difference model for real estate sales, where the Hill District is defined as the treated group and the post-period is defined as 1999 and later. Thus, we evaluate (1) the difference in an outcome (e.g., property sales price) between a 9-year period prior to the inception of the major public investments and the 16 years of continued heightened investments in the Hill District; and (2) the difference in changes over time in the outcomes over the time period between the intervention area (Hill District) and a control area (Homewood). This is presented in equation 2.

While the binary and the continuous treatment intensity models are based on the same difference-in-difference assumptions, we prefer the continuous treatment intensity difference-in-difference model because it uses all the available information rather than aggregating investment amounts into one “pre” period and one “post” period. The continuous treatment intensity model also allows us to make conclusions about the return to each additional \$1 million of public-private investment on the outcomes of interest.

$$Y_{ijt} = \alpha + \psi_j + \gamma_t + \delta \text{Hill}_j \times \text{Post}_t + X_{ijt}\theta + \varepsilon_{ijt} \quad (2)$$

In both the binary and the continuous treatment intensity models we use heteroskedasticity-robust standard errors clustered at the neighborhood by year level.

DATA

Public Investment

Table 2 and Figure 1 demonstrate the higher level of public real estate investment in the Hill District and the growing amount of investments overall. This is based on interviews of and

requests we fielded with the following four public agencies: HACP, Urban Redevelopment Authority (URA), Pennsylvania Housing Finance Agency (PHFA), and City of Pittsburgh. Table A.1 in the Appendix lists all investments in receipt of public dollars that these agencies were able to document for the period of 1990-2015.⁶ While we lack the data to disaggregate every one of the real estate projects' total development costs into public and private sources, we know that private sources were often a majority share of development costs, reflecting the fact that many redevelopment projects included market-rate housing and commercial property.

Property Sales Data

To estimate the impact of the collection of publicly-funded real estate development in the Hill District on property sales, we use data we purchased from RealStats, Inc., a firm that collects information on recorded real estate transactions throughout the Pittsburgh metropolitan region.

The full dataset includes each of the 40,300 property sale transactions that occurred between 1990 and 2015 in all nine Pittsburgh wards that contained the neighborhoods in our study. The nine wards, however, are much larger than our two study neighborhoods. After excluding transactions that have a missing sales price (135) and are outside of the Hill District and Homewood neighborhood boundaries (33,012), 7,153 transactions remain in the dataset. We also exclude transactions that are non-arm's length (e.g., sheriff sales, sales within a family, and affidavit) (2,192), transactions that are publicly funded at least in part and are thus part of the intervention we examine (30), involve public buyers (97), and have a sale price of \$1 or \$0 (3). Our final dataset includes 4,831 transactions. Of these, 3,796 are residential sales, and 1,035 are commercial sales.

Table 3 presents the means and standard deviations of the residential sales prices and the all of the control variables we used about the properties in the residential sales analyses.⁷ We show these means and standard deviations for Hill District and Homewood residential sales from 1990-1998 (the pre-investment period) and from 1999-2015 (the investment period). Table 4 presents the commercial sales data organized the same way.

While the two neighborhoods' sale transactions shared many similarities in the pre-treatment period, we find some differences between the two. Most notably, both the lot size and the residential average transaction price were higher in Hill District than in Homewood, and

⁶The authors interviewed housing development directors at each of these agencies during the months of December 2016 – February 2017. In these interviews, we requested Total Development Cost, calendar years of development, number of homes or square feet of commercial space, and sources of financing for every demolition or construction project that received public funding during 1990-2015. Table A.1 is the summary information from the interviews, augmented by compilation of online sources from these agencies.

⁷While not presented in Table 3, our regressions additionally control for property usage. Usage takes on the following values: Assemblage; Auto dealer, parking garage, etc.; Communications Tower; Condominium; Condominium-New Construction; Detached single family house; Detached single family house - New Cons; Double house or duplex, attached housing; Funeral Home; Gas station; General Commercial; Industrial building, warehouse; Institutional, church, library, school; Lot Commercial; Lot Condominium; Lot Miscellaneous; Lot Residential; Miscellaneous; Motel, hotel; Multiple family investment, four units; Office Building, medical office, medical; Outdoor advertising sign, billboard; Recreational facility; Restaurant, tavern, fast food; Shopping Center. When the variable is missing, we create an indicator variable taking on a value of 1 if missing, and then set the variable equal to zero for missing observations.

Homewood had a greater share of privately-owned housing as shown in Table 1 and thus (given the similar population size) a larger number of properties sold in each period.

In the regressions, we examine two versions of the sales prices: the sales prices, which we trimmed of outliers (above the 99.9th percentile), and the log sale price, which we did not trim. We present both, although we prefer and focus on the log sales price model, both because it retains all observations and because the sales price data are log-normally—not normally—distributed.⁸ Figure 2 presents the average log price by year for the two neighborhoods. There is no noticeable difference in the neighborhoods for commercial prices, but there is for residential prices, where the Hill District saw a greater increase.

Property Rental Data

We use the Census and the American Community Survey (ACS) data to examine the effects of public-private investments in Hill District on rental prices. The public-use ACS data does not have transaction-level rental data, so we relied on rental statistics of the number of units in each of the ACS-provided price ranges for the years 1990, 2000, 2009, and 2015. Specifically, we observe the counts of rental units in a given price range (e.g., \$200 to \$299) and number of bedrooms (0, 1, 2, or 3+) in a given census block group and year. To assemble the data across price ranges into a comparable format useable in our regressions, we use the midpoint of the price range as the approximation for the rental price of each bedroom size category of rental units. For example, for the counts of rental units in the \$200 to \$299 range, we assign \$250 as the average rent. We do this for each combination of location, price range, and number of bedrooms. We then regress the midpoint price on the difference-in-difference continuous treatment intensity specification and include as controls the number of bedrooms, the average age of the units, the fraction of units within five years old, the fraction publicly subsidized, and year and census block group fixed effects. Critically, we use the counts of the units in each of the price range/census block group/year/number of bedroom bins as frequency weights in the regressions, and cluster the standard errors at the census block group level. This reconstructs the distribution of rental prices in each neighborhood by accounting for how many units are in point of the rent price range.

Table 5 shows the summary statistics for the rental data. Prices remained virtually the same in Homewood from pre-years of 1990-1998 to post years of 1999-2015, whereas there was a marked increase in rental prices in the Hill District over the two time periods. Homewood had a slightly higher average number of rooms and were built more recently in the pre-period, while the Hill District in the post-period was, as expected, more likely to have new units. The receipt of major federal grants described in the introduction initiated significant redevelopment starting in 1999 that had the effect of demolishing public housing and replacing it with newly constructed mixed-income residential and commercial development.

Figure 3 shows the average log rental prices in each of the four observed years. The Hill District showed a steady increase in average real estate rental prices, while Homewood was more level over time.

⁸Using a Shapiro-Wilk W test, we strongly reject that the distribution of sales prices is normally distributed, with p-value below 0.00001, while we fail to reject that the data is log-normally distributed, with p-value of 0.834

Crime Data

We acquired annual counts of crime data by city-defined Hill District and Homewood neighborhood from the Pittsburgh Police Department and merged these with decennial Census and ACS data on neighborhood demographics and population.⁹ For the crime counts, we aggregated up to Part 1 and Part 2 crimes, as defined in the Uniform Crime Reporting system. Part 1 crimes includes the following serious and violent crimes: murder and non-negligent homicide, rape (legacy & revised), robbery, aggravated assault, burglary, motor vehicle theft, larceny-theft, and arson. Part 2 crimes are all other less serious crimes.¹⁰ We separately summed all Part 1 crimes and all Part 2 crimes within a neighborhood in a year, and then divided by the population (in thousands) of the neighborhood in that year to get the crime rate per 1,000 people for Part 1 and for Part 2 crimes. We regressed these crime rates on the difference-in-difference specifications including controls for the variables listed in Table 10, which include demographic characteristics of each neighborhood as well as year and city neighborhood fixed effects. Table 6 contains the summary statistics for the crime data.

Figure 4 shows the overall crime rates in the Hill District and Homewood over time. Both the Part 1 and Part 2 crime rates decreased across the entire time period in both the Hill District and Homewood. For Part 2 crimes, there is some evidence that in more recent years, the Hill District differed from the trends of Homewood, with the Hill District experienced a greater decrease in crime rates. However, this greater decrease does not control for additional factors, such as the demographic composition and year trends, which the regression analysis below does.

RESULTS

Property Sales Results

In this section, we first present the results from the difference-in-difference model for residential and then commercial property sales using our preferred continuous treatment intensity measure. For the property sales results only, we also present results from the difference-in-difference model using the binary treatment indicator to illustrate the relationship between the two different specifications of treatment.

The continuous treatment intensity model for residential sale price results are shown in Table 7. As discussed in the methodology section, we prefer results from the log of prices instead of the prices, both because it retains all observations and because the data is distributed log-normal. However, we include results from the non-transformed models in all tables in the results section for the reader's reference. Here, the interpretation of the coefficient of interest is the effect of an additional \$1 million of public-private investment. The coefficient for the log sale price model is 0.00095. This means that for each additional \$10 million of

⁹Given that we use a model of crime per 1,000 people, we require estimates of the population within each neighborhood each year. We only observe population counts for 1990, 2000, 2009, 2010, and 2015, so for the missing years in between, we interpolate missing years of population data using a cubic spline, and set 2016 equal to the 2015 value.

¹⁰Other categories (non-Part I) of crime maintained by the Pittsburgh Police Department include: disorderly conduct, drunken driving, drug violations, embezzlement, family violence, forgery, fraud, gambling, liquor law violation, other offenses, other sex offenses, prostitution, public drunkenness, simple assault, stolen property, vagrancy, vandalism, and weapons violation.

investment, we estimate an increase of 0.95 percent in the sales price. Using Table 2, the total increase from 1990/1998 to 1999/2015 in public-private investment in the Hill District was \$468 million more than the increase in public-private investments in Homewood over the same time periods. Multiplying this difference of \$468 million by 0.095, we estimate that the cumulative additional public-private investment in Hill District over and above what was invested in Homewood by 2015 induced a total of 44.5 percent increase in Hill District residential property values over a period of 16 years, or an additional \$13,000 per residence using the untransformed sales price model with coefficient of 27.84. Given the average residential sales price in the post-period for the control group (Homewood) is \$30,603 dollars (Table 3), this represents around a 42 percent increase in the residential sales price.

Note that if we consider only the HOPE VI investments, the coefficients increase by a factor of approximately 1.6 (e.g., 0.00095/0.00152). This is to be expected, as the analysis assumes that the same observed shifts in sales prices are due to a smaller dosage of investments (i.e., HOPE VI only), inflating the resulting estimate of the impact of each invested dollar. In fact, the ratio of the additional investment growth from all investments (\$468 million) to those just from the HOPE VI investments (\$306 million) is 1.5, very similar to the ratio of the coefficients in the log model.

Table 8 presents the continuous treatment intensity model results for the commercial sales. The first thing to note is that the effect sizes are much larger than for residential sales. The coefficient of 0.0027 in the log model is nearly three times as large as the effect in the residential model, implying each additional \$10 million of public-private investment increased commercial sales prices by 2.7 percent. Multiplying this by the \$468 million dollars more investment in the Hill District implies an increase of prices of 126.4 percent over commercial prices in Homewood as a result of the additional investment over those 16 years. The \$343 coefficient in the commercial sales price model implies that the same \$468 million higher investment induces an increase of \$160,000 over the period of 16 years in price per sold commercial property. Given the average commercial sales price in the post-period for the control group of Homewood is \$75,088 dollars (Table 4), this represents a 213 percent increase in commercial sales price.

As with the residential sales prices, limiting our commercial sales price analysis to examine only the HOPE VI investments implies an even larger coefficient; the log model is again at a ratio of around 1.6. For the remainder of the analyses, we only present the results using the total public-private investments, and not limited to the HOPE VI ones. In results not shown here, we find that the HOPE VI estimate is always larger than the all investments approach, for the reason described above, and in the range of 1.6, similar to the ratio of investment totals as noted before.

Turning to the binary treatment measure difference-in-difference model, we see the same pattern of larger effects of public-private investment on commercial compared to residential sales prices. Table 9 presents these results. The effect for log prices is 0.0989 for residential sales. Using Kennedy's (1981) transformation for a dummy variable in a log-linear model, this is equivalent to approximately a 10 percent increase in the residential sales prices from treatment.¹¹ A similar exercise for commercial sales prices yields a 117 percent increase.

Both are sizeable increases in the prices of the property from combined set of Hill District public-private investments. The continuous treatment intensity and binary treatment results both show that the significant amount of neighborhood reinvestment in Hill District yielded a sizeable increase in property sales prices.

Property Rental Results

We next look at the property rental price treatment effects, presented in Table 10. For both models, we find a positive statistically significant effect from the cumulative public-private investment. The log model estimates a 0.55 percent increase in rental prices for each additional \$10 million of investment; given the \$468 million of additional investment, this represents a 25.7 percent increase in rental prices by 2015 from the overall set of investments in the Hill District. The rental price estimate implies a \$131 higher monthly rent on average from the overall set of investments. Given average rental prices in Homewood in the post-period of about \$577 dollars (Table 5), this represents a 23 percentage point increase in rental prices.

Crime Rate Results

We also looked at the effects of the bundle of public-private real estate investments in Hill District versus Homewood on a non-real estate outcome: crime rates. Table 11 shows the regression results for crime rates. There is not a statistically significant result for the impact of investment on Part 1 crime, but there is a decrease in part 2 crimes that is marginally significant. For part 2 crimes, the bundle of public-private investment higher gains of \$468 million is associated with a decrease of 25 Part 2 crimes per thousand people, down from a pre-investment years' mean of 158 crimes per 1,000 people.

SENSITIVITY ANALYSES

To check the robustness of our findings, we conducted five different sensitivity analyses. These five analyses corroborate that Hill District and Homewood were on parallel paths prior to the inception of major public-private investments in Hill District, that the inclusion of various additional property types or controls do not materially change the results, and that our overall results are robust to different model specifications.

First, for the property sales regressions, we tested an event study difference-in-difference model wherein we estimated the difference in prices between Hill District and Homewood in every year, using 1990 as the baseline. Coefficients of around zero would imply the two neighborhoods have similar sales prices, holding all else constant, whereas a positive coefficient that is statistically different from zero would imply that Hill District experienced a premium in sales prices, all else constant, which we presume to relate to the differences in investment over those periods. The results are presented in Figure A.1 in the Appendix. For convenience, we overlay the treatment effect trends with the difference in cumulative real estate investment. While these trends are somewhat underpowered, especially for

¹¹Using the transformation that the percent increase for the marginal effect of increasing from treatment = 0 to treatment = 1 is $100 * \left(\exp(\hat{\delta} - .5se(\hat{\delta})^2) - 1 \right)$.

commercial sales where there was an average of 20 sales per year per neighborhood, we do observe differences near zero in the early years when investments were similar, and then a subsequent increasing trend in the price premium in Hill District after the public-private investments began in earnest in 1999. This exercise also serves as a test of the parallel trends assumption undergirding the difference-in-difference framework. The near-zero and non-significant differences in the pre-investments years between Hill District and Homewood supports the assumption of parallel trends, implying Homewood is a viable counterfactual for Hill District after controlling for observable differences.

Second, we test to see if the inclusion of multiple-parcel properties, which are different in pricing and characteristics than single parcel properties, influences the results. The results are presented in Appendix Table A.2. We find that the results are generally the same, especially for the preferred log price models.

Third, we tested a model wherein we allowed the implicit prices of property characteristics (such as the increased additional price for each bedroom or for each additional square foot) to differ across Hill District and Homewood. In our main analyses, we restricted the implicit prices to be same in both neighborhoods, because we consider part of the treatment effect to be increases in implicit prices, so allowing them to differ would absorb some of the estimated treatment effect. Appendix Tables A.3 through A.4 present these models. The estimated coefficients of the property sales models are roughly the same, with slightly lower coefficients in the log price model, implying differences in implicit prices between the two neighborhoods are not sufficient to induce shifts in the estimated impacts of investments. On the other hand, the rental price model shows about a doubling of the coefficients when separate implicit prices are allowed, which may be due to sensitivity in the model due to the aggregation of the rental data.

Fourth, we added to the property sales and rental price regressions the same neighborhood demographic and socioeconomic indicators we included in the crime regressions. Our primary specification does not include them in the real estate models because these controls may be part of the treatment effect (changing the characteristics of the neighborhood in a way that is valued by buyers or renters), and because the direction of causality is not clear (i.e., whether price changes in one neighborhood leads to differences in the demographic composition of the neighborhood, or if the change in demographics impacts the prices, or both). Plus, the demographic controls are only available for four years (1990, 2000, 2009, and 2015), such that we would need to impute demographics for each year for the real estate sales regressions. Despite these reservations about use of these demographics as controls, we chose in our main analysis of crime to include them because demographics are particularly salient determinants of crime, and because we have no other control variables available to make the two neighborhood more comparable (unlike the property sales and rental price regressions). The results are shown in Appendix Tables A.5 – A.7. The property sales and crime regressions are very similar whether or not demographic controls are included. The rental regressions, on the other hand, drop, by a magnitude of about one third and are no longer statistically significant when demographic controls are included.

Finally, we performed spatial autoregressive regressions (SAR) of each of the models to allow for dependence of prices and crime given their geographic proximity. We do not use these as our primary specification to keep the models simpler and burdened with fewer assumptions. To account for sales proximity, we used the longitude and latitude of properties to calculate the distance between any two sales. These were then controlled for using SAR to correct for correlations in the error terms depending on distances. For rentals, we used the centroid of the census block group, and thus distance between any two rental data point. For crime, we used the centroid of the neighborhood. Each of these reflects the smallest geographic unit at which the data was available. The results are presented in Appendix Tables A.8 through A.10. Generally, we find that the Wald statistic testing for the significance of the parameters allowing for geographic dependence given distance to be statistically significant. However, the results are largely unchanged in the property sales and rental regressions when we allow for spatial dependence. On the other hand, the crime regression results changed substantially, especially when we allow for dependence not only in the error terms but also in the dependent variables. There, we see both treatment effects (for part 1 and part 2 crimes) become positive and significant, suggesting that more public-private real estate investment led to more arrests, and not fewer. It is unclear why the estimated result would switch signs in this case. When demographic covariates were excluded from the model, the result remains negative.

DISCUSSION

The results show statistically significant and large effects of the bundle of public-private neighborhood revitalization projects in Hill District on commercial sale prices and residential sale prices, and rents, and a marginally statistically significant decrease in non-violent crime.

The largest beneficiaries of the spillover effects we measured were commercial property investors, homeowners, followed by rental landlords. The City of Pittsburgh also benefited, since the city taxes commercial property at a higher rate than residential property. Increased tax rolls fund public services, which in turn benefit neighborhoods and residents. Residents and businesses in the Hill District may also have benefitted (or suffered) from other aspects of neighborhood change that are outside the scope of this paper, such as changes in their health outcomes or feelings of belonging or satisfaction with the neighborhood.

Those most adversely affected from the property value increases in Hill District included prospective purchasers of commercial property priced out by the 126.4 percent price increase over the 16-year period; prospective home buyers priced out by the 44.5 percent increase in residential sales over that same time period; and unsubsidized low-income renters, who had no buffer from the 25.7 percent increase in inflation-adjusted rental prices in the Hill District from 2000 to 2015. Our results suggest that cities should pair these private-public real estate investments for neighborhood revitalization endeavors with additional programs aimed to help low-income individuals that do not receive subsidized housing at the outset of major neighborhood investment initiative to soften the ensuing impact on them, given they are the most likely to be priced out by rising rent rates.

By comparison, the *subsidized* Hill District renters, who also had low-incomes, were generally shielded from increases in rental prices (shown in Figure 3) since they contributed about one-third of their income towards rent while the federal housing subsidy covered the gap between the tenant's contribution and overall rent level (up to capped rent levels). The overall number of housing-subsidized renters in Hill District remained relatively stable, dropping by seven percent over 2000 to 2016 (i.e., from 2,482 down to 2,304 households).¹²

The fact that the overall count of subsidized households remained fairly stable in this study of these two Pittsburgh neighborhoods should not imply that it always does so in cases of urban redevelopment. The supply of subsidized housing in a neighborhood can and does decline over time for a variety of reasons. For example, subsidized housing can convert to market-rate housing after a required affordability period elapses, or subsidized housing can be demolished (and not replaced) due to obsolescence from low-rent levels that contribute to deferred maintenance.¹³ Just as city agencies should pre-plan for unsubsidized low-income renters when planning neighborhood revitalization, so too should they take stock of their subsidized renter households and anticipate their future housing provision.

The lack of statistically significant effects on crime from the investments runs counter to prior research showing neighborhood revitalization investments lowering crime. However, we do estimate a meaningful size reduction of about 17.5 percent in the non-violent crime rates relative to Homewood. Our results may reflect an improved comparison over other studies that have examined a focal neighborhood relative to city-wide averages, suggesting that investments might not meaningfully influence criminal activity. They may simply be the result of that specific analysis being underpowered from few observations. Alternatively, these results might be attributable to redistributive allocation of policing resources to hot spots and areas of elevated crime. Homewood, for example, belongs to the geographically smallest of three police zones in Pittsburgh, yet it is the zone with the largest number of sworn personnel (97 officers for a 7.9 square mile zone).¹⁴

While we do find strong evidence of housing and commercial property price reactions to public investment in large scale neighborhood revitalization, there are several limitations to the generalizability of these findings. First, our results best generalize to urban redevelopment efforts on a large scale of tens or hundreds of millions of dollars public-private investments. There may be an initial threshold of investment required relative to neighborhood size before the incremental additions of \$1 million would have the effects we find. Second, our results are also most relevant to neighborhoods in cities like Pittsburgh, which experienced some population decline in the city overall but a stable or improving economy overall.

¹²The reason the overall number of subsidized households remained relatively stable in the Hill District (and in Homewood) was because the increase in the number of households with housing vouchers largely offset the decrease of those living in public housing resulting from the replacement of public housing with mixed-income developments. When housing authorities demolish public housing, they are obligated to offer subsidized housing alternatives to displaced households, including housing vouchers. This fact likely explained the increase in the number of housing vouchers.

¹³For more information about potential reasons for the decline in subsidized housing, see the discussion on page 18 of Schwartz et al., 2016.

¹⁴Source: Pittsburgh City Police [2015 Annual Report](#).

Third, when tallying public-private investments in the two neighborhoods, we limited our accounting to only those investments within the geographic boundaries of the neighborhood. This omits, for example, additional investments that happened just outside the boundaries, such as the replacement of a sports arena and development of a neighboring university as occurred near the Hill District. Fourth, we are further limited by the rental data and crime data being at an aggregated level with lower statistical power. Finally, while Homewood was very similar on almost all observable dimensions to the Hill District at the outset of the large public-private investments in the Hill District starting around 1999, it is not identical, which could modestly alter the findings. However, even with these caveats, this work demonstrates that there is evidence of sizable spillover effects of public-private investments on the value of local properties.

CONCLUSION

Comprehensive efforts to redevelop cities' most distressed neighborhoods can often involve coordinated, significant public dollars from a large array of public sector agencies including urban redevelopment authorities, public housing authorities, city housing departments, federal government and state housing finance authorities. In so doing, these agencies typically make numerous public investments over a period of years, covering a wide variety of uses such as residential, commercial, redevelopment, parks, roads, and other infrastructure.

In this paper, we examine public investments in real estate holistically, recognizing that HOPE VI investments are often part of that larger public-private local strategy that involve many public investments and private partners over time, and that they together will impact local outcomes such as property sales and rental prices. By carefully cataloguing the collection of public-private investments, and evaluating them in a difference-in-difference framework, we are able to estimate the returns to the marginal \$1 million of these public-private investments. We are also able to contrast these estimates to the upward biased estimates that would result from considering subsets of investments in isolation. This allows for a more complete and nuanced analysis of the impact. We make several additional contributions to the literature on the effectiveness of public housing investments, including much longer timeline of 25 years in our analysis, and an evaluation of the impact on commercial real estate sales in addition to residential sales.

We find large effects of the public-private investments on residential and commercial prices. The largest effects for commercial sales. For each additional \$10 million of public-private investment, we find a 0.95 percent increase in residential sales prices, 2.7 percent increase in commercial sales prices, and 0.55 percent increase in rental prices. Given that there was an additional investment of \$468 million in Hill District over and above the amount of investment in the comparison neighborhood, this implies a 126 percent increase in commercial prices, a 45 percent increase in residential sale prices, and a 26 percent increase in rental prices over a 16-year period. Finally, we find marginally significant decreases in non-violent crime rates as well, with a reduction of 0.5 crimes per 1,000 residents for each additional \$10 million in public-private investment.

Our findings align with and expand upon prior research about the effects of large scale publicly funded neighborhood revitalization. By examining a 16-year period of public-private investments in dozens of projects rather than one large one (such as most studies of HOPE VI have done), this paper provides cities and counties with a longer-range view of the impacts they could expect from long-term neighborhood revitalization efforts in other post-industrial cities housing similar populations.

Public real estate investments, such as those administered through the HOPE VI program, can be an effective policy tool to improve distressed neighborhoods, especially as they may encourage and spur further development. As a result, real estate value and thus prices increase, so that commercial property owners, landlords, and, by extension, city tax rolls benefitted substantially. But to ensure these benefits do not come at the expense of renters, local government agencies should plan at the outset of neighborhood redevelopment to ensure low-income renters are not priced out. Specifically, additional attention should be given to the low-income unsubsidized renter population, who, without aid, could face increased rents and ultimately be priced out of the very neighborhoods that were improved for their and others' benefit.

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APPENDIX

Table A.1.

List of real estate investments in receipt of some public funding, 1990-2015

Property	Neighborhood	Year came online	Residential (R) Commercial (C)	Total Development Cost
Crawford Square - Phase I	Hill	1993	R	\$30,594,180
Crawford Square - Phase II	Hill	1995	R	\$13,434,931
Milliones Manor Apartments	Hill	1995	R	\$5,610,930
Towne Place	Hill	1997	R	\$1,372,603
Christopher A. Smith Terrace	Hill	1998	R	\$5,603,772
Oak Hill - Phase 1A	Hill	1999	R	\$47,708,034
Wylie Avenue Townhomes	Hill	1999	R	\$4,611,645
Bedford Dwellings HOPE Center	Hill	2000	R	\$2,929,467
Crawford Square - Phase III	Hill	2000	R	\$12,370,776
Oak Hill - Phase 1B	Hill	2000	R	\$24,439,975
Oak Hill - Phase 3	Hill	2001	R	\$25,109,562
Freedom Corner	Hill	2001	C	\$634,000
Warren Plaza	Hill	2002	R	\$1,542,010
One Hope Square	Hill	2002	C	\$3,035,800
Oak Hill - Phase 4	Hill	2003	R	\$14,396,173

Property	Neighborhood	Year came online	Residential (R) Commerical (C)	Total Development Cost
Carnegie Library of Pittsburgh, Hill District	Hill	2003	C	\$3,600,000
Bedford Hill Apartments Phase 1 – rental	Hill	2004	R	\$32,568,869
Bedford Hill Apartments Phase 1 – homeownership	Hill	2006	R	\$7,906,655
The Legacy Senior Apartments	Hill	2007	R	\$16,171,200
Wesley Geothermal Project	Hill	2007	C	\$80,891
Bedford Hill Apartments Phase 2 – rental	Hill	2008	R	\$30,556,005
Bedford Hill Apartments Phase 3 – rental	Hill	2009	R	\$23,168,471
Ammon Community Recreation Center	Hill	2009	C	\$600,000
Arcena Street Overlook	Hill	2009	C	\$1,200,000
August Wilson Birthplace / Cultural Center	Hill	2009	C	\$2,000,000
John Gibson Field	Hill	2009	C	\$300,000
Beth Hamedrash Hagadol-Beth Jacob Synagogue	Hill	2010	C	\$5,500,000
Epiphany Church Rectory	Hill	2010	C	\$3,000,000
Falk Laboratory School	Hill	2010	C	\$18,100,000
Dinwiddie Townhomes Phase I	Hill	2011	R	\$8,272,390
Oak Hill - Phase II - Wadsworth	Hill	2011	R	\$37,225,828
Kaufman Center	Hill	2011	C	\$6,000,000
New Granada Theater	Hill	2011	C	\$1,200,000
Petersen Sports Complex	Hill	2011	C	\$29,000,000
Dinwiddie Townhomes Phase II	Hill	2012	R	\$7,575,639
Oak Hill Commons	Hill	2012	C	\$8,000,000
YMCA – Thelma Lovette	Hill	2012	C	\$13,000,000
Bedford Dwellings Modernizations	Hill	2013	R	\$7,998,807
Energy Innovation Center	Hill	2013	C	\$47,100,000
Shop n'Save grocery store	Hill	2013	C	\$11,000,000
Alleghany Union Baptist Association Apartments	Hill	2014	R	\$1,240,000
Dinwiddie Townhomes Phase III	Hill	2014	R	\$9,295,662
Skyline Terrace	Hill	2014	R	\$56,718,523
Jeron X. Grayson Community Center	Hill	2014	C	\$1,500,000
Salk Hall	Hill	2014	C	\$50,600,000
Dinwiddie Townhomes Phase IV	Hill	2015	R	\$8,176,002
YWCA, Homewood-Brushton - 2	Homewood	1998	C	\$2,000,000
Veterans Place	Homewood	2000	R	\$2,529,422
Homewood North	Homewood	2003	R	\$277,002
Silver Lake Commons	Homewood	2003	R	\$13,712,000
Helen Faison Arts Academy Elementary School	Homewood	2004	C	\$20,400,000

Property	Neighborhood	Year came online	Residential (R) Commerical (C)	Total Development Cost
YMCA, Homewood-Brushton - 1	Homewood	2005	C	\$5,000,000
Kelly Street Highrise	Homewood	2007	R	\$652,685
Auburn Towers	Homewood	2008	R	\$877,000
Carnegie Library of Pittsburgh Homewood	Homewood	2008	C	\$3,600,000
Susquehanna Street	Homewood	2009	R	\$2,998,226
Homewood Station Senior Housing	Homewood	2014	R	\$11,516,268
Larimer Pointe	Homewood	2015	R	\$21,000,000
Bridgeway Capital Building	Homewood	2015	C	\$15,000,000

Sources: Data collected by authors from Housing Authority of City of Pittsburgh, Urban Redevelopment Agency, and Pennsylvania Housing Finance Agency.

Notes: Total Development Cost includes all public and private sources of funds for the project. Costs are not normalized to 2015.

Table A.2:

Property sales regressions when including or not including multi-parcel sales

	Residential		Commercial	
	Log price	Trimmed price	Log price	Trimmed price
All	0.000949 *** (0.000260)	27.84 (23.67)	0.00271 *** (0.000539)	342.8 ** (153.1)
Observations	3,796	0.248	1,035	1,032
Drop multi-parcel sales	0.00116 *** (0.000257)	43.55 *** (10.45)	0.00289 *** (0.000666)	175.8 * (101.7)
Observations	3,555	3,554	866	863

Sources: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Each cell is from a separate regression. Standard errors in parentheses clustered at the neighborhood by year level.

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

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

Table A.3:

Property sales regressions when allowing implicit prices of property characteristics to vary across neighborhoods

	Residential		Commercial	
	Log price	Trimmed price	Log price	Trimmed price
Pooled implicit prices	0.000949 *** (0.000260)	27.84 (23.67)	0.00271 *** (0.000539)	342.8 ** (153.1)
Separate implicit prices	0.000939 *** (0.000276)	74.52 ** (31.73)	0.00180 *** (0.000678)	372.4 ** (184.1)

Sources: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Each cell is from a separate regression. Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01
**
p<0.05

*
p<0.1.

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

Table A.4:

Rental regressions when allowing implicit prices of property characteristics to vary across neighborhoods

	Log price	Price
Pooled implicit prices	0.000553 *** (0.000155)	0.279 *** (0.0796)
Separate implicit prices	0.00104 *** (0.000268)	0.524 *** (0.143)

Source: Authors' analyses of American Community Survey data.

Notes: Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01

**
p<0.05

*
p<0.1.

Regression based on year/neighborhood/rental price range/number of bedroom cells in the ACS data, with the number of units in each cell serving as frequency rates in the regression. Also includes census block group fixed effects.

Table A.5:

Property sales regressions, comparing the inclusion of neighborhood demographics as control variables

	Residential		Commercial	
	Log price	Trimmed price	Log price	Trimmed price
Basic covariates	0.000949 *** (0.000260)	27.84 (23.67)	0.00271 *** (0.000539)	342.8 ** (153.1)
Demographic covariates included	0.000583 ** (0.000279)	5.768 (23.93)	0.00289 *** (0.000721)	394.8 *** (150.9)

Sources: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Each cell is from a separate regression. Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01

**
p<0.05

*
p<0.1.

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases). Additional demographic variables included are fraction male, fraction unemployed, fraction age 0 to 34, fraction Black, fraction Hispanic, and fraction with a bachelor's degree or higher.

Table A.6:

Rental regressions, comparing the inclusion of neighborhood demographics as control variables

	Log price	Price
Basic covariates	0.000553 *** (0.000155)	0.279 *** (0.0796)
Demographic covariates included	0.000164 (0.000165)	0.108 (0.0761)

Source: Authors' analyses of American Community Survey data.

Notes: Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01

**
p<0.05
*
p<0.1.

Regression based on year/neighborhood/rental price range/number of bedroom cells in the ACS data, with the number of units in each cell serving as frequency rates in the regression. Also includes census block group fixed effects. Additional demographic variables included are fraction male, fraction unemployed, fraction age 0 to 34, fraction Black, fraction Hispanic, and fraction with a bachelor's degree or higher.

Table A.7:

Crime regressions, comparing the inclusion of neighborhood demographics as control variables

	Part 1	Part 2
No demographic covariates	-0.0108 (0.0168)	-0.0651 ** (0.0266)
Demographic covariates	0.0144 (0.0133)	-0.0543 * (0.0315)

Sources: Authors' analyses of Pittsburgh Police Department and ACS data.

Notes: Robust standard errors in parentheses, clustered at neighborhood by year. Regressions additionally control for year and city neighborhood fixed effects and (when demographics are included) fraction male, fraction unemployed, fraction age 0 to 34, fraction Black, fraction Hispanic, fraction with a bachelor's degree or higher, and population density.

p<0.01
**
p<0.05
*
p<0.1

Table A.8:

Spatial auto-regressions for property sales regressions

		Residential		Commercial	
		Log price	Trimmed price	Log price	Trimmed price
Primary specification	Marginal effect Std. Error	0.00105 *** (0.000241)	29.89 (25.23)	0.00281 *** (0.000563)	280.0 * (159.8)
SAR on error terms	Marginal effect Std. Error	0.00106 *** (0.000234)	30.95 (19.69)	0.00286 *** (0.000512)	275.8 *** (86.24)
	Wald chi2	1.543	0.571	11.77	1.131
	Wald p-value	0.214	0.450	0.000601	0.288
SAR on error terms and dependent var.	Marginal effect Std. Error	0.00103 *** (0.000234)	30.97 (19.68)	0.00285 *** (0.000512)	318.9 *** (96.53)
	Wald chi2	11.82	5.085	11.45	1.161
	Wald p-value	0.00271	0.0787	0.00327	0.560

Sources: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Each cell is from a separate regression. Standard errors in parentheses clustered at the neighborhood by year level.

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

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

Table A.9:

Spatial auto-regressions for rental regressions

		Log price	Price
Primary specification	Marginal effect Std. Error	0.000553 *** (0.000155)	0.279 *** (0.0796)
	Marginal effect Std. Error	0.000544 *** (0.000172)	0.275 *** (0.103)
SAR on error terms	Wald chi2	2.377	0.593
	Wald p-value	0.123	0.441
	Marginal effect Std. Error	0.000427 *** (0.000164)	0.224 ** (0.0983)
SAR on error terms and dependent var.	Wald chi2	116.9	109.1
	Wald p-value	0	0

Source: Authors' analyses of American Community Survey data.*Notes:* Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01

**

p<0.05

*

p<0.1.

Regression based on year/neighborhood/rental price range/number of bedroom cells in the ACS data, with the number of units in each cell serving as frequency rates in the regression. Also includes census block group fixed effects.

Table A.10:

Spatial auto-regressions for arrests

		Part 1	Part 2
Primary specification	Marginal effect Std. Error	0.0144 (0.0133)	−0.0543 * (0.0315)
SAR on error terms	Marginal effect Std. Error	0.0168 (0.0135)	0.0365 (0.0256)
	Wald chi2	7.866	118.4
	Wald p-value	0.00504	0
	Marginal effect Std. Error	0.0289 * (0.0163)	0.100 *** (0.0202)
	Wald chi2	10.97	996.5
SAR on error terms and dependent var.	Wald p-value	0.00416	0

Sources: Authors' analyses of Pittsburgh Police Department and ACS data.

Notes: Robust standard errors in parentheses, clustered at neighborhood by year. Regressions additionally control for year and city neighborhood fixed effects and fraction male, fraction unemployed, fraction age 0 to 34, fraction Black, fraction Hispanic, fraction with a bachelor's degree or higher, and population density.

p<0.01

**

p<0.05

*

p<0.1

Figure A.1: Event studies, difference in residual price of Hill District over Homewood

Sources: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Each cell is from a separate regression. Standard errors in parentheses clustered at the neighborhood by year level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

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Figure 1:

Cumulative investments by neighborhood and year

Sources: Data collected by authors from Housing Authority of City of Pittsburgh, Urban Redevelopment Agency, and Pennsylvania Housing Finance Agency.

Notes: Total Development Cost includes all public and private sources of funds for the project. Costs are normalized to 2015. There were no HOPE VI investments in Homewood across these years.

Figure 2.

Average log sales prices over time in each neighborhood

Sources: Authors' analyses of sales data purchased from RealStats Inc.

Figure 3.
Average log rental prices over time in each neighborhood
Source: Authors' analyses of American Community Survey data.

Figure 4.

Overall crime rates (per 1,000 people) over time

Sources: Authors' analyses of Pittsburgh Police Department.

Table 1.

Comparison of Hill District and Homewood prior to major public investments in Hill District

Characteristic	1990			2000		
	Hill District	Homewood	County tract mean (SD)	Hill District	Homewood	County tract mean (SD)
Neighborhood characteristics						
Total population	14,192	15,503	2,678 (1,783)	11,853	11,885	3,081 (1,582)
Total size (sq. miles)	1.37	1.45		1.37	1.45	
Housing characteristics						
Occupied homes (%)	84	88	93 (5.8)	78	77	91 (8.6)
Vacant homes (%)	16	12	7 (5.8)	21	23	9 (7.9)
Owned homes (%)	26	45	64 (23.3)	28	46	66 (21.9)
Household characteristics						
Heads of households who were African American (%)	96	94	14 (25.9)	92	95	15 (26.0)
Heads of household who were female (%)	83	68	36 (18.2)	72	67	34 (15.2)
Heads of households who were 65 or older (%)	32	35	28 (9.5)	42	33	28(7.4)
Households who had children (%)	52	44	40 (11.3)	32	36	29 (9.0)
Average household size	2.25	2.49	2.47	2.11	2.47	2.39
Households who were in poverty (%)	52	38	14 (18.0)	42	33	13 (12.9)
Households who had public assistance (%)	39	30	9 (10.5)	15	13	4 (5.1)
Households who earned \$75,000 or more (%)	1	1	8 (12.1)	5	5	18 (14.7)
Residents with college degrees who were 25 or older (%)	6	7	21 (17.6)	11	8	26 (18.5)
Per capita income (2015 \$)	11,668	13,515	26,356 (15,313)	16,466	16,458	31,727 (14,488)

Sources: U.S. Census Bureau (1990, 2000). Minnesota Population Center. National Historical Geographic Information

System: Version 11.0 [Database]. Minneapolis: University of Minnesota. 2016.

Notes: Although we date to 1999 the investments that comprise the bundle of neighborhood reinvestments in Hill District, we report 2000 Census data as baseline since it is the closest Census time point to when large scale reinvestments began to come online in Hill District. We did not perform statistical tests of differences between Hill District and Homewood, since the data presented here are the census of the population rather than sampled data.

Table 2.

Total development costs of public-private residential and commercial developments

	Pre-intervention period: 1990-1998		Intervention period: 1999-2015	
	Hill District	Homewood	Hill District	Homewood
HOPE VI	0	0	\$306,350,000	0
All public-private investments	\$89,999,000	\$2,908,000	\$664,773,000	\$109,693,000

Sources: Data collected by authors from Housing Authority of City of Pittsburgh, Urban Redevelopment Agency, and Pennsylvania Housing Finance Agency.

Notes: Total development costs adjusted to 2015 dollars and rounded to nearest thousand. Appendix table A.1 lists total development cost for each development and year of completion in nominal costs, which accounts for the difference in values between the tables.

Table 3.

Mean and standard deviation for residential property sales data

Variable	Hill District		Homewood	
	1990-1998	1999-2015	1990-1998	1999-2015
Sale price (\$) ¹	58,597 (64,951)	65,781 (118,991)	26,183 (30,102)	30,603 (146,344)
Log(sale price)	10.19 (1.51)	10.19 (1.56)	9.46 (1.36)	9.31 (1.41)
Lot size (square acres)	0.66 (13.88)	0.09 (0.28)	0.06 (0.19)	0.08 (0.20)
Number of bedrooms	3.07 (0.98)	3.09 (1.07)	3.51 (1.19)	3.56 (1.32)
Frontage footage (feet)	33.21 (25.75)	30.13 (35.77)	30.51 (19.73)	27.69 (23.07)
Number of baths	1.48 (0.63)	1.49 (0.67)	1.45 (0.66)	1.41 (0.65)
Square footage of building	1,622.07 (691.67)	1,671.32 (711.07)	1,737.49 (605.31)	1,727.74 (589.13)
Number of stories of building	1.82 (0.84)	2.01 (0.65)	2.09 (0.52)	2.09 (0.41)
Year built	1938.43 (33.62)	1935.92 (32.49)	1919.60 (22.94)	1918.42 (21.92)
Transaction type ²				
Apartment sale	2.4%	3.0%	2.1%	2.2%
Multi-parcel sale	5.9%	8.2%	5.8%	5.5%
New construction sale	9.2%	3.7%	1.8%	1.5%
Public transaction	17.6%	6.2%	22.7%	7.9%
Rowhouse sale	0.0%	6.6%	0.0%	3.4%
Townhouse sale	2.2%	5.9%	1.7%	1.1%
Garage	10.2%	22.3%	15.9%	13.9%
Vacant property	0.2%	3.5%	0.2%	1.7%
Lot transaction	0.0%	0.0%	0.0%	0.0%
Count of sales	541	988	842	1425

Source: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Standard deviations in parentheses. Standard deviations not presented for binary variables, where it is $\sqrt{p(1-p)}$.

¹While we would prefer to analyze price per square foot, square footage was missing in 40.7 percent of the 4,831 transactions in our analytic dataset. So instead we control for it as a covariate where we have square footage, and set a dummy indicator to 1 when in it missing and include those observations in the regression.

²Sale transaction types are not mutually exclusive, so percentages sum to more than 100.

Table 4.

Mean and standard deviation for commercial property sales data

Variable	Hill District		Homewood	
	1990-1998	1999-2015	1990-1998	1999-2015
Sale price (\$) ¹	25,334 (55,436)	86,907 (428,546)	65,759 (226,148)	75,088 (228,574)
Log(sale price)	8.36 (1.93)	9.18 (2.07)	8.78 (2.19)	9.13 (2.29)
Lot size (square acres)	0.69 (7.20)	1.38 (18.88)	0.18 (0.40)	0.25 (0.55)
Number of bedrooms	3.07 (0.59)	3.03 (0.88)	3.67 (1.67)	3.39 (1.24)
Frontage footage (feet)	49.46 (69.90)	46.14 (75.80)	63.75 (80.93)	62.75 (104.71)
Number of baths	1.79 (0.56)	1.69 (0.46)	1.71 (0.62)	1.81 (0.77)
Square footage of building	1,644.72 (564.26)	1,688.88 (758.23)	1,791.00 (682.25)	1,922.06 (390.28)
Number of stories of building	0.75 (1.16)	0.59 (1.08)	0.76 (1.02)	0.82 (1.13)
Year built	1985.86 (29.49)	1990.85 (33.62)	1951.42 (42.46)	1962.28 (50.42)
Transaction type ²				
Apartment sale	3.1%	7.5%	3.6%	5.9%
Multi-parcel sale	16.0%	23.6%	10.9%	15.1%
New construction sale	0.0%	0.0%	0.0%	0.0%
Public transaction	51.5%	31.5%	46.8%	28.1%
Rowhouse sale	0.0%	0.0%	0.0%	0.0%
Townhouse sale	0.0%	0.0%	0.0%	0.0%
Garage	7.4%	2.8%	5.2%	9.7%
Vacant property	3.7%	29.1%	2.8%	22.4%
Lot transaction	48.5%	68.5%	36.7%	52.4%
Count of sales	163	254	248	370

Source: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Standard deviations in parentheses. Standard deviations not presented for binary variables, where it is $\sqrt{p(1-p)}$.

¹While we would prefer to analyze price per square foot, square footage was missing in 40.7 percent of the 4,831 transactions in our analytic dataset. So instead we control for it as a covariate where we have square footage, and set a dummy indicator to 1 when in it missing and include those observations in the regression.

²Sale transaction types are not mutually exclusive, so percentages sum to more than 100.

Table 5.

Mean and standard deviation for rental data

Variable	Hill District		Homewood	
	Pre-1999	Post-1998	Pre-1999	Post-1998
Rental price (2015 \$)	382.8 (451.2)	525.6 (398.1)	568.5 (288.8)	577.0 (303.3)
Log(rental price)	5.7 (0.6)	6.0 (0.7)	6.2 (0.6)	6.2 (0.6)
Number of bedrooms	1.9 (0.8)	1.8 (0.8)	1.9 (0.8)	2.0 (0.8)
Average age of units	39.1 (9.2)	40.1 (15.2)	33.6 (7.3)	50.7 (14.1)
Fraction of units less than five years old	0.01 (0.03)	0.06 (0.09)	0.03 (0.06)	0.01 (0.04)
Count of rental units	4,725	3,625	3,211	2,112

Source: Authors' analyses of Census (1990, 2000) and ACS (2005-2009, 2011-2015) data. Minnesota Population Center. National Historical Geographic Information

System: Version 11.0 [Database]. Minneapolis: University of Minnesota. 2016.

Notes: Standard deviations in parentheses. Pre-1999 includes 1990-1999, and Post-1998 includes 2000-2015.

Table 6.

Summary statistics for crime data

	Hill District		Homewood	
	Pre	Post	Pre	Post
Crime characteristics				
Total incidents, Part 1 crimes	244.6 (146.7)	125.5 (67.5)	381.1 (166.0)	223.5 (101.0)
Total incidents, Part 2 crimes	437.6 (346.3)	223.9 (131.8)	534.9 (293.4)	320.3 (155.5)
Crime rate per 1,000 people, Part 1	87.8 (53.1)	59.7 (29.4)	121.8 (55.1)	102.2 (33.6)
Crime rate per 1,000 people, Part 2	158.6 (126.5)	108.5 (62.5)	159.5 (59.8)	144.8 (44.5)

Sources: Authors' analyses of Pittsburgh Police Department, U.S. Census (1990, 2000), American Community Survey (ACS 2005-2009, ACS 2011-2015) U.S. Census Bureau. Minnesota Population Center. National Historical Geographic Information System: Version 11.0 [Database]. Minneapolis: University of Minnesota. 2016.

Notes: Pre includes 1990-1999, and post includes 2000-2016. Crime analyses were at city-defined neighborhood level since crime data going back to 1990 are reported at this level.

Table 7.

Regression results for residential real estate sales price

Variables	Log Sale Price			Sales Price		
	All investments		HOPE VI investments	All investments		HOPE VI investments
Cumulative investments (\$M)	0.00101 *** (0.000307)	0.000949 *** (0.000260)	0.00152 *** (0.000359)	17.01 (26.69)	27.84 (23.67)	62.90 ** (28.54)
Multi-parcel		0.233 ** (0.111)	0.231 ** (0.111)		31,481 (21,243)	31,488 (21,292)
Public transaction		-0.811 *** (0.0602)	-0.811 *** (0.0603)		-20,034 *** (2,534)	-20,088 *** (2,547)
Square footage of building		0.000350 *** (6.01e-05)	0.000351 *** (6.02e-05)		13.77 ** (5.882)	13.75 ** (5.898)
Number of bedrooms		0.0283 (0.0272)	0.0283 (0.0274)		-3,538 ** (1,655)	-3,501 ** (1,661)
Number of baths		-0.0758 * (0.0444)	-0.0763 * (0.0444)		-4,690 (3,440)	-4,777 (3,452)
Year built		0.0157 *** (0.00121)	0.0157 *** (0.00122)		530.1 *** (103.6)	529.6 *** (103.2)
Lot square footage		0.00377 *** (0.000929)	0.00393 *** (0.000927)		463.2 (460.5)	474.4 (462.3)
Vacant lot		0.184 (0.193)	0.182 (0.192)		-44,625 (29,815)	-45,084 (29,982)
Apartment		-0.386 (0.372)	-0.387 (0.373)		-64,138 (86,636)	-63,959 (86,778)
Townhouse		-0.488 ** (0.209)	-0.487 ** (0.209)		-30,189 (19,150)	-29,681 (19,256)
Row house		-0.0363 (0.153)	-0.0338 (0.154)		-8,416 (5,539)	-8,937 (5,618)
Garage		0.354 *** (0.0727)	0.350 *** (0.0729)		6,658 (4,058)	6,178 (4,128)
Frontage		0.00709 *** (0.00103)	0.00707 *** (0.00104)		1,246 *** (428.1)	1,246 *** (427.4)
Stories		-0.0727 (0.0534)	-0.0742 (0.0537)		-12,080 *** (3,905)	-12,246 *** (3,929)
Observations	3,796	3,796	3,796	3,795	3,795	3,795
R-squared	0.128	0.384	0.384	0.059	0.248	0.248

Sources: Authors' analyses of sales data purchased from RealStats Inc.*Notes:* Standard errors in parentheses clustered at the neighborhood by year level.***
p<0.01**
p<0.05*
p<0.1.

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

Table 8.

Regression results for commercial real estate sales price

Variables	Log Sale Price			Sales Price		
	All investments		HOPE VI investments	All investments		HOPE VI investments
Cumulative investments (\$M)	0.00206 *** (0.000750)	0.00271 *** (0.000539)	0.00438 *** (0.000816)	287.7 * (154.7)	342.8 ** (153.1)	434.9 ** (172.7)
Multi-parcel		0.515 *** (0.153)	0.516 *** (0.154)		41,581 (25,298)	42,733 (25,917)
Public transaction		-0.919 *** (0.145)	-0.908 *** (0.146)		-45,053 *** (11,995)	-44,312 *** (11,713)
Square footage of building		0.000188 (0.000279)	0.000178 (0.000280)		-10.85 (28.31)	-11.11 (28.75)
Number of bedrooms		0.225 (0.140)	0.219 (0.140)		7,873 (9,566)	7,910 (9,832)
Number of baths		0.197 (0.356)	0.203 (0.356)		16,918 (24,820)	15,369 (25,119)
Year built		0.0221 *** (0.00655)	0.0218 *** (0.00656)		945.0 ** (381.1)	924.5 ** (387.7)
Lot square footage		0.0102 *** (0.00185)	0.0102 *** (0.00181)		1,039 *** (239.5)	1,052 *** (247.1)
Vacant lot		-0.522 *** (0.160)	-0.531 *** (0.160)		12,286 (30,025)	11,020 (30,450)
Apartment		-0.0123 (0.251)	-0.00191 (0.252)		-26,891 (45,309)	-24,512 (45,378)
Garage		-0.311 (0.228)	-0.310 (0.228)		-45,374 ** (19,515)	-46,910 ** (19,254)
Frontage		0.00439 *** (0.000907)	0.00441 *** (0.000898)		601.3 ** (271.4)	605.1 ** (272.7)
Stories		0.101 (0.0797)	0.102 (0.0798)		50,457 (36,088)	50,249 (36,220)
Observations	1,035	1,035	1,035	1,032	1,032	1,032
R-squared	0.113	0.623	0.624	0.061	0.340	0.336

Sources: Authors' analyses of sales data purchased from RealStats Inc.

Notes: Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01

**
p<0.05

*
p<0.1.

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

Table 9.

Binary difference-in-difference regression results for real estate sales price, coefficient on Treatment x Post-period

	Log sales price	Sales price
Residential	0.0989 (0.0828)	7,843 (5,683)
Commercial	0.795 ^{***} (0.176)	75,665 ^{***} (28,886)

Sources: Authors' analyses of sales data purchased from RealStats, Inc.

Notes: Each cell is from a separate regression. Standard errors in parentheses clustered at the neighborhood by year level.

^{***}
p<0.01

^{**}
p<0.05

^{*}
p<0.1.

All regressions additionally control for year dummies and city neighborhood dummies. Regressions with controls additionally control use (see footnote 7) and for missing indicators where certain variables (square footage, number of bathrooms, number of bedrooms, and year built) are at times missing (and set to zero in those cases).

Table 10.

Regression results for rental price

	Log rental price	Rental price
Cumulative investment (\$M)	0.000553 *** (0.000155)	0.279 *** (0.0796)
1 bedroom unit	−0.0677 (0.0956)	−35.86 (47.48)
2 bedroom unit	0.126 (0.116)	73.81 (55.95)
3+ bedroom unit	0.357 *** (0.109)	205.4 *** (57.89)
Average unit age	−0.00312 (0.00341)	−1.377 (1.743)
Fraction of units built within last five years	−0.393 (0.361)	−157.7 (183.0)
Observations	25,148	25,148
R-squared	0.276	0.184

Source: Authors' analyses of American Community Survey data.

Notes: Standard errors in parentheses clustered at the neighborhood by year level.

p<0.01

**
p<0.05

*
p<0.1.

Regression based on year/neighborhood/rental price range/number of bedroom cells in the ACS data, with the number of units in each cell serving as frequency rates in the regression. Also includes census block group fixed effects.

Table 11.

Regression results for crime rates per thousand people

	Part 1 crimes	Part 2 crimes
Cumulative investment (\$M)	0.0144 (0.0133)	-0.0543* (0.0315)
Average proportion of neighborhood population that was male	296.2*** (49.44)	540.9*** (104.9)
Average proportion of neighborhood population that was unemployed	195.5*** (46.13)	16.21 (85.18)
Average proportion of neighborhood populations that was age 0-34	137.8*** (43.59)	97.53 (91.66)
Average proportion of neighborhood population that was Black	163.2*** (38.50)	449.4*** (67.35)
Average proportion of neighborhood population that was Hispanic	570.4*** (164.5)	1,654*** (394.4)
Average proportion of neighborhood populations that had bachelor's degree or higher	199.8*** (39.22)	356.1*** (72.55)
Population density	-0.00507*** (0.00153)	0.00673* (0.00382)
Observations	243	243
R-squared	0.853	0.823

Sources: Authors' analyses of Pittsburgh Police Department and ACS data.

Notes: Robust standard errors in parentheses, clustered at neighborhood by year. Regressions additionally control for year and city neighborhood fixed effects and fraction male, fraction unemployed, fraction age 0 to 34, fraction Black, fraction Hispanic, fraction with a bachelor's degree or higher, and population density.

p<0.01

**
p<0.05

*
p<0.1