

Beyond anecdotal evidence: Do subsidized housing developments increase neighborhood crime?



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ABSTRACT

While planners and policymakers have advocated the need for project-based subsidized housing, they often face the challenge of strong community opposition due to the negative perceptions of subsidized housing and subsidized households, and the fear that these developments and residents would bring increased crime. This paper aims to extend beyond anecdotal evidence by examining the impact of a popular U.S. affordable housing program, the Low-Income Housing Tax Credit (LIHTC) program, on neighborhood crime rates. We estimate the levels and trends in neighborhood crime before and after LIHTC developments, based on crime incidents data from 2000 to 2009 in Austin, Texas, using the Adjusted Interrupted Time Series–Difference in Differences (AITS–DID) approach to clarify the causal direction of impacts of LIHTC developments. Results show that LIHTC subsidized housing tended to be developed in neighborhoods where crime was already prevalent, and contrary to popular perception, LIHTC developments have a mitigating impact on neighborhood crime. These results suggest that LIHTC developments may be an effective tool for revitalizing distressed neighborhoods by ameliorating the “broken windows” problem and reducing neighborhood crime.

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1. Introduction

While many researchers and policymakers have advocated the need for project-based subsidized housing, they often face the challenge of strong community opposition to subsidized housing developments. Local community residents are typically staunchly opposed to the introduction of subsidized housing into their neighborhoods, expressed through Not-In-My-Back-Yard (NIMBY) behavior. Concerns about subsidized housing from local residents are typically rooted in a negative perception of households receiving subsidies, which are often tied to attitudes toward their race/ethnicity and poverty status (Freeman & Botein, 2002). However, one of the cores of NIMBY sentiment from local residents often stems from the fear that subsidized housing would bring increased crime into the neighborhood due to the influx of “undesirable” households (Ellen, Lens, & O'Regan, 2012; Lens, 2014; Nguyen, 2005). NIMBY attitudes have posed a significant barrier for the placement of subsidized housing, presenting a conundrum for policymakers pursuing more affordable housing options

(Freeman & Botein, 2002; Galster, Tatian, & Smith, 1999; Santiago, Galster, & Tatian, 2001).

During the past few decades, project-based subsidized housing programs in the U.S. have shifted from the traditional public housing program to the LIHTC program. The LIHTC program is unique because it utilizes private equity to produce affordable housing by awarding tax credits to housing developers (Deng, 2007; Van Zandt & Mhatre, 2009). Thus, compared to the public housing program, the LIHTC program has been considered a more effective tool in creating low-income housing that is of a better structural quality and more mixed income (Deng, 2009; Woo, Joh, & Van Zandt, 2014). While previous studies have examined the relationships between public housing developments and neighborhood crime, few studies have focused specifically on the impacts of LIHTC developments. Furthermore, the results from previous research have been inconsistent, with some studies finding a negative impact of subsidized housing on neighborhood crime while others have found an insignificant impact (DeLone, 2008; Galster, Pettit, Santiago, & Tatian, 2002; Griffiths & Tita, 2009; McNulty & Holloway, 2000). These inconsistent findings may stem from the methodological limitations of previous studies that do not take into account the direction of causality between subsidized housing and neighborhood crime. Our study fills these gaps

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by examining how the spatial distribution of LIHTC developments in neighborhoods influences crime incidents.

We examine the impacts of LIHTC developments on neighborhood crime from 2000 to 2009 in Austin, Texas. The empirical methodology of this study specifies the causal direction of the impacts of LIHTC developments to explain the change of levels and trends in crime rates over time. We also examine how the impacts of LIHTC developments vary across different types of crime such as property and violent crime in neighborhoods. To briefly summarize the results, we find that LIHTC subsidized housing tends to be developed in neighborhoods with already higher crime rates, rather than promoting the increase of neighborhood crime. Contrary to popular perception, LIHTC developments do not contribute to increased crime and may have a positive impact on reducing neighborhood crime. This suggests that concerns about heightened crime due to LIHTC developments might be misguided. Our results may help policymakers understand how LIHTC developments impact crime in neighborhoods and help them develop policies to enhance its positive impacts and alleviate negative ones.

2. Literature review

2.1. The spatial concentration of crime in cities

It is a well-established fact that the majority of crimes are committed in cities, and within cities some neighborhoods are more prone to crime than others. Hence, crime tends to be concentrated in a few places within a given city (Sampson, 1985; Sherman, Gartin, & Buerger, 1989; Weisburd & Amram, 2014). While early studies in spatial criminology were rather coarse in terms of geographic scale, more recent studies have examined the distribution of crime at much smaller levels of aggregation due to advances in data availability, such as the street block or street segment level (Andresen & Malleson, 2013; Groff, Weisburd, & Yang, 2010). Both cross-sectional and longitudinal studies of crime distribution have shown that crime is highly concentrated in small micro-areas within a given city, colloquially known as “hot spots” of crime. Researchers have shown that a disproportionately large number of crime incidents occur in very small geographic areas within cities. For example, Sherman et al. (1989) found that 50 percent of calls for police service originated from only 3 percent of addresses and intersections in Minneapolis, Minnesota; in a more recent study, Weisburd, Groff, and Yang (2012) found a similar pattern in Seattle, Washington where 5 percent of street segments accounted for 50 percent of crime incidents. Similar patterns of crime concentrations were also found in cities outside of the U.S. (Andresen & Linning, 2012; Andresen & Malleson, 2011; Weisburd & Amram, 2014).

Where there appears to be a general consensus on the phenomenon of crime concentration in cities, there are still limitations and knowledge gaps. While it has been largely established that crime tends to occur in small geographic areas, many studies have not considered the spatial nature of crime concentration and subsidized housing developments. For instance, some neighborhoods with subsidized housing developments may be more prone to crime, which reinforces negative public perceptions on subsidized housing. Another gap is the limited number of study areas or cities where crime concentrations have been examined, which raises the issue of generalizability. Finally, the past literature is relatively scant in terms of examining crime concentrations by crime type, as certain categories of crime (e.g., violent crime such as homicide, robbery, assault, and rape) may have a very different spatial distribution than property crimes. We address these limitations and gaps in our study by examining the relationship between subsidized housing developments and the distribution of different crime

types at a micro-level scale in a U.S. city (Austin, Texas) that has not been the focus of many previous studies on crime.

2.2. How subsidized housing developments may affect neighborhood crime

Community opposition to subsidized housing developments has been a longstanding concern for policymakers. This opposition is often rooted in fear of “undesirables” into neighborhoods, which often carries racial and class undertones due to differences in characteristics among residents and tenants of subsidized and non-subsidized housing (Nguyen, 2005; Woo et al., 2014). Recent literature on the topic have pointed to numerous studies showing how subsidized housing developments may decrease neighborhood housing prices due to the spillover effects of subsidized housing from physical and socioeconomic changes (Baum-Snow & Marion, 2009; Woo, Joh, & Van Zandt, 2015).¹ These changes may result in a drop in housing prices due to “white flight” or if potential home buyers perceive the neighborhood as undesirable due to tenant characteristics or perceived disamenities.

Additionally, subsidized housing developments may promote increased housing turnover in neighborhoods (Baum-Snow & Marion, 2009; Tiebout, 1956; Woo et al., 2014). Racial and socioeconomic differences among tenants of subsidized and non-subsidized housing may have a destabilizing effect on neighborhoods as the migration of subsidized households into neighborhoods may drive some existing non-subsidized residents to move out (Woo et al., 2014). Rapid turnover discourages neighborhood social cohesion and contributes to the breakdown of informal social control (Ross, Reynolds, & Geis, 2000; Sampson, 1985; Sampson & Groves, 1989). The constant influx and outflow of residents in response to subsidized housing developments may lower social integration by inhibiting the growth of neighborhood networks. Therefore, high housing turnover due to lower neighborhood social cohesion may increase crime within neighborhoods (Ross et al., 2000; Smith & Jarjoura, 1988).

Furthermore, the decline of neighborhood quality due to the influx of subsidized households may increase neighborhood crime (Dear, 1992; Kean & Ashley, 1991). The broken windows theory, which is one of the paradigms explaining the relationships between crime and physical dilapidation, proposes that an environment of physical disrepair or disorder causes neighborhood decline (Sampson & Raudenbush, 2004; Wilson & Kelling, 1982). The deterioration of the physical appearance of neighborhoods due to graffiti, garbage, abandoned cars, and dilapidated houses in communities may lead to individual perceptions of prevalent crime, which triggers community disinvestments and neighborhood decline (Massey & Denton, 1993). In this context, concerns about increasing crime due to the influx of subsidized households into neighborhoods might be plausible.

2.3. LIHTC subsidized housing developments in the U.S.

The public housing program in the U.S. produced over one million affordable housing units between the late 1930s and the mid-1980s (Eriksen & Rosenthal, 2010; Schwartz, 2010).

¹ However, the findings in previous studies examining whether subsidized housing has negative impacts on nearby property values have been inconsistent. Some researchers who found negative impacts of subsidized housing point to the influx of “undesirables” as the cause of neighborhood decline (Cummings & Landis, 1993; Lee et al., 1999), while others suggested that subsidized housing developments lead to neighborhood revitalization by eliminating disamenities in neighborhoods (Baum-Snow & Marion, 2009; Koschinsky, 2009; Schwartz et al., 2006).

However, support for public housing developments eroded in the 1980s (Eriksen & Rosenthal, 2010). The public housing program has been criticized for concentrating disadvantaged populations in high-rise complexes or projects that were often poorly designed and constructed, leading to neighborhood deterioration and social decay (Deng, 2007; Goering, Kamely, & Richardson, 1997; Rohe & Freeman, 2001). Furthermore, the program has drawn criticism for contributing to higher crime rates, lowering nearby property values, and promoting white flight by intensifying poverty concentration in neighborhoods (Goldstein & Yancey, 1983; Lee, Culhane, & Wachter, 1999; McNulty & Holloway, 2000; Roncek, Bell, & Francik, 1981; Saltman, 1990). Thus, planners and policymakers have cast doubt on whether the implementation of a program built, owned, and operated by the government is best left to the private sector (Eriksen & Rosenthal, 2010).

Since its establishment by the Tax Reform Act of 1986, the LIHTC program has grown into the largest project-based subsidized housing program in the U.S (Woo et al., 2014). The premise of the LIHTC program differs from that of other project-based subsidized housing programs (Baum-Snow & Marion, 2009). Federal tax credits are allocated to each state proportional to its population, and these tax credits are awarded to housing developers based on a state's evaluation of that developer's proposal (Van Zandt & Mhatre, 2009). By achieving a partnership between government and housing developers, the LIHTC program creates a channel for private investment in affordable housing, which may revitalize neighborhoods by eliminating disamenities such as dilapidated buildings and other visually unappealing elements (Freedman & Owens, 2011; Schwartz, Ellen, Voicu, & Schill, 2006). Thus, LIHTC developments may not necessarily promote neighborhood crime, unlike other project-based subsidized housing programs. Despite the hope many planners and policymakers place in the LIHTC program, few studies have actually examined the relationships between LIHTC developments and neighborhood crime.

2.4. Previous evidence on impacts of subsidized housing on neighborhood crime

Although several studies have examined the impacts of subsidized housing developments on neighborhood crime, they have produced conflicting results. Some researchers have found that the introduction of public housing developments increases crime in neighborhoods (DeLone, 2008; Farley, 1982; McNulty & Holloway, 2000; Roncek et al., 1981). However, other researchers have found a positive impact (Goetz, Lam, & Heitlinger, 1996) and even no impact of public housing developments on neighborhood crime (Griffiths & Tita, 2009). These inconsistent results may be due to the limitation of empirical methodologies in previous studies. Because many studies have employed a cross-sectional analysis to examine the relationships between public housing developments and crime, they do not take the direction of causality into account—whether subsidized housing developments are the cause of crime in neighborhoods or whether subsidized housing is only developed in neighborhoods where crime is prevalent.

Among numerous studies examining the associations between subsidized housing and crime, many researchers have also estimated the impacts of the Housing Choice Voucher (HCV) program on neighborhood crime in recent years (Ellen et al., 2012; Lens, 2014; Mast & Wilson, 2013; Popkin et al., 2012; Suresh & Vito, 2009). However, surprisingly few studies have focused on the relationships between LIHTC developments and neighborhood crime. Van Zandt and Mhatre (2009) found that clustered LIHTC units were significantly associated with higher neighborhood

crime rates. However, their study does not clarify the causal direction of impacts of LIHTC developments on neighborhood crime due to cross-sectional analysis. Additionally, Freedman and Owens (2011) analyzed whether LIHTC developments within a county increase crime in that county and found that LIHTC developments reduce violent crime at the county level. Taking advantage of an inconsistency in the funding for these tax credits (i.e., developers receive larger subsidies in census tracts above a set of poverty thresholds), they use a model that allows for an improved estimation of the causality between LIHTC developments and crime in a county (Ellen et al., 2012). However, their study does not employ neighborhood-level data, but utilizes county-level aggregated data to estimate the impacts of LIHTC developments on crime (Ellen et al., 2012). Our research builds upon the body of previous studies by taking into account the levels and trends of neighborhood crime rates related to LIHTC developments, specifying the pre- and post-period of developments at the neighborhood level.

3. Study area and data

3.1. Definition of microneighborhood: impact areas

This study estimated crime rates inside and outside of a microneighborhood of LIHTC developments (i.e., impact areas vs. control areas) in Austin. A microneighborhood is defined as the Euclidean distance buffer around the boundaries of LIHTC sites. This is based on the perception that neighbors would recognize LIHTC units from the boundaries of the housing complexes, and not from the center point (see Fig. 1). When crime incidents fall within a microneighborhood of LIHTC sites, we identify the crime incident as within the sphere of influence of the LIHTC development. In some cases, the microneighborhood boundaries of LIHTC sites in Austin were partially overlapped (i.e., eight projects out of the twenty LIHTC projects between 2002 and 2007). Thus, the locations of some crime incidents were within more than two microneighborhoods of LIHTC sites. Specifically, 1.7 percent (6444 incidents) of the total crime incidents (378,681 incidents) in Austin between 2000 and 2009 was located within these areas. In such cases, this study associated those crime incidents with the nearest LIHTC developments (Holzman, Hyatt, & Kudrick, 2005).²

The microneighborhoods surrounding LIHTC sites are identified as impact areas while census tracts or parts thereof (i.e., the remaining parts of census tracts) with no proximate LIHTC sites are defined as control areas in our analysis. Specifically, the impact areas are clipped from the census tract and defined as the microneighborhoods surrounding LIHTC sites. Additionally, the control areas are the rest of the census tract not included in the impact area or the census tract with no LIHTC developments. Thus, these two types of geographical areas were used as a unit of analysis in the study. The buffer distance of a microneighborhood varies in prior studies with the most common distances using 1000 feet, 1500 feet, or 2000 feet. For this study, we used a buffer distance of 2000 feet because it yielded the best goodness of fit based on a sensitivity test using various distance thresholds. This distance also makes results comparable with the

² The crime incident within overlapped areas might be associated with both LIHTC developments. Thus, the crime incident may be counted more than once. This method may overestimate the impacts of LIHTC developments on neighborhood crime. However, we analyzed impacts of LIHTC using both methods (nearest count and double count of crime incidents) and found both results to be consistent with each other.

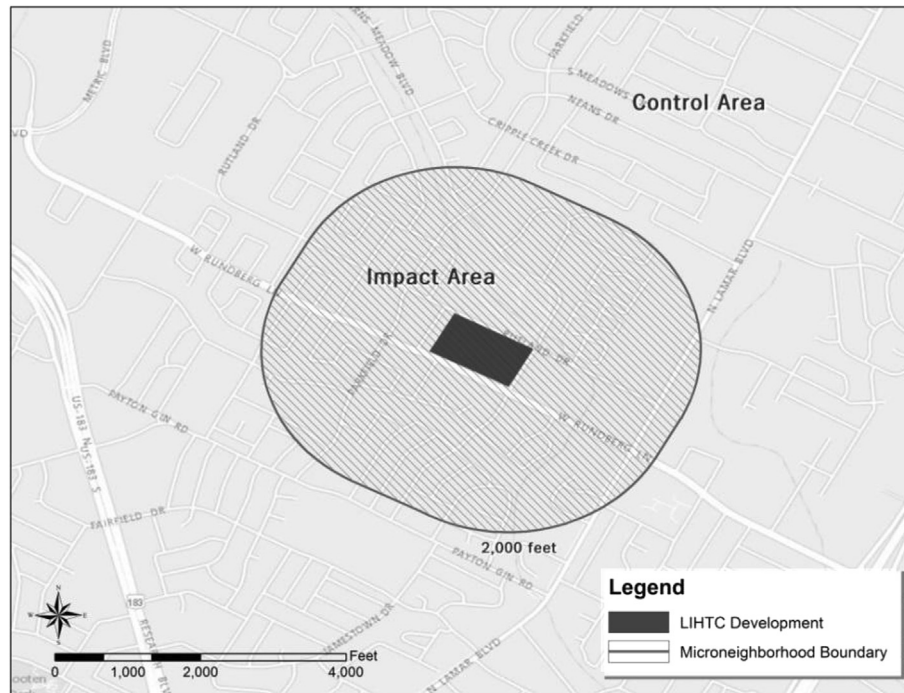


Fig. 1. Definition of microneighborhood.

existing literature (Galster et al., 2002; Santiago, Galster, & Pettit, 2003; Woo et al., 2015).

3.2. Study area

The study area is Austin, the state capital of Texas and the 14th largest city in the U.S. with a population of 790,390 (US Census Bureau, 2010). There is growing concern about the lack of affordable housing across the city, as the median housing value has increased almost 90 percent from 1998 to 2008 and the burden for housing costs has worsened for both homeowners and renters in Austin (BBC Research and Consulting, 2009). To offset this affordable housing shortage, promoting new housing is the top priority in the city development administrators' agenda. Although LIHTC subsidized housing developments may play a key role in producing affordable housing units, the program raises concerns for local residents and neighbors about rising neighborhood crime due to the influx of disadvantaged populations.

Additionally, many research areas examining the topics of subsidized housing developments have been located in northeastern cities with a legacy of public housing programs such as New York, Philadelphia, and Baltimore (Nguyen, 2005; Woo et al., 2014). Hence, by focusing on one of the fastest-growing southern cities, our study contributes to extending studies on project-based subsidized housing beyond the Northeast region, although our findings may not be applicable to all regions in the U.S.

3.3. Data sources and description

This study assessed the impacts of LIHTC subsidized housing based on the longitudinal data for crime incidents and LIHTC developments. Crime data from 2000 to 2009 obtained from the Austin Police Department were used to estimate neighborhood crime. The data included about 1.6 million records with the date and time, type of crime, and the locations where the crime occurred. In this study, we focused on all property and violent

crimes categorized as Part I crimes following previous studies (Ellen et al., 2012).³ In total, there were 355,435 property crime and 23,246 violent crime incidents between 2000 and 2009 in Austin. These data were geocoded to estimate distances from a LIHTC site. In terms of proximity to LIHTC developments, 9.96 percent (35,415 incidents) of property crimes were within 2000 feet of LIHTC developments and 15.76 percent (3664 incidents) of violent crimes were within 2000 feet of LIHTC sites. Additionally, as the dependent variable in our analyses, we used crime rates that were standardized per 100 residents using Census 2000 population estimates for constituent census block groups (Galster et al., 2002; Santiago et al., 2003).⁴

Table 1 shows the trend in crime rates per 100 persons in Austin. The total crime rate in Austin increased gradually until 2003 and then declined slightly between 2004 and 2006. However, the total crime rate increased after 2007. The total crime rate trend was generally consistent with those of property crime that comprised the majority of all crimes in Austin.

Fig. 2 shows the spatial variation in property and violent crime rates across census tracts that provide a more comprehensive picture of neighborhood crime rates that is not captured by the city-wide crime rates in Table 1. Property crime rates in Austin varied from zero in some census tracts to a high of 39.5 crime incidents per 100 persons in the highest crime census tract. Crime rates tended to

³ Specifically, Part I property crimes included arson, burglary, larceny, and motor vehicle theft while Part I violent crimes included rape, aggravated assault, robbery, and homicide. However, there are some variations for each crime type between the FBI's Uniform Crime Report and the data used in the study. These variations are due to differences in categorization for specific crime incidents. We employed a more parsimonious approach for categorizing crime incidents; for instance, we tabulated aggravated assault incidents by including only crime types that explicitly included the term "aggravated assault" (e.g., aggravated assault family/date violence, aggravated assault on public servant, aggravated assault with motor vehicle, etc.).

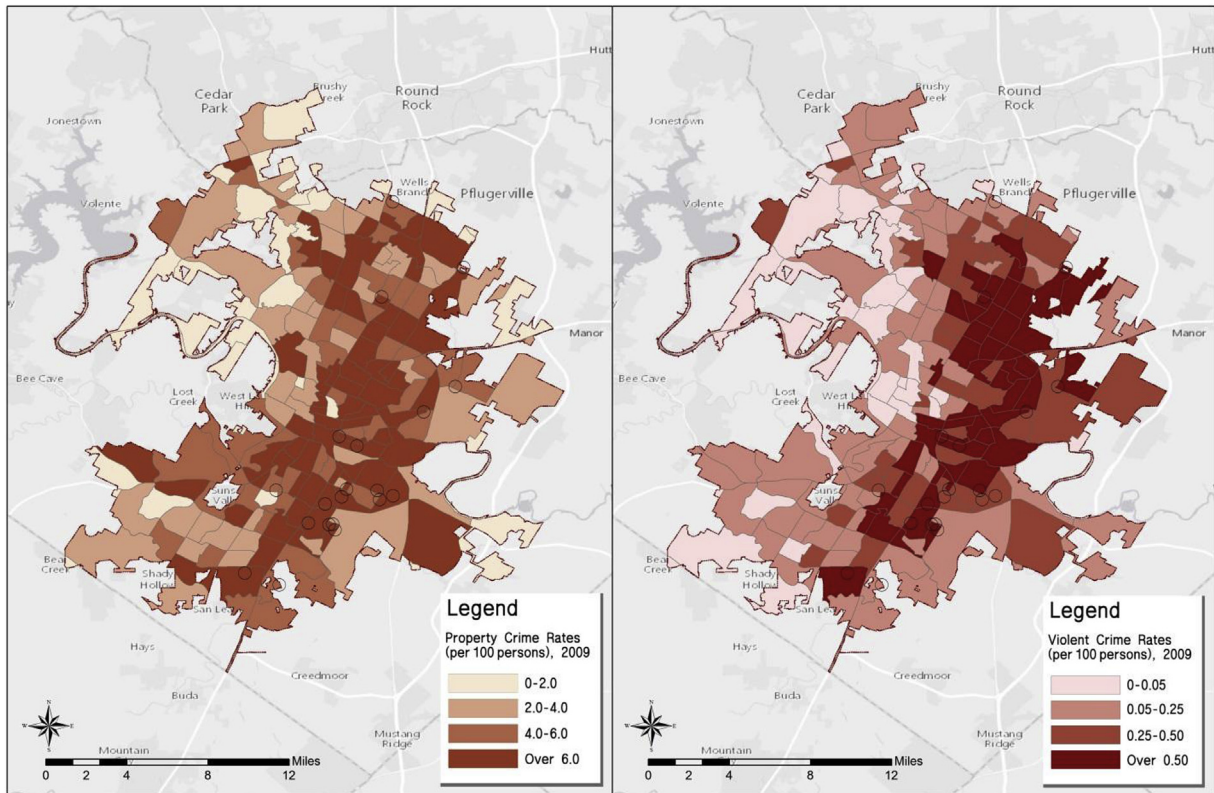
⁴ Specifically, the census block group population was assigned to LIHTC impact areas when the centroid of the impact area falls within the census block group.

Table 1

Austin reported crime rates per 100 persons.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Property	4.24	4.82	5.05	5.37	5.23	5.26	5.30	6.16	6.11	6.61
Violent	0.28	0.31	0.32	0.33	0.36	0.33	0.36	0.42	0.41	0.43
Total	4.52	5.12	5.37	5.71	5.59	5.59	5.67	6.58	6.52	7.04

Source: Austin Police Department

**Fig. 2.** Property and violent crime rates in Austin, 2009.

be higher along the central corridor (from south to north along the I-35 expressway) and eastern parts of Austin. Violent crime rates also varied from zero to a high of 4.5 incidents per 100 persons in the highest crime census tract. Both property and violent crime rates were lower along the northwestern fringes of the city, which generally correspond to the neighborhoods comprising higher income and majority white.

The LIHTC Property Inventory was obtained from the Texas Department of Housing and Community Affairs (TDHCA) to identify the characteristics of LIHTC developments, such as the location of sites and project completion years. In our analysis, the sample of LIHTC developments was restricted to those completed between 2002 and 2007 because there needed to be a sufficient amount of years of crime data both before and after LIHTC developments to estimate crime trends (Galster et al., 2002). Thus, inasmuch as crime data were available between 2000 and 2009, at least two years of observation before and after LIHTC developments (i.e., 2002–2007) were desirable in our analysis (Galster et al., 2002). As a result, there were 20 LIHTC projects between 2002 and 2007 in Austin (Fig. 3).

The 2000 census data were used for identifying the population of each area (i.e., impact and control areas) and the fixed effects reflecting the unobserved and time-invariant neighborhood

characteristics. In this study, our data included 180 census tracts in Austin.

4. Methodology

This study used the Adjusted Interrupted Time Series–Difference in Differences (AITS–DID) approach to assess the impacts of LIHTC developments on neighborhood crime. The underlying concept of the AITS–DID model is comparing the levels and trends of crime rates in neighborhoods with a LIHTC site before and after it was developed with those in other neighborhoods across the city where a LIHTC site was not developed (Galster et al., 2002; Koschinsky, 2009; Santiago et al., 2003; Woo et al., 2015). Thus, the model clarifies the causal direction of impacts of LIHTC developments by projecting the pre-development level and trend of crime rates in the neighborhood into the post-development period, while accounting for changes in city-wide crime trends (Santiago et al., 2003). Our model could be specified as:

$$Crime_{it} = \alpha + \beta T_{it} + \gamma N_i + \delta R_{it} + \mu S_{it} + \varepsilon_{it}, \quad (1)$$

where $Crime_{it}$ is the annual rate of crimes per 100 persons during year t in area i . The vector T_{it} is a series of time dummy variables for

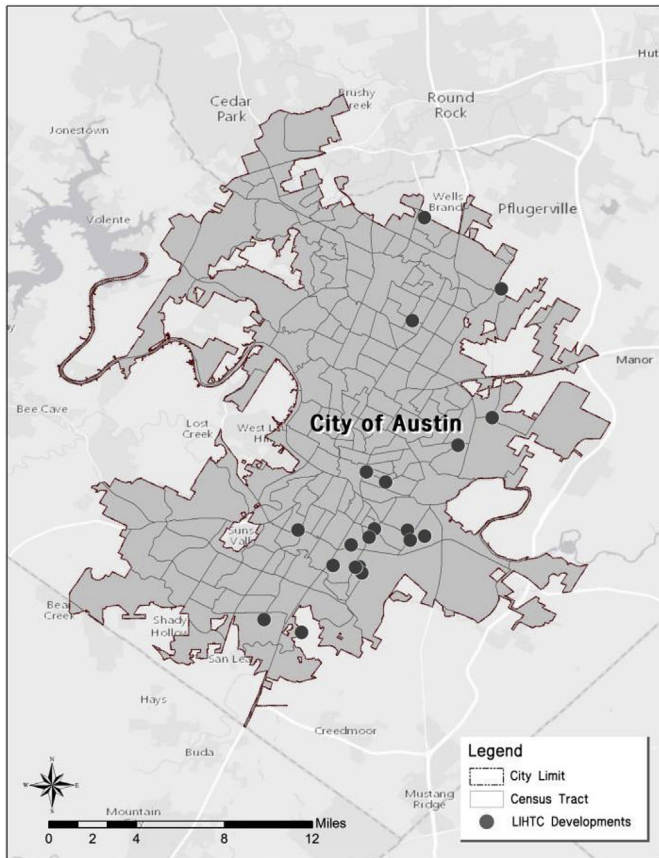


Fig. 3. LIHTC developments in Austin, 2002–2007.

crime rates in area i , indicating a measure of intertemporal variations in crime rates for all areas in Austin. The vector N_i is a set of dummy variables indicating each impact or control area i . These variables indicate area fixed effects controlling for the unobserved and time-invariant features of different areas, such as impact areas indicating each microneighborhood of LIHTC developments and control areas signifying the 2000 census tracts or parts thereof with no proximate LIHTC developments. R_{it} is a vector of ring variables that captures differentials in the levels and trends of crime rates before and after LIHTC housing was developed within an area, described in more detail in the section on LIHTC development variables. S_{it} is a vector of size variables that explains the size effects of newly developed subsidized housing, which is the total number of subsidized housing units after LIHTC was developed within a microneighborhood, and ε_{it} is an error term of the model.

4.1. LIHTC development variables

The vector of ring variables (R_{it}) captures the differentials in levels and trends of pre- and post-crime rates related to LIHTC developments by comparing control and impact areas (Galster et al., 2002; Koschinsky, 2009; Santiago et al., 2003; Woo et al., 2014). The fundamental concept of ring variables could be explained in terms of 1) crime rates in control/impact areas and 2) pre/post differentials in the levels and trends of crime rates.

First, all areas in Austin can be categorized into two areas: control areas and impact areas. Crime rates in impact areas (impact crimes) are defined as crime rates within the microneighborhood of LIHTC developments. Crime rates in control areas (control crimes) are crime rates that are not within the LIHTC site's

microneighborhood, thereby crime rates unaffected by proximity to any LIHTC sites (Santiago et al., 2003). Second, the ring variables capture the differentials in the levels and trends of crime rates in the microneighborhood of LIHTC developments before and after its completion. Thus, impact crimes can be further divided into two categories according to the completion years of LIHTC housing: pre-impact crimes and post-impact crimes. Pre-impact crimes are crime rates prior to LIHTC developments while post-impact crimes are crime rates after LIHTC housing was developed within the microneighborhoods.

In this context, the ring variables include two dummy variables to capture the differences in the level of crime rates. Pre-impact crimes for crime levels (pre-crime level) take on a value of one when there will be LIHTC developments within the microneighborhood. This explains the existing crime levels in microneighborhoods and reflects the inherent area crime levels before LIHTC housing is developed. Post-impact crimes for crime levels (post-crime level) take on a value of one after LIHTC housing was developed within the microneighborhood. This measures the crime levels in microneighborhoods after LIHTC housing is developed. By specifying these two variables, we can compare the differentials in the levels of crime rates with control crimes before and after LIHTC was developed within microneighborhoods.

The ring variables also include two more variables to estimate the break in the trends of crime rates. One variable indicates the amount of time in years between the crime year and the beginning of the research period (pre-crime trend) (Galster et al., 2002; Santiago et al., 2003). Another variable measures the amount of time in years between the crime year and the completion year of LIHTC developments (Galster et al., 2002; Santiago et al., 2003). For example, the post-crime trend variable is zero if no LIHTC sites are in the area; the variable is one if the crime occurs in the first year after LIHTC housing is developed within the microneighborhood; the variable is two if the crime occurs two years after LIHTC housing is developed within the microneighborhood. In sum, the vector of ring variables allows us to compare the differentials in levels and trends of crime rates between impact areas and control areas before and after LIHTC housing was developed.

5. Results

5.1. Regression results for total crime

The results for total crime rates including both property and violent crimes can be found in Table 2. All variables explain around 95.9 percent of the variance in total crime rates. Our model included many area dummy variables. Thus, for brevity, the tables included in this paper report only the results of key variables that are related to LIHTC developments.

The coefficient of the pre-crime level variable showed a positive sign, indicating that the total crime rate level within LIHTC microneighborhoods is higher compared to the control area prior to the development of LIHTC housing. The crime rate level for impact areas was 3.4 incidents per 100 residents higher in microneighborhoods compared to control areas before LIHTC housing was developed. In contrast, the coefficient of the post-crime level variable showed a negative sign, indicating that the total crime rate level in LIHTC impact areas is lower compared to the control area after LIHTC developments, albeit not statistically significant in the model. Furthermore, crime trend changes were substantial within microneighborhoods, averaging an incline of 0.96 incidents per 100 residents before LIHTC developments, and an average decline of 0.51 incidents per 100 residents after LIHTC developments (see Table 2 and Fig. 4). However, the development size effect was not statistically significant. In sum, our results show that LIHTC housing

Table 2
Results for total crime (both property and violent crime).

Variables	Coefficient	t-value	Standard error
Level and trend of crime (key variables)			
Pre-crime level	3.366***	3.61	0.933
Post-crime level	−0.288	−0.36	0.802
Pre-crime trend	0.956***	7.78	0.123
Post-crime trend	−0.505***	−3.46	0.146
No. of LIHTC units	−0.002	−0.55	0.004
Seasonal indicators ^a			
Year 2001	0.399**	2.12	0.188
Year 2002	0.548***	2.91	0.188
Year 2003	0.777***	4.11	0.189
Year 2004	0.677***	3.57	0.190
Year 2005	0.672***	3.54	0.190
Year 2006	0.763***	4.01	0.190
Year 2007	1.608***	8.42	0.191
Year 2008	1.484***	7.75	0.192
Year 2009	2.012***	10.45	0.193
Area indicators ^b			
Included			
Number of observations	2000		
F	218.62***		
Adjusted R ²	0.9585		

***p < 0.01; **p < 0.05; *p < 0.10.

^a Year 2000 as the reference categories.

^b The full table including Area indicators is available from the lead author upon request.

was developed in neighborhoods where crime rates were already higher than other neighborhoods. This finding implies that the cross-sectional analyses estimating the impacts of subsidized housing developments on neighborhood crime may misguide the causal impacts of the developments because they do not identify the preexisting crime levels of neighborhoods where subsidized housing was developed. It is also noteworthy that LIHTC developments decrease neighborhood crime in terms of the levels and trends in crime rates.

5.2. Regression results for property and violent crime

We also estimated impacts of LIHTC developments by the two major types of crime incidents: property crime and violent crime. The adjusted R-squared values were 0.955 for the property crime

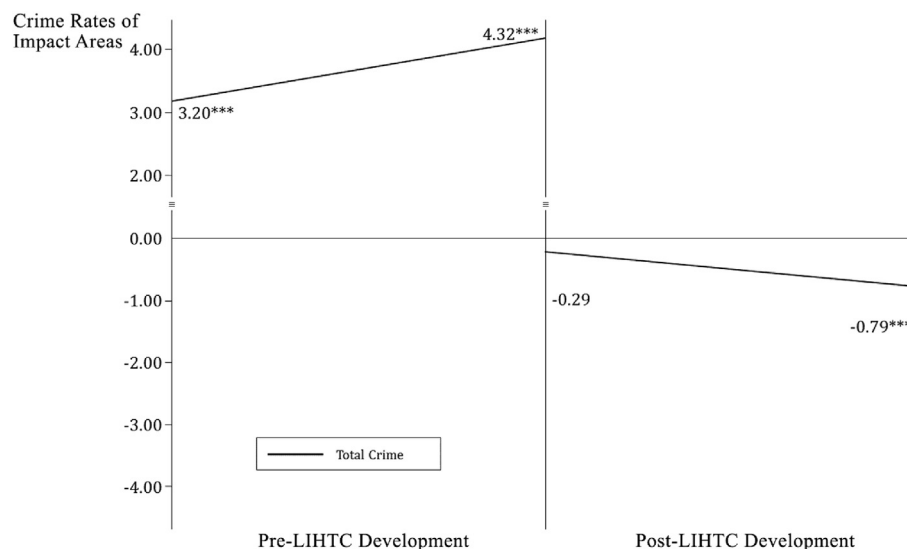
rate model and 0.938 for the violent crime rate model. The results for key variables in both models were largely consistent with the results in total crime, with the exception of the post-crime level variable in the violent crime model (see Table 3).

The coefficient for the pre-crime level variable in the property crime model showed a positive sign—the crime level was 3.4 incidents per 100 residents higher in the microneighborhoods compared to the control areas prior to LIHTC developments. However, after LIHTC housing was developed, the property crime rates of impact areas were not significantly higher than control areas, suggesting that LIHTC developments may have mitigated the impacts of property crime. Crime trend changes were also substantial for property crime rates within microneighborhoods. The trend in property crimes within the microneighborhoods was rapidly rising before LIHTC housing was developed, but the trend was falling compared to control areas after LIHTC was developed (See Table 3 and Fig. 5).

In terms of violent crime, our results showed no statistically significant evidence that LIHTC developments increased the level in violent crime rates within the microneighborhoods. Further, the crime trend changes indicate the positive impacts of LIHTC developments. The trend in violent crimes prior to LIHTC developments within the microneighborhood increased while the trend in violent crimes significantly decreased after LIHTC housing was developed (See Table 3 and Fig. 5). However, the decline for violent crime after LIHTC developments is less substantial compared to property crime, indicating that the impact of LIHTC developments may have a more modest impact on reducing violent crime.

6. Conclusion

Do subsidized housing developments increase neighborhood crime? With respect to the LIHTC program in Austin, Texas, our results suggest far more counterfactual evidence; LIHTC subsidized housing tended to be located in neighborhoods where crime was already prevalent. Our findings for total crime and property crime showed that the crime rate levels for impact areas were higher than those for control areas before LIHTC developments. Additionally, our results for total crime, property crime, and violent crime



Note: ***Denotes a 1% significance level; **denotes a 5% significance level; *denotes a 10% significance level.

Fig. 4. Results for total crime: Pre- and post-crime levels and trends.

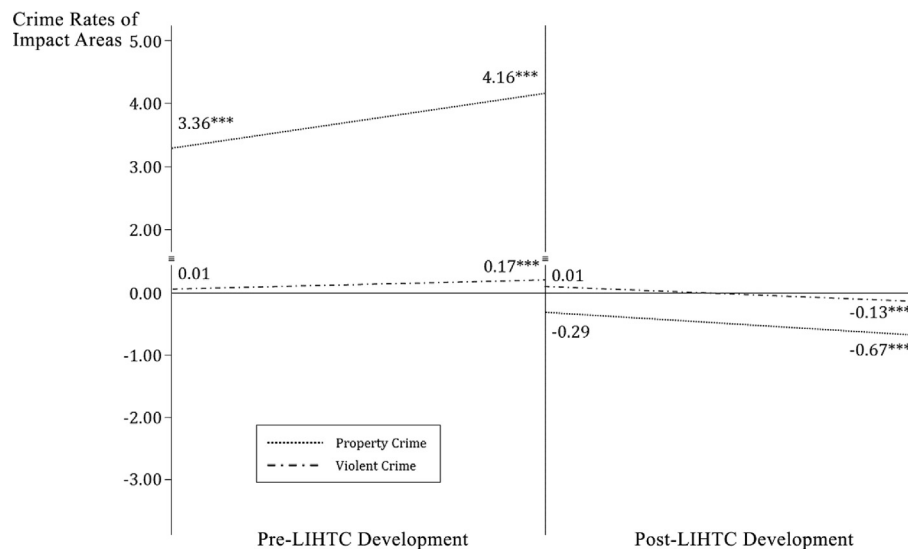
Table 3
Results for property and violent crimes.

Variables	Property crime			Violent crime		
	Coef.	t-value	Std. Err	Coef.	t-value	Std. Err
Level and trend of crime (key variables)						
Pre-crime level	3.359***	3.82	0.879	0.007	0.06	0.126
Post-crime level	−0.293	−0.39	0.756	0.005	0.04	0.108
Pre-crime trend	0.798***	6.89	0.116	0.158***	9.55	0.017
Post-crime trend	−0.373***	−2.71	0.138	−0.132***	−6.71	0.020
No. of LIHTC Units	−0.002	−0.46	0.003	−4.19e−04	−0.85	0.000
Seasonal indicators ^a						
Year 2001	0.394**	2.23	0.177	0.005	0.18	0.025
Year 2002	0.544***	3.06	0.177	0.005	0.19	0.025
Year 2003	0.755***	4.24	0.178	0.023	0.89	0.025
Year 2004	0.628***	3.52	0.179	0.049*	1.91	0.026
Year 2005	0.673***	3.76	0.179	−0.001	−0.03	0.026
Year 2006	0.739***	4.12	0.179	0.024	0.93	0.026
Year 2007	1.508***	8.38	0.180	0.100***	3.91	0.026
Year 2008	1.396***	7.74	0.180	0.088***	3.40	0.026
Year 2009	1.933***	10.66	0.181	0.078***	3.02	0.026
Area indicators ^b						
Included	Included			Included		
Number of Observations	2000			2000		
F	199.44***			142.46***		
Adjusted R ²	0.9546			0.9375		

***p < 0.01; **p < 0.05; *p < 0.10.

^a Year 2000 as the reference categories.

^b The full table including Area indicators is available from the lead author upon request.



Note: ***Denotes a 1% significance level; **denotes a 5% significance level; *denotes a 10% significance level.

Fig. 5. Results for total crime: Pre- and post-crime levels and trends.

suggest that LIHTC subsidized housing was developed in neighborhoods where the trends in crime rates were already rising. It is also important to note that the completion of LIHTC developments had a mitigating impact on neighborhood crime. After LIHTC housing was developed, the higher preexisting crime levels in impact neighborhoods appear to have diminished, shown by the statistical significance of the pre-crime level variable and the loss of statistical significance in the post-crime level variable for the total crime and property crime models. Furthermore, the upward trend in crime rates before LIHTC developments reversed direction after LIHTC developments.

Our results imply that planners and policymakers need to counter the widespread perception that project-based subsidized housing would increase neighborhood crime. Beyond providing affordable housing for low-income households using a tool for new

residential investment, the LIHTC program has been utilized to revitalize distressed neighborhoods by many U.S. state agencies (Deng, 2007; National Council of State Housing Agencies, 2002). This implies that LIHTC developments may decrease neighborhood crime by addressing the “broken windows” syndrome through the removal of dilapidated buildings, graffiti, abandoned lots, and other visually unappealing elements that promote crime in neighborhoods (Ellen, Schill, Schwartz, & Voicu, 2005; Schwartz et al., 2006). LIHTC subsidized housing investments may serve as a tool for community revitalization rather than a locally undesirable land use. Thus, an effective strategy for future LIHTC investments in Austin may be achieved by directing developments towards more deteriorated neighborhoods in order to both provide more affordable housing and revitalize communities. In this context, the U.S. Department of Housing and Urban Development’s (HUD) use of

Qualified Census Tracts (QCTs) has successfully brought LIHTC developments into distressed neighborhoods. Specifically, LIHTC developments in QCTs, which include tracts in which at least half of the households have incomes below 60 percent of the area's median income, allow developers to receive larger tax credits. Thus, the designation of QCTs has contributed to the siting of LIHTC developments in neighborhoods where the market may not normally support it (Van Zandt & Mhatre, 2009).⁵

However, our findings should not be interpreted as suggesting that LIHTC subsidized housing should be developed only in disadvantaged neighborhoods. Although the LIHTC program has achieved some success in providing more affordable and higher quality housing units to low-income residents (Freeman, 2004; Van Zandt & Mhatre, 2009), there is growing concern about whether the program provides subsidized households with suitable living environments and access to community resources and opportunities. Our study demonstrated that LIHTC households were more likely to be located in disadvantaged neighborhoods, especially in terms of higher crime rates. While placing LIHTC in distressed neighborhoods may attenuate neighborhood opposition and promote community revitalization, it may also limit the access of subsidized households to neighborhood goods and services that support various socioeconomic opportunities for upward mobility, such as quality education, high-paying jobs, safety from crime, and healthier physical and social conditions. Although the primary intention of the LIHTC program is to increase the supply of affordable housing where housing needs are most urgent, typically in low-income neighborhoods, its implementation in states suggests additional expectations related to its siting. In other words, the LIHTC program has the potential to be an important tool to provide quality housing in distressed neighborhoods as well as increase housing options in higher-opportunity areas (Van Zandt & Mhatre, 2009).

7. Limitations

Many state agencies have promoted LIHTC developments to improve urban neighborhoods by removing disamenities (Deng, 2007; National Council of State Housing Agencies, 2002; Woo et al., 2015). This may suggest that LIHTC developments, by revitalizing distressed neighborhoods, may have mitigating impacts on neighborhood crime. However, our study was unable to control for all alternative explanations, given data limitations. For instance, HOPE VI redevelopments including LIHTC and HCV units may be another possible explanation for reducing neighborhood crime by replacing large deteriorated public housing complexes with fewer units and residential displacement (Hanlon, 2010; Walker & Hanchette, 2015).⁶ This revitalization might reduce neighborhood

crime through decreasing or displacing neighborhood population. On the other hand, new LIHTC housing developments including the removal of abandoned/vacant lots and other visually unappealing elements may also be a significant explanation for reduced neighborhood crime incidents in spite of increasing residents in neighborhoods. Thus, additional studies examining the changes in neighborhood dynamics due to LIHTC subsidized housing developments (i.e., the replacement of large size public housing with fewer units or new development of abandoned/vacant lots with increased residents) may empirically look beyond the current role of LIHTC developments as the tools for mitigating neighborhood crime.

We caution that our findings may not be representative of other U.S. cities. We suggest that future studies extend the scope of impacts of LIHTC developments by exploring other cities, suburban areas, and other types of subsidized housing developments. Further, additional research is needed to better understand the conditions under which subsidized housing developments may raise or decrease neighborhood crime, such as the income-level of neighborhoods, because subsidized housing developments in affluent neighborhoods may have different impacts on neighborhood crime than those in poorer neighborhoods.

References

- Andresen, M. A., & Lanning, S. J. (2012). The (in)appropriateness of aggregating across crime types. *Applied Geography*, 35, 275–282.
- Andresen, M. A., & Malleson, N. (2011). Testing the stability of crime patterns: implications for theory and policy. *Journal of Research in Crime and Delinquency*, 48, 58–82.
- Andresen, M. A., & Malleson, N. (2013). Crime seasonality and its variations across space. *Applied Geography*, 43, 25–35.
- Baum-Snow, N., & Marion, J. (2009). The effects of low income housing tax credit developments on neighborhoods. *Journal of Public Economics*, 93(5), 654–666.
- BBC Research and Consulting. (2009). *Comprehensive housing market study: City of Austin*. Denver, Colorado: BBC Research and Consulting.
- Cummings, P., & Landis, J. (1993). *Relationships between affordable housing developments and neighbouring property values*. Institute of Urban and Recreational Development, University of California at Berkeley Working Paper. California: University of California at Berkeley.
- Dear, M. (1992). Understanding and overcoming the NIMBY syndrome. *Journal of the American Planning Association*, 58(3), 288–300.
- DeLone, G. J. (2008). Public housing and the fear of crime. *Journal of Criminal Justice*, 36(2), 115–125.
- Deng, L. (2007). Comparing the effects of housing Vouchers and low-income housing tax credits on neighborhood integration and school quality. *Journal of Planning Education and Research*, 27(1), 20–35.
- Deng, L. (2009). Working Paper Series. *Assessing changes in neighborhoods hosting the low-income housing tax credit projects* (Vol. 8, pp. 1–64). Ann Arbor, MI: Center for Local, State, & Urban Policy (CLOSUP).
- Ellen, I. G., Lens, M. C., & O'Regan, K. (2012). American murder mystery revisited: do housing voucher households cause crime? *Housing Policy Debate*, 22(4), 551–572.
- Ellen, I. G., Schill, M. H., Schwartz, A. E., & Voicu, I. (2005). *Does federally subsidized rental housing depress neighborhood property values? Law school law and economics research paper*. New York University.
- Eriksen, M. D., & Rosenthal, S. S. (2010). Crowd out effects of place-based subsidized rental housing: new evidence from the LIHTC program. *Journal of Public Economics*, 94(11), 953–966.
- Farley, J. E. (1982). Has public housing gotten a bum rap? The incidence of crime in St. Louis public housing developments. *Environment and Behavior*, 14(4), 443–477.
- Freedman, M., & Owens, E. G. (2011). Low-income housing development and crime. *Journal of Urban Economics*, 70(2), 115–131.
- Freeman, L. (2004). *Siting affordable housing: Location and neighborhood trends of low income housing tax credit development in the 1990s*. Washington, DC: The Brookings Institution. Census 2000 Survey Series.
- Freeman, L., & Botein, H. (2002). Subsidized housing and neighborhood impacts: a theoretical discussion and review of the evidence. *Journal of Planning Literature*, 16(3), 359–378.
- Galster, G., Pettit, K., Santiago, A., & Tatian, P. (2002). The impact of supportive housing on neighborhood crime rates. *Journal of Urban Affairs*, 24(3), 289–315.
- Galster, G., Tatian, P., Santiago, A., Pettit, K., & Smith, R. (2003). *Why not in my backyard? Neighborhood impacts of deconcentrating assisted housing*. New Brunswick, NJ: Center for Urban Policy Research.
- Galster, G., Tatian, P., & Smith, R. (1999). The impact of neighbors who use section 8 certificates on property values. *Housing Policy Debate*, 10(4), 879–918.

⁵ However, some scholars argue that QCTs may cause the concentration of the disadvantaged in undesirable neighborhoods (Oakley, 2008; Rohe & Freeman, 2001).

⁶ Many findings from studies generally agree on the impacts of the traditional public housing program. Larger size and higher density public housing developments tend to increase neighborhood crime by promoting poverty concentration (DeLone, 2008; Farley, 1982; McNulty & Holloway, 2000; Roncek et al., 1981), while more dispersed public housing developments have insignificant impacts on neighborhood crime (Galster, Tatian, Santiago, Pettit, & Smith, 2003; Goetz et al., 1996). In contrast, recent studies examining the impacts of HCV units on neighborhood crime have produced inconsistent results. Some researchers have found that HCV units significantly increase neighborhood crime (Mast & Wilson, 2013; Popkin et al., 2012), while others have found that the impact of HCV units on neighborhood crime is insignificant, suggesting that HCV households tend to be placed in neighborhoods where crime levels are already high (Ellen et al., 2012; Lens, 2014). In this context, HCV households in neighborhoods may be associated with neighborhood crime. However, this paper only focused on LIHTC developments given the limited data available on HCV households.

- Goering, J., Kamely, A., & Richardson, T. (1997). Recent research on racial segregation and poverty concentration in public housing in the United States. *Urban Affairs Review*, 32(5), 723–745.
- Goetz, E. G., Lam, H. K., & Heitlinger, A. (1996). There goes the neighborhood? Subsidized housing in urban neighborhoods. *CURA Reporter*, 26(1), 1–6.
- Goldstein, I., & Yancey, W. L. (1983). Public housing projects, blacks, and public policy: the historical ecology of public housing in Philadelphia. In J. M. Goering (Ed.), *Housing desegregation and federal policy* (pp. 262–289). Chapel Hill: University of North Carolina Press.
- Griffiths, E., & Tita, G. (2009). Homicide in and around public housing: is public housing a hotbed, a magnet, or a generator of violence for the surrounding community? *Social Problems*, 56(3), 474–493.
- Groff, E. R., Weisburd, D., & Yang, S.-M. (2010). Is it important to examine crime trends at a local “micro” level? A longitudinal analysis of street to street variability in crime trajectories. *Journal of Quantitative Criminology*, 26(1), 7–32.
- Hanlon, J. (2010). Success by design: HOPE VI, new urbanism, and the neoliberal transformation of public housing in the United States. *Environment and Planning A*, 42(1), 80–98.
- Holzman, H. R., Hyatt, R. A., & Kudrick, T. R. (2005). Measuring crime in and around public housing using GIS. In F. Wang (Ed.), *Geographic information systems and crime analysis* (pp. 311–329). Hershey, PA: Idea Group Publishing.
- Kean, T. H., & Ashley, T. L. (1991). *Not in my back yard: Removing barriers to affordable housing*. Washington, D.C: The Advisory Commission on Regulatory Barriers to Affordable Housing.
- Koschinsky, J. (2009). Spatial heterogeneity in spillover effects of assisted and unassisted rental housing. *Journal of Urban Affairs*, 31(3), 319–347.
- Lee, C.-M., Culhane, D. P., & Wachter, S. M. (1999). The differential impacts of federally assisted housing programs on nearby property values: a Philadelphia case study. *Housing Policy Debate*, 10(2), 75–93.
- Lens, M. C. (2014). The impact of housing vouchers on crime in US cities and suburbs. *Urban Studies*, 51(6), 1274–1289.
- Massey, D. S., & Denton, N. A. (1993). *American apartheid: Segregation and the making of the underclass*. Cambridge, MA: Harvard University Press.
- Mast, B. D., & Wilson, R. E. (2013). Housing choice vouchers and crime in Charlotte, NC. *Housing Policy Debate*, 23(3), 559–596.
- McNulty, T. L., & Holloway, S. R. (2000). Race, crime, and public housing in Atlanta: testing a conditional effect hypothesis. *Social Forces*, 79(2), 707–729.
- National Council of State Housing Agencies. (2002). *Comment on GAO's Report: Comparing the characteristics and costs of housing programs*. Washington, DC: U.S. General Accounting Office.
- Nguyen, M. T. (2005). Does affordable housing detrimentally affect property values? A review of the literature. *Journal of Planning Literature*, 20(1), 15–26.
- Oakley, D. (2008). Locational patterns of low income housing tax credit developments: a sociospatial analysis of four metropolitan areas. *Urban Affairs Review*, 43(5), 599–628.
- Popkin, S. J., Rich, M. J., Hendey, L., Hayes, C., Parilla, J., & Galster, G. (2012). Public housing transformation and crime: making the case for responsible relocation. *Citiescape*, 14(3), 137–160.
- Rohe, W. M., & Freeman, L. (2001). Assisted housing and residential segregation: the role of race and ethnicity in the siting of assisted housing developments. *Journal of the American Planning Association*, 67(3), 279–292.
- Roncek, D. W., Bell, R., & Francic, J. (1981). Housing projects and crime: testing a proximity hypothesis. *Social Problems*, 29(2), 151–166.
- Ross, C. E., Reynolds, J. R., & Geis, K. J. (2000). The contingent meaning of neighborhood stability for residents' psychological well-being. *American Sociological Review*, 65, 581–597.
- Saltman, J. (1990). *A fragile movement: The struggle for neighborhood stabilization*. New York, NY: Greenwood Press.
- Sampson, R. J. (1985). Neighborhood and crime: the structural determinants of personal victimization. *Journal of Research in Crime and Delinquency*, 22(1), 7–40.
- Sampson, R. J., & Groves, W. B. (1989). Community structure and crime: testing social-disorganization theory. *American Journal of Sociology*, 94(4), 774–802.
- Sampson, R. J., & Raudenbush, S. W. (2004). Seeing disorder: neighborhood stigma and the social construction of “broken windows”. *Social Psychology Quarterly*, 67(4), 319.
- Santiago, A. M., Galster, G. C., & Pettit, K. L. S. (2003). Neighbourhood crime and scattered-site public housing. *Urban Studies*, 40(11), 2147–2163.
- Santiago, A. M., Galster, G. C., & Tatian, P. (2001). Assessing the property value impacts of the dispersed housing subsidy program in Denver. *Journal of Policy Analysis and Management*, 20(1), 65–88.
- Schwartz, A. F. (2010). *Housing policy in the United States* (pp. 201–207). New York, NY: Routledge.
- Schwartz, A. E., Ellen, I. G., Voicu, I., & Schill, M. H. (2006). The external effects of place-based subsidized housing. *Regional Science and Urban Economics*, 36(6), 679–707.
- Sherman, L. W., Gartin, P., & Buerger, M. E. (1989). Hot spots of predatory crime: routine activities and the criminology of place. *Criminology*, 27(1), 27–55.
- Smith, D. A., & Jarjoura, G. R. (1988). Social structure and criminal victimization. *Journal of Research in Crime and Delinquency*, 25(1), 27–52.
- Suresh, G., & Vito, G. F. (2009). Homicide patterns and public housing: the case of Louisville, KY (1989–2007). *Homicide Studies*, 13(4), 411–433.
- Tiebout, C. M. (1956). A pure theory of local expenditures. *The Journal of Political Economy*, 416–424.
- U.S. Census Bureau. (2010). *American FactFinder fact sheet* (Austin, TX).
- Van Zandt, S., & Mhatre, P. C. (2009). Growing pains: perpetuating inequality through the production of low-income housing in the Dallas/Fort Worth Metropolis. *Urban Geography*, 30(5), 490–513.
- Walker, M. A., & Hanchette, C. (2015). Residents' experiences in the aftermath of a HOPE VI revitalization project: a three-pronged, grounded visualization approach. *Applied Geography*, 57, 71–79.
- Weisburd, D., & Amram, S. (2014). The law of concentration of crime at place: the case of tel Aviv. *Police Practice and Research*, 15(2), 101–114.
- Weisburd, D., Groff, E. R., & Yang, S.-M. (2012). *The criminology of place: Street segments and our understanding of the crime problem*. New York, NY: Oxford University Press.
- Wilson, J. Q., & Kelling, G. L. (1982). Broken windows. *Atlantic Monthly*, 249(3), 29–38.
- Woo, A., Joh, K., & Van Zandt, S. (2014). Impacts of the low-income housing tax credit program on neighborhood housing turnover. *Urban Affairs Review*. <http://dx.doi.org/10.1177/1078087414561824>. Advance online publication.
- Woo, A., Joh, K., & Van Zandt, S. (2015). Unpacking the impacts of the low-income housing tax credit program on nearby property values. *Urban Studies*. <http://dx.doi.org/10.1177/0042098015593448>. Advance online publication.