Justice Quarterly

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rjqy20

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To cite this article: Marie Skubak Tillyer, Arthur Acolin & Rebecca J. Walter (2022): Place-Based Improvements for Public Safety: Private Investment, Public Code Enforcement, and Changes in Crime at Microplaces across Six U.S. Cities, Justice Quarterly, DOI: 10.1080/07418825.2022.2127843

To link to this article: https://doi.org/10.1080/07418825.2022.2127843

JUSTICE QUARTERLY
https://doi.org/10.1080/07418825.2022.2127843

Place-Based Improvements for Public Safety: Private Investment, Public Code Enforcement, and Changes in Crime at Microplaces across Six U.S. Cities

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ABSTRACT

Research demonstrates that crime concentrates at relatively few microplaces, and changes at a small proportion of locations can have a considerable influence on a city's overall crime level. Yet there is little research examining what accounts for change in crime at microplaces. This study examines the relationship between two mechanisms for place-based improvements – private investment in the form of building permits and public regulation in the form of municipal code enforcement – and yearly changes in crime at street segments. We use longitudinal data from six cities to estimate Spatial Durbin Models with block group and census tract by year fixed effects. Building permits and code enforcement are significantly associated with reductions in crime on street segments across all cities, with spatial diffusion of benefits to nearby segments. These findings suggest public safety planning should include efforts that incentivize and compel physical improvements to high crime microplaces.

ARTICLE HISTORY
Received 27 January 2022
Accepted 14 September 2022

KEYWORDS
Hot spots; place-based improvements; investment; code enforcement; crime and place

Introduction

Research on spatiotemporal crime patterns reveals that crime is concentrated at relatively few microplaces (e.g. addresses, intersections, street segments, and businesses), it tends to be stable over time, and changes at a small proportion of microplaces can have a considerable effect on a city's overall crime level (e.g. Andresen et al., 2017; Braga et al., 2010; Curman et al., 2015; Groff et al., 2010; Lee et al., 2017; Sherman et al., 1989; Tillyer & Walter, 2019; Weisburd et al., 2004, 2012, 2014). These findings have prompted calls for targeted place-based interventions to efficiently allocate scarce prevention resources (Groff et al., 2010; Weisburd et al., 2012). Research on place-based interventions has primarily focused on hot spots policing, which has demonstrated the viability of targeting small spatial scales for prevention (e.g. Ariel et al., 2020; Weisburd & Eck, 2004; Weisburd et al., 2010, 2021). Some scholars, however,

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/07418825.2022.2127843

have also emphasized the potential of non-policing place-based improvements that may be well suited to address underlying criminogenic conditions of microplaces (Eck, 2018a; Eck & Eck, 2012; MacDonald, 2015; Sampson, 1989).

The study of crime and place has largely drawn from two traditions, both of which suggest place-based improvements may reduce crime (see Wilcox & Tillyer, 2018 for a review). The first is a community criminology perspective that highlights concepts such as social disorganization, informal social control, and collective efficacy (Sampson et al., 1997; Shaw & McKay, 1942). While research in this paradigm has traditionally focused on understanding neighborhood-level variability in crime, some researchers have applied these concepts to smaller spatial scales, arguing that theoretical processes that rely on social interaction, cooperation, and the development of shared norms for problem solving may be more relevant at smaller units of analysis where there is a greater degree of familiarity among residents (e.g. Groff, 2015; Weisburd et al., 2004, 2012). The second is an environmental criminology perspective that views the spatial distribution of crime as a function of criminal opportunity, defined by offenders' perceptions of the effort, risk, and rewards of crime (Clarke & Cornish, 1985). Offenders' perceptions are shaped by the characteristics of places, including environmental design, routine activities, and place management (Brantingham & Brantingham, 1981; Cohen & Felson, 1979; Cozens, 2008; Jeffery, 1971; Newman, 1972).

As we discuss more fully below, physical improvements to microplaces may discourage crime, both by increasing informal social control and reducing criminal opportunity. Building on research examining spatiotemporal crime patterns, this study uses data from six large and varied U.S. cities (Chicago, Los Angeles, New York City, Philadelphia, San Antonio, and Seattle) over an eleven-year period[1] to examine the relationship between two mechanisms for place-based improvements – private investment in the form of building permits and public regulation in the form of municipal code enforcement – and changes in crime at street segments over time. We also examine the effects of building permits and code enforcement on crime at nearby segments to detect evidence of spatial displacement and/or diffusion of benefits. The results highlight how practices beyond traditional policing strategies, such as incentivizing targeted private investment and prioritizing code enforcement at crime hot spots, might be strategically implemented to enhance public safety.

Spatiotemporal Crime Patterns

An established set of research findings from the past 30 years demonstrates that crime tends to spatially concentrate at relatively few microplaces within cities, with numerous studies documenting the nonrandom distribution of crime across addresses, intersections, street segments, and businesses (e.g. Andresen & Malleson, 2011; Braga et al., 2010, 2011Curman et al., 2015; Eck et al., 2000; Gill et al., 2017; O'Brien & Winship, 2017; Sherman et al., 1989; Tillyer & Walter, 2019; Weisburd & Amram, 2014; Weisburd et al., 2004, 2009). Weisburd has referred to this phenomenon as the *law of crime concentration*, stating that "for a defined measure of crime at a specific microgeographic

[1]The study period is 2008–2018 for all cities except San Antonio, for which the data were limited to 2008–2016.

unit, the concentration of crime will fall within a narrow bandwidth of percentage for a defined cumulative proportion of crime" (2015, p.138). Despite historical focus neighborhood-level variation in crime, such studies reveal substantial *within*-neighborhood variation and highlight the degree to which a relatively small proportion of microplaces account for a disproportion amount of a city's total crime. For example, Weisburd et al. (2004) report that just 4.5% of street segments in Seattle accounted for approximately half of all crimes in the city from 1989 to 2002.

Studies examining the crime trajectories of microplaces over time reveal the potential for changes in crime at a small number of locations to have an outsized influence on citywide crime. In Seattle, for example, Weisburd et al. (2004) found that crime levels at most street segments were stable, although sharp declines at a small proportion of segments (14%) largely accounted for the 24% decline in city-level crime observed over the course of the study (see also Braga et al., 2010, 2011). Subsequent studies have investigated the spatial relationships *among* high crime places, with findings indicating evidence of both street-to-street variability and clustering. Groff et al. (2010), using the crime trajectories of street segments in Seattle from 1989 to 2004, report that while clustering was most notable among chronically high crime segments, many segment trajectories were not associated with nearby segment trajectories (see also Weisburd et al., 2012; Wheeler et al., 2016). Collectively, research on spatiotemporal crime patterns signals a need for targeted interventions at small spatial units (Groff et al., 2010; Weisburd et al., 2012). Moreover, recent research indicates that crime hot spots are marked by numerous adverse physical and mental health outcomes, making it even more pressing to address these locations (Weisburd & White, 2019; Weisburd et al., 2018).

Understanding Crime at Microplaces

Early work in the study of crime across space focused on neighborhoods as the primary unit of analysis. Scholars at the University of Chicago in the early twentieth century asserted neighborhoods are distinct units of social life that vary in their ability to develop social cohesion among residents and uphold social order. Socially disorganized neighborhoods – that is, those with weak social institutions and interpersonal networks among residents – lack social cohesion and the capacity for informal social control, leading to higher rates of crime and delinquency (Shaw & McKay, 1942). More recently, scholars have focused on the importance of collective efficacy – that is, the mutual trust among residents and the willingness to intervene for the common good – as key in a neighborhood's ability to realize residents' common values and exert social control (Sampson et al., 1997). Yet this neighborhood-level focus fails to account for what has become an enduring finding: there is substantial variation in crime *within* neighborhoods that remains unexamined in studies that treat neighborhoods as homogenous (Sherman et al., 1989).

Conversely, a number of environmental criminological theories and perspectives – including routine activities theory, the rational choice perspective, crime pattern theory, and environmental design theory – emerged in the 1970s and 1980s that focused on understanding crime events (see Weisburd & Eck, 2018; Wortley & Mazerolle, 2008 for summaries). Collectively, this paradigm identifies *criminal opportunity* as key to explaining spatial and temporal variations in crime. Criminal opportunity is high when people motivated to commit crime perceive they can attack rewarding targets with little effort or risk (Brantingham & Brantingham, 1981; Clarke & Cornish, 1985; Cohen & Felson, 1979). Perceptions of criminal opportunity are shaped by, among other things, the characteristics of places, including their environmental design (Cozens, 2008; Jeffery, 1971; Newman, 1972), users and functions (Brantingham & Brantingham, 1995), and how effectively they are managed (Eck, 1994; Madensen, 2007).

In the past 30 years, research has drawn from both the Chicago School and environmental criminology to investigate variation in crime across small units such as addresses, intersections, street segments, and businesses (see Groff, 2015). The distinction between these traditions has diminished over time, as elements of social disorganization, collective efficacy, and informal social control can be viewed as aspects of criminal opportunity, signaling to offenders the associated effort, risk, and rewards of crime at a given location (Wilcox & Tillyer, 2018). Indeed, studies of crime and place have often taken this more integrated approach (e.g. Smith et al., 2000; Weisburd et al., 2020). For example, a number of empirical studies using discrete choice models confirm offender spatial decision making in robberies, burglaries, and theft from vehicles is influenced by both indicators of social (dis)organization and criminal opportunity (Bernasco, 2010; Bernasco & Block, 2009, 2011; Johnson & Summers, 2015).

As noted above, changes in crime at a few microplaces can have a considerable impact on a city's level of crime overall, yet most of what is known about what accounts for such change at a city's microplaces comes from research conducted on a single city. In their study of hot spots in Seattle, Weisburd et al. (2012, 2014) applied group-based trajectory analysis to identify crime patterns among street segments over a 16-year period. They then used multinomial regression analysis to determine segment characteristics that predict membership in a trajectory pattern. Both social characteristics – such as property value, housing assistance, and physical disorder – and indicators of criminal opportunity – such as bus stops, arterial roads, and public facilities – differentiated stable low crime street segments from chronic hot spots. They, then, explored how *change* in segment characteristics influenced crime patterns, but the researchers urge caution when interpreting these findings because they did not have data over time for many measures and for others, the time periods are limited. Changes in social disorganization variables were predictive of increasing and decreasing trajectory patterns. The impact of changes in the opportunity variables were relatively weaker, which the researchers speculate may be due to limited change in criminal opportunity during the study period and data limitations.

Within this theoretical backdrop, we explore how physical place-based improvements – via private investment in the form of building permits and public regulation in the form of municipal code enforcement – might contribute to changes in crime at microplaces. Indeed, a review of the literature by MacDonald (2015) highlights the various mechanisms by which the built environment might reduce crime at microgeographic units, while also reducing the reliance on traditional policing strategies for public safety. From a community criminology perspective, place-based improvements may strengthen neighborhood housing and economic infrastructure while simultaneously increasing residents' willingness to intervene for the common good, thus facilitating collective efficacy (Velez et al., 2012). From an environmental criminology perspective, property owners and those tasked with place management are viewed as rational actors with multiple functions – including organizing space, regulating conduct, controlling access, and acquiring resources – that can create or reduce criminal opportunity (Eck, 2018b; Linning & Eck, 2021; Madensen, 2007; Sampson et al., 2010). Those with greater investments in their properties and those who experience physical improvements on their block via code enforcement will have more incentive to address the underlying conditions that create opportunities for crime. Moreover, the place-based improvements themselves may change offenders' perceptions about a place's suitability for crime, which we explore more fully below.

Place-Based Improvements and Crime

Evidence from Mesolevel Studies

Studies on community/economic development initiatives, mortgage lending, urban revitalization/housing (re)development, and broader redevelopment processes/neighborhood change demonstrates the potential of place-based improvements to influence crime, although much of this work focuses on larger spatial units (e.g. MacDonald et al., 2010; Montolio, 2018; Ramey & Shrider, 2014; Shrider & Ramey, 2018). For example, research suggests that business improvement districts (BIDs) (i.e. special districts created to fund investment and management activities in an area) may have crime reduction benefits. MacDonald et al. (2010) examined the effects of 30 BIDs on violent crime in Los Angeles from 1994 to 2005 and found that implementation of a BID was associated with a 12% decline in robbery and an 8% decrease in total violent crime. Similarly, Seattle's Neighborhood Matching Fund (NMF) program demonstrates how parochial partnerships between community members and public agencies aimed at improving neighborhoods might have the added benefit of reducing crime. Ramey and Shrider (2014) report a negative relationship between NMF program funding and violent crime, with stronger effects in poorer neighborhoods and as funds accrued over time (see also Shrider & Ramey, 2018). Mortgage lending has also been associated with crime reductions, although again, much of this work focuses on larger aggregates, and findings vary based on crime type and neighborhood dynamics (Saporu et al., 2011; Velez & Richardson, 2012; Velez et al., 2012).

The literature on urban revitalization and housing redevelopment activities also highlights the potential for investment to produce crime prevention benefits. Research suggests that some housing investment strategies, such as expanding the affordable housing stock, may result in crime reductions, with the greatest gains experienced in distressed neighborhoods (Dillman et al., 2017; Freedman & Owens, 2011; Woo & Joh, 2015). A study examining revitalization in Seattle from 1982 to 2000, Kreager et al. (2011) found that census tracts in the urban core that experienced the greatest investment exhibited the largest crime reductions. Within-tract longitudinal analyses indicated a curvilinear relationship between yearly housing investments and crime, with early phases of investment related to modest increases in crime, and more consolidated forms of investment over time associated with modest crime reductions.

Finally, redevelopment processes and neighborhood change may also be associated with crime reduction. A recent study by Branic and Hipp (2018), for example, explored the relationship between changes in resident sociodemographic characteristics, home improvement and refinance activity by residents, and crime in Los Angeles using census tracts to approximate neighborhoods. Using latent class analysis, they identified classes of neighborhoods that shared similar change patterns from 2000 to 2010, noting six broad categories of neighborhood change. Among their findings, Branic and Hipp (2018) report that "urban investor" neighborhoods generally experienced decreases in crime, and property crime in particular. MacDonald and Stokes (2020) summarize the research on urban redevelopment processes in the United States that began in the 1990s, highlighting the importance of land use changes and infrastructure improvements. Generally, research indicates that gentrification and related land use changes are associated with reductions in neighborhood crime, with little evidence of crime displacement, although the authors note the need for improved gentrification measures and further study of displacement. In addition, the complex nuances of the gentrification-crime relationship warrant additional investigation. For example, Papachristos et al. (2011) used the opening of coffee shops as an indicator of gentrification in Chicago neighborhoods from 1991 to 2005. They report that the opening of coffee shops was associated with declines in homicides regardless of neighborhood racial/ethnic composition. For robbery, however, the opening of coffee shops was associated with declines in robbery in White and Hispanic neighborhoods, and increases in robbery in Black neighborhoods.

Place-Based Improvements and Crime at Microplaces

Research conducted at smaller units of analysis also points to the potential public safety benefits of investment and other place-based improvements, including housing repair activities, remediation of disinvestment in targeted areas, building permit activity including demolition, and civil code enforcement. For example, South et al. (2021) examined the effects of the City of Philadelphia's Basic Systems Repair Program (BSRP), which provided grants of less than $20,000 to low-income homeowners to make structural home repairs. Using a difference-in-differences design to compare block faces with participating homes to those with homes eligible to receive BSRP funding but still on the waitlist, the authors report that the presence of a BSRP-funded home was associated with a 21.9% decrease in crime on the block face. Moreover, the relationship was dose dependent, with a stronger relationship observed among block faces with higher numbers of participating homes (South et al., 2021)

Building permits represent private investment in properties, as municipalities require permits for new construction and demolition, as well as making substantial renovations and improvements to existing properties (e.g. replacing a roof, demolishing a portion of a building, changing piping or electrical wiring, creating new doors or windows, and structural changes).[2] Studies that have assessed the impact of building permits on crime

[2]More information can be found at each study city's building department web page: https://www.sanantonio.gov/DSD/Constructing, https://www.ladbs.org/services/getting-started/about-the-construction-process, https://www1.nyc.gov/site/buildings/property-or-business-owner/property-or-business-owner.page, https://www.chicago.gov/city/en/depts/bldgs/provdrs/permits.html, https://www.seattle.gov/sdci/permits, https://www.phila.gov/services/permits-violations-licenses/apply-for-a-permit/building-and-repair/get-a-building-permit/

have primarily focused on addressing disinvestment through demolition. For example, housing demolitions were associated with a 90% decline in crime on the same parcel in Buffalo, New York and a 5% decline in crime up to 1000 feet away (Wheeler et al., 2018; see also Kim & Wo, 2021). Remediation of disinvestment in the form of abandoned buildings and vacant lots is used by many local governments as a crime prevention tool (Accordino & Johnson, 2000) and can produce reductions in crime, including gun violence (Branas et al., 2016, 2018; Kondo et al., 2015; Moyer et al., 2019; Stacy, 2018; but see Han & Helm, 2020).

Place-based improvements to properties may also be compelled via civil code. Code enforcement involves ensuring compliance with rules, regulations, and laws and is used as a prevention strategy by local governments to eliminate public nuisances and maintain public health and safety. Violation examples include debris and junk on private property, building safety concerns, improper use of signs, illegal dumping of garbage, land use violations (e.g. nonpermitted animals or operation of businesses in residential zones), noise disturbances, or the construction of structures without a permit.[3] The enforcement of municipal codes may lead to place-based improvements that reduce crime via multiple mechanisms. Sampson (1989), for example, calls for a broader crime control perspective that identifies the roles of government sectors not directly tasked with crime reduction, or what he calls "crime effects of noncrime policies," positing that lack of code enforcement can contribute to crime via social disorganization and neighborhood deterioration (e.g. trash, abandon vehicles, boarded housing), which creates a perception that local residential social control by is weak.

Given the disproportionate amount of crime observed at relatively few microplaces, Eck and Eck (2012) argue for regulatory policies that improve place management practices at high crime locations (see also Eck, 2018b). Eck (2018a) argues that regulatory approaches for crime control that focus on property owners offer several potential benefits over policing, including a greater and longer-term crime reductions resulting from addressing underlying criminogenic conditions; less reliance on criminal sanctions; fewer financial and social costs; less crime displacement and greater diffusion of benefits; and transferring the responsibility and costs of crime reduction from the taxpayer to those whose create the conditions for crime (see also Scott, 2004). There is some evidence that the threat of code enforcement can be used to leverage place manager cooperation to address high crime locations. In an experiment designed to reduce crime at private rental properties marked by drug dealing in San Diego, crime was reduced by 60% among properties whose owners were assigned to meet with a detective and code enforcement officials to discuss how drug dealing could be curbed at their property (Eck, 1998). Prior to the meetings, the owners received a letter from the police describing potential drug enforcement and civil action that could occur to close the apartment building if the owner failed to cooperate to address drug dealing.

Similarly, Worrall and Wheeler (2019) draw on routine activities theory, positing that neglectful property ownership is an indicator of weak guardianship or place

[3]More information can be found at each study city's code enforcement web page: https://www.sanantonio.gov/ces/about, https://www.ladbs.org/services/core-services/code-enforcement, https://www1.nyc.gov/site/hpd/services-and-information/enforcement.page, https://www.chicago.gov/city/en/depts/bldgs/provdrs/inspect.html, https://www.seattle.gov/sdci/about-us/who-we-are/code-compliance, https://www.phila.gov/departments/department-of-licenses-and-inspections/inspections/code-enforcement/.

management that contributes to crime, and that code enforcement officers represent potential "super controllers," (Sampson et al., 2010), or those with formal authority who can alter the behavior of place managers to reduce crime. Such intervention goes beyond arrest and criminal prosecution to include authority to invoke civil processes (e.g. enforcing zoning ordinances, minimum housing standards, etc.) to compel behavioral change. In their evaluation of a community prosecution program in Dallas, Worrall and Wheeler (2019) found that code enforcement targeted at improving residential and commercial property conditions was associated with a significant decline in crime in treatment areas over a six-year period relative to control areas.

The Present Study

Federal tax incentives such as Opportunity Zones (Gelfond & Looney, 2018), banking mandates through the Community Reinvestment Act of 1977 (Getter, 2015), and other federal, state, and local policies such as the Community Development Block Grant program (Rohe & Galster, 2014) encourage development and investment activity in disadvantaged communities, many of which also have high crime rates. Yet a substantial body of research indicates there is considerable *within*-neighborhood variability in crime, even in high-crime communities. Microplaces tend to display stable crime levels year-to-year; fluctuations at a small proportion of places can have a considerable impact on a city's overall crime level. Much of what is known about what accounts for microplace variation in crime within a city comes from Weisburd et al.'s (2012, 2014) seminal work in Seattle. Their research examines street segment indicators of criminal opportunity and social disorganization that predict membership in various crime trajectory patterns, with a focus on chronic hot spots. Yet as these authors noted, lack of access to yearly data on many variables limited their ability to examine what accounts for year-to-year segment *change*.

In light of the push to encourage development activity and investment in disadvantage areas, and given research documenting that crime concentrates at relatively few microplaces, it is particularly important to develop a better understanding of what accounts for *change* in crime at small units of analysis to help inform how policies might be strategically implemented to support place-based improvements for maximal crime reduction. The current study examines the potential public safety benefits of incentivizing targeted investment and prioritizing code enforcement at microplaces. To do so, we use yearly data from six large and varied U.S. cities to investigate how two indicators of place-based improvements – that is, private investment in the form of building permits and public regulation in the form of municipal code enforcement – are associated with changes in crime at street segments. We also consider the potential effects of place-based improvements on crime at *nearby* street segments by examining whether there is evidence of spatial displacement and/or diffusion of benefits (Guerette & Bowers, 2009; Weisburd et al., 2006). In doing so, this research responds to calls to consider additional means beyond traditional policing strategies to enhance public safety.

Data and Methods

This study uses data from Chicago, Los Angeles, New York City, Philadelphia, San Antonio, and Seattle over eleven years (2008–2018)[4] to examine the relationship between building permits, code enforcement, and yearly *changes* in crime at street segments over time (see Table S1 in the Supporting Information for more information on the data sources). The unit of analysis is the street segment, which includes the length of a street until it intersects another street, and includes properties and the events that occur on those properties on both sides of the street. This unit of analysis has been used in prior microscale studies examining crime patterns in urban settings and is consistent with research demonstrating street-to-street variability in crime on adjacent street segments (e.g. Andresen & Malleson, 2011; Groff et al., 2010; Weisburd et al., 2004, 2012; Wheeler et al., 2016).[5] Street segments for all six cities were processed in ArcGIS Pro based on municipal street shapefiles by creating individual segments at each intersection.

We estimate Spatial Durbin Models (SDMs) with block group and census tract by year fixed effects (described below) to control for time invariant microlevel characteristics and time variant mesolevel characteristics. This double fixed effect approach is similar to that used by Ellen et al. (2013) when examining the impact of foreclosures on crime, and estimates the effects of placed-based improvements on *change* in crime over time. Due to the double fixed effect approach, only street segments in block groups with variation in the dependent variable and independent variables over the study period and those in tracts with variation across segments during a given year (explained in more detail below) are included in the multivariate analyses.[6]

Dependent Variable

Crime incident data with geocoordinates and dates were collected from the study cities' police departments.[7] We created the following crime type categories to classify each incident: (1) violent/personal crimes (e.g. assault, battery, homicide, human

[4]The only exception is San Antonio, for which the data were limited to 2008-2016.

[5]For segments with address ranges greater than 100, Weisburd et al. (2004) created multiple segments defined by "hundred blocks." For example, they created three segments for a street with addresses ranging from 1 to 299.

[6]Of all street segments, 91% in Chicago, 85% in Los Angeles, 61% in New York City, 96% in Philadelphia, 89% in San Antonio, and 98% in Seattle experienced some variation in the dependent and independent variables within block group and are, therefore, included in our multivariate analysis. We did not systematically exclude any type of street segment (e.g., highways, roads in parks, etc.) from the analyses. When examining the spatial distribution of the street segments that were dropped from the analyses due to lack of variation, they were predominately in areas absent of urban activity where crime, building permits, and code enforcement do not occur. In Chicago, the majority of the street segments dropped from the multivariate analysis are streets closed to the public at the O'Hare International Airport and major highways such as I-55, I-290, I-94, and I-90. Major highways (I-5, I-10, and I-405, e.g.) were also removed from the multivariate analysis in Los Angeles along with many street segments in state parks such as Topanga and city parks like Griffith Park. New York City had the most street segments removed since it has an expansive street network of underground tunnels and highways. Street segments in areas such as the John F Kennedy International Airport, LaGuardia Airport, Rikers Island, Randall's Island Park, and Governors Island were removed in New York City. The fixed effects also removed from the multivariate analysis similar areas in Philadelphia, San Antonio, and Seattle.

[7]Geocoding is used when data are provided at the address level. Because the crime incident, building permit, and code violation provided by municipal police and building departments data were point incidents with geocoordinates (i.e., *xy* coordinates), there was no need to geocode for this study.

trafficking, kidnapping, robbery, sexual offenses, and stalking); (2) property crimes (e.g. arson, burglary, larceny-theft, and motor vehicle theft); (3) public order crimes (e.g. drug, public indecency, prostitution, and public peace violation); (4) other crimes (e.g. concealed carry violation, gambling, liquor law violation, intoxicated while driving, loitering, and obscenity) (Weisburd et al., 2012). Crime incidents are aggregated annually to the nearest street segment.

Independent Variables

Building permit data were obtained from the study cities' building departments at the property level with geocoordinates. The data capture a range of investments in the built environment including new construction, alterations, and substantial renovations or repair of existing buildings. Therefore, the permits tend to represent capital investments. Routine preventive and corrective maintenance activities (e.g. replacing entry locks, repair of water leaks, replacing filters, painting, etc.) are not included in the building permit data since these types of activities do not require a permit. Depending on project scale and local procedures, a single project may require several permits. Building permits have been used as a measure of private investment by property owners, with a higher number of permits expected to represent more dollars invested in an area (Acolin et al., 2022; Lacoe et al., 2018). Building permits are aggregated annually to the street segment.

Code enforcement data were obtained at the property level with geocoordinates from each city's department or office responsible with enforcing code as described in Footnote 3 above. Code enforcement aims to ensure compliance with regulations that apply to property owners and occupants to limit public nuisances and maintain public health and safety. Citations are issued to property owners when city compliance officers receive a complaint or witness violations of city land use and zoning, construction, noise, housing, or other local codes. Depending on priorities and capacity, offices vary in terms of administration procedures for enforcement. Code enforcement citations are aggregated annually to the nearest street segment.

We also incorporate built environment controls that may influence place-based improvement initiatives. A measure of land use based on Zillow Transaction and Assessment Dataset (ZTRAX) data controls for whether all properties on a street segment are classified as commercial, industrial, or residential (Zillow, 2021). Street segments on which different land uses are present are classified as mixed use. We also use the ZTRAX data to produce a measure of the number of vacant lots on each street segment.[8]

The crime, building permit, and code enforcement data are transformed using the inverse hyperbolic sine (IHS) to account for the skewed distribution of these variables

[8]While the crime, building permit, and code enforcement variables are annual measures, the land use and vacant lot variables are time invariant and based on the reported land use as of 2018 due to data availability; we did not have access to these measures for all six cities for all study years. Although time variant measures are preferred, we chose to include these as control variables because land use classification categories are generally stable over time. It is possible the number of vacant lots on a street segment changed over the course of the study; using a time invariant measure may depress the size of the coefficients (which nonetheless were statistically significant in 28 of 30 models presented below), but should not introduce systematic biases.

that include a substantial proportion of zeros in a given year but also a long right tail, with a large number of crimes, building permits, and code enforcement actions on some segments.[9] The IHS transformation can be expressed as: $\text{IHS}(x) = \log\left(\sqrt{x^2+1}+x\right)$, where x represents the number of crimes, building permits, or code enforcement citations on a given street segment. The IHS transformation has the same benefits as the log transformation; it adjusts for skewness and a 1% increase in the IHS transformed independent variable corresponds to a 1% change in the IHS transformed dependent variable. Relative to the log transformation, however, it has the benefits of retaining zero and negative values and has been commonly used for variables that contain a substantial share of zeros (Acolin et al., 2022; Burbidge et al., 1988; Friedline et al., 2015; Lambert et al., 2010).[10]

Analytic Technique

We investigate the impact of changes in building permits and code enforcement on crime in the subsequent year on street segments using a model with block group and census tract by year fixed effects based on the approach developed by Ellen et al. (2013) to estimate the impact of changes in foreclosure on crime. The block group fixed effect allows us to control for all time invariant omitted variables at the block group level that may be associated with both crime and the covariates. The census tract by year fixed effect controls for time varying characteristics of the surrounding neighborhood and allows us to estimate the impact of building permits and code enforcement on crime among street segments that are in the same census tract. The combination of fixed effects controls for both time variant and invariant characteristics. The use of the fixed effects over random effects models is supported by Hausman specification tests in all six cities.

In addition, we also explore potential spatial displacement and/or diffusion of benefits by examining the effects of building permits and code enforcement citations on crime at adjacent segments. Spatial displacement occurs when crime is shifted to another location in response to prevention efforts at specific places, whereas diffusion of benefits refers to crime prevention that extends beyond the specific location targeted by a strategy (Clark & Weisburd, 1994; Eck, 1993). A systematic review of the literature on displacement and diffusion of benefits suggests that when displacement does occur, it tends to represent a fraction of crime that was prevented at the targeted locale (Guerette & Bowers, 2009; see also Hesseling, 1994; Weisburd et al., 2006). Moreover, some place-based interventions produce wider crime prevention benefits, with nearby locales not directly targeted for prevention experiencing crime declines.

[9]Among street segment-year observations used in the multivariate analyses, the percent with 0 crimes in a given year ranges from 3% in Philadelphia to 23% in Seattle. The percent with 0 building permits in a given year ranges from 34% in Seattle to 71% in San Antonio. The percent with 0 code enforcement citations ranges from 56% in Philadelphia to 79% in Los Angeles.

[10]We also estimated results with log transformations instead of IHS transformations (see Supporting Information, Table S3). [AQ] The results are largely similar in terms of magnitude, demonstrating that the findings are robust to alternative specifications.

We examine the impact of trends on adjacent street segments using the Spatial Durbin Model (SDM) that includes a spatial lag for both the dependent variable and the independent variables, including building permits, code enforcement citations, vacant lots, and land use (Elhorst, 2017; Vega & Elhorst, 2015). To do so, we created a spatial weights matrix based on all intersecting neighbors for each street segment. For example, a segment on a regular grid would have six neighbors (three on each end). The advantage to using the SDM model relative to alternative models is that it allows us to include a lag for crime (Spatial Lag of X model), which is supported by likelihood ratio tests in all six cities.

We estimate the following model:

$$\begin{aligned} crime_{bgt} = \; & \beta_0 + \beta_1 \mathrm{crime}_{bt-1} + \beta_1 \mathrm{permits}_{bt-1} + \beta_2 \mathrm{enforcement}_{bt-1} + \beta_3 \mathrm{vacant}_b \\ & + \beta_4 \mathrm{landuse}_b + \beta_5 \mathrm{neighcrime}_{bt-1} + \beta_5 neighpermits_{bt-1} \\ & + \beta_6 \mathrm{neighenforce}_{bt-1} + \beta_7 \mathrm{neighvacant}_b + \beta_8 \mathrm{neighlanduse}_b + \gamma_g + \delta_t + \varepsilon_{bgt} \end{aligned}$$

crime_{bgt} is the IHS of the total number of crimes (or crime type) on a street segment b in block group g in year t. We control for the lag crime, crime_{bt-1}. $\mathrm{permits}_{bt-1}$ is the IHS of the number of permits and $\mathrm{enforcement}_{bt-1}$ is the IHS of the number of code enforcement citations associated with that street segment the previous year.[11] vacant_b controls for the number of vacant lots on the street segment and $\mathrm{landuse}_b$ is a categorical variable that controls for land use. For each of these variables we include the value of their neighbors. γ_g is the block group fixed effect and δ_t is the census tract by year fixed effect. We cluster the standard errors at the census tract by year level.[12]

Results

Table 1 reports descriptive statistics for the six cities and includes the untransformed mean annual crime incidents, building permits, and code enforcement citations per segment by city.[13] The average annual number of crime incidents by street segment is highest in New York and Chicago (6.5 and 6.2, respectively)

[11]We include one-year temporal lags, with the expectation that trends over the most recent period have a larger impact. In Table S4 of the Supporting Information, we also report results for temporal lags up to 5 years for the crime, building permit, and code enforcement measures. The largest coefficients are for the most recent lag, but the relationships do persist across years.

[12]This modeling approach is a form of spatiotemporal difference-in-difference in which results are compared for crime activity on street segments within tracts so that changes at the street segment level are compared to changes in other street segments within the same tract. This is a modified version of the Two-Way Fixed Effect (TWFE) approach used for panel data (de Chaisemartin & D'Haultfoeuille, 2020; Wooldridge, 2019) that has been applied in urban economics to a set of issues for which there are time varying social phenomena at small geographical scales that can arguably be expected to be influenced by similar trends at the mesolevel (Delgado & Florax, 2015; Ellen et al., 2013). Our paper adopts a similar modeling approach to Ellen et al. (2013) who include tract*year fixed effects and blockface fixed effects. As noted in Ellen et al. (2013) and in a recent review of the TWFE approach by Wooldridge (2021), this approach does not completely address endogeneity concerns but allows for more flexibility than the standard difference-in-difference estimator over two periods.

[13]As noted above, we transformed these variables in the multivariate analyses using the inverse hyperbolic sine (IHS) to account for their skewed distributions. Table S2 in the Supporting Information presents the descriptive statistics by municipality for the IHS transformed variables for the sample of street segment-year observations included in the regression analysis. It is, therefore, a subset of the overall number of street segment-year observations that does not include those without variations within the fixed effect groups as described above.

Table 1. Descriptive statistics by municipality.

	Chicago	Los Angeles	New York	Philadelphia	San Antonio	Seattle
Number of street segments	51,470	91,782	75,225	40,913	59,905	24,013
Mean number of neighboring street segments	6.2	6.1	6.0	6.1	6.1	5.9
Mean annual crime incidents per street segment						
All crime types	6.2	2.3	6.5	4.6	3.6	1.9
	(13.3)	(34.6)	(28.7)	(37.7)	(16.4)	(14.9)
Violent crime	1.8	0.7	2.1	1.0	0.5	0.2
	(5.1)	(17.0)	(13.8)	(13.5)	(3.8)	(3.4)
Property crime	3.2	1.5	3.0	1.9	1.7	1.6
	(8.2)	(24.2)	(15.8)	(18.4)	(10.6)	(12.3)
Disorder crime	0.7	0.0	0.7	0.4	0.2	0.1
	(3.5)	(0.7)	(8.7)	(13.5)	(5.2)	(3.5)
Other crime	0.5	0.2	0.6	1.0	0.8	0.1
	(1.7)	(4.7)	(8.8)	(21.2)	(8.7)	(2.1)
Mean annual building permits per street segment	1.7	0.5	4.4	1.2	0.2	1.7
	(6.4)	(3.4)	(10.0)	(4.4)	(1.8)	(4.7)
Mean annual code enforcement per street segment	2.4	0.3	1.1	2.8	0.9	0.4
	(6.9)	(2.3)	(2.8)	(6.4)	(6.2)	(1.1)
Mean number of vacant lots per street segment	0.7	0.3	0.8	0.6	0.5	0.0
	(1.9)	(2.6)	(2.1)	(2.1)	(1.8)	(0.1)
Percent of street segments with respective land use						
Residential	42.6%	69.9%	59.0%	61.3%	71.6%	72.5%
Commercial	6.1%	11.8%	7.2%	9.1%	19.4%	12.1%
Industrial	2.2%	5.8%	1.5%	2.4%	0.5%	2.9%
Mixed Use	49.1%	12.6%	32.4%	27.3%	8.6%	12.5%

Notes: Average annual crime per street segment is calculated for 2008–2018, except for San Antonio for which the period covered is 2008–2016. Standard deviations are reported in parentheses.

followed Philadelphia (4.6), San Antonio (3.6), Los Angeles (2.3), and Seattle (1.9). Property crimes are the most common reported crimes in all cities. The average annual number of building permits per segment is highest in New York (4.4), followed by Chicago and Seattle (1.7). The average number of code enforcement citations per street segment is highest in Philadelphia (2.8), followed by Chicago (2.4), New York (1.1), and San Antonio (0.9). New York and Chicago have the highest average number of vacant lots per street segment (0.8 and 0.7, respectively), followed by Philadelphia (0.6) and San Antonio (0.5). Residential is the majority land use in all cities except Chicago (42.6%), where mixed use street segments are most common (49.1%). Mixed use street segments are the second most common type in Los Angeles, New York, Philadelphia, and Seattle, while commercial is the second most common type in San Antonio.

In terms of the relationship between indicators of place-based improvements and year-to-year changes in total crime at segments, the results show a consistent negative and significant relationship for both building permits and code enforcement citations (see Table 2). Specifically, a 1% increase in building permit activity is associated with a 0.2% to 0.4% decrease in total crime in Chicago, Philadelphia, and San Antonio. The estimated relationship is somewhat smaller (less than 0.1%) in Los Angeles, New York, and Seattle, but statistically and economically significant.[14] With respect to code enforcement citations, the relationship is of greater magnitude in Los Angeles, New York, and Seattle, with a 1% increase in code enforcement citations associated with a 0.3% to 0.5% decrease in total crime. The effect in Chicago, Philadelphia, and San Antonio was smaller, yet still significant, with a 1% increase in code enforcement associated with less than a 0.1 decline in total crime.

When observing the effects of adjacent street segment building permits and code enforcement citations on total crime, the coefficients are smaller (0.1 or less), but statistically significant. The only exception is adjacent segment building permit activity in Seattle, which was not associated with a statistically significant change in total crime. The absence of positive relationships indicates no evidence of immediate spatial displacement to nearby segments resulting from private investment and public regulation. Moreover, the significant and negative effects of adjacent segment building permits and code enforcement suggest place-based improvements at microplaces result in substantial spatial spillovers, whereby a diffusion of benefits produces declines in crime levels on neighboring street segments.

The findings also indicate a strong degree of persistence in crime trends at the microscale in all six cities, with a 1% increase in crime in the previous year associated with a 0.3% to 0.5% increase in crime in year *t*. In addition, a higher number of vacant lots on the segment and on surrounding segments is associated with higher levels of total crime in all cities. Relative to residential streets, commercial and mixed-use segments tend to have higher levels of crime, while the relationship is mixed but mostly negative for industrial streets (exceptions are Seattle, where it is positive and

[14]Though explaining cross-city differences is beyond the scope of the present study, difference of coefficients tests (Paternoster et al., 1998) reveal that the reported effect sizes vary significantly ($p < .01$) between cities, with the exception of the effect of building permits on total crime and property crime in Chicago and San Antonio; the effect of code enforcement on disorder in Los Angeles and San Antonio; and the effect of code enforcement on other crime types in San Antonio and Seattle.

Table 2. Building permits, code enforcement, and total crime, spatial Durbin model.

	Chicago	Los Angeles	New York	Philadelphia	San Antonio	Seattle
Crime Lag 1 (IHS)	0.409***	0.524***	0.355***	0.426***	0.415***	0.274***
	(0.00140)	(0.00112)	(0.00114)	(0.00136)	(0.00168)	(0.00208)
Building Permit Lag 1 (IHS)	−0.380***	−0.0979***	−0.0569***	−0.224***	−0.377***	−0.0722***
	(0.00160)	(0.00137)	(0.00107)	(0.00155)	(0.00241)	(0.00234)
Code Enforcement Lag 1 (IHS)	−0.0625***	−0.484***	−0.283***	−0.0854***	−0.0937***	−0.260***
	(0.00128)	(0.00165)	(0.00127)	(0.00130)	(0.00217)	(0.00291)
Number of Vacant Lots	0.0611***	0.00372***	0.0398***	0.00725***	0.00962***	0.147***
	(0.00083)	(0.000564)	(0.000602)	(0.000752)	(0.000894)	(0.0149)
Land Use (ref. = Residential)						
Commercial	0.188***	0.0408***	0.147***	0.0711***	0.268***	0.179***
	(0.00734)	(0.00489)	(0.00559)	(0.00626)	(0.00626)	(0.00932)
Industrial	−0.0919***	−0.0220**	−0.0508***	−0.0537***	0.0353	0.131***
	(0.01280)	(0.00800)	(0.0124)	(0.0119)	(0.0314)	(0.0173)
Mixed Use	0.0940***	0.0377***	0.0496***	0.0783***	0.0893***	0.153***
	(0.00364)	(0.00397)	(0.00325)	(0.00384)	(0.00634)	(0.00844)
Neighbors Crime Lag 1 (IHS)	0.0891***	0.219***	0.233***	0.304***	0.0984***	0.146***
	(0.00253)	(0.00165)	(0.00182)	(0.00221)	(0.00231)	(0.00308)
Neighbors Building Permit Lag 1 (IHS)	−0.0549***	−0.0114***	−0.00313*	−0.0850***	−0.0715***	0.00193
	(0.00203)	(0.00123)	(0.00121)	(0.00142)	(0.00191)	(0.00335)
Neighbors Code Enforcement Lag 1 (IHS)	−0.0191***	−0.112***	−0.144***	−0.0683***	−0.0124***	−0.116***
	(0.00168)	(0.00122)	(0.00130)	(0.00137)	(0.00187)	(0.00294)
Neighbors Number of Vacant Lots	0.00894***	0.00217***	0.0142***	0.00363***	0.00116**	0.0686***
	(0.00033)	(0.000262)	(0.000267)	(0.000300)	(0.000416)	(0.00682)
Neighbors Land Use (ref. = Residential)						
Neighbors Commercial	0.111***	0.116***	0.125***	0.0108	0.325***	0.171***
	(0.02320)	(0.00980)	(0.0127)	(0.0135)	(0.00885)	(0.0188)
Neighbors Industrial	−0.142***	0.0876***	0.0639**	−0.217***	−0.00335	0.0408
	(0.03310)	(0.0145)	(0.0248)	(0.0248)	(0.0846)	(0.0486)
Neighbors Mixed Use	0.0730***	0.190***	0.180***	0.224***	0.234***	0.323***
	(0.00544)	(0.00334)	(0.00352)	(0.00421)	(0.00485)	(0.00625)
N	399,579	701,649	614,700	378,564	336,828	179,932
Adj. *R*-sq	0.424	0.643	0.641	0.582	0.555	0.523
Block group fixed effect	X	X	X	X	X	X
Tract-year fixed effect	X	X	X	X	X	X

Notes: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Robust standard errors in parentheses, clustered at the census tract level.

significant, and San Antonio, where the relationship is not significant). Similar relationships are found for the surrounding streets with neighboring segments that are industrial having more of a mixed relationship with crime (negative and significant in Chicago and Philadelphia, positive and significant in Los Angeles and New York City, and nonsignificant in San Antonio and Seattle).

In addition to total crime, we also examined the relationship between place-based improvements and each crime type (i.e. violent crime, property crime, disorder, and other crime). These results are largely consistent with the overall results, with higher building permit and code enforcement citations associated with declines in crime. There are, however, differences in magnitude by crime type. Table 3 reports the results for violent crime. The findings are consistent with the total crime models indicating negative and significant effects of building permits and code enforcement citations on changes in violent crime. The magnitude of the relationship for building permit activity is similar to total crime, with 1% higher building permit activity associated with a 0.2% to 0.4% decrease in crime levels in Chicago, Philadelphia, and San Antonio; the estimated effect is less than 0.1% in Los Angeles, New York, and Seattle but statistically significant. The three cities with weaker building permit effects on violent crime experienced stronger code enforcement effects, similar to the results for total crime. In Los Angeles, New York, and Seattle, a 1% increase in code enforcement citations is associated with a 0.1% to 0.6% decrease in violent crime; the magnitude is less than 0.1% in Chicago, Philadelphia, and San Antonio but still statistically significant. As with total crime, spatial spillovers were observed in all cities, with adjacent segment building permits and code enforcement citations negatively and significantly related to violent crime (with the exception of building permits in New York City).

Table 4 presents the results for property crime. Of all the crime types, the observed effects of both building permits and code enforcement are strongest for property crimes across all cities. Negative and significant effects for building permits and code enforcement citations on changes in property crime at street segments are observed for all cities. The magnitude of these relationships ranges from −0.09 in New York to −0.5 in Chicago and San Antonio for a 1% increase in building permit activity and −0.1 in Chicago and Philadelphia to −0.8 in Los Angeles for a 1% increase in code enforcement. Evidence of diffusion of benefits is also strongest for property crime. For both adjacent segment building permits and code enforcement, the effect on property crime across all study cities was negative and statistically significant, with the largest magnitude of spatial spillover for any crime type.

Although building permits and code enforcement exert consistent negative and significant effects on public disorder crimes and other crimes, the magnitude of these relationships is not as strong as those observed for property and violent crime. An exception is in Los Angeles, where permit activity is associated with *increases* in disorder and other crimes, although the size of the estimated relationships is small; a 1% increase in building permits increases disorder and other crimes by 0.03% and 0.06%, respectively. With respect to investment activity and code enforcement on surrounding segments, the effects tend to be substantially smaller than those resulting from changes on the street segment itself, but the relationships remain negative and statistically significant (Tables 5 and 6).

Table 3. Building permits, code enforcement, and violent crime, spatial Durbin model.

	Chicago	Los Angeles	New York	Philadelphia	San Antonio	Seattle
Crime Lag 1 (IHS)	0.434***	0.565***	0.401***	0.485***	0.355***	0.141***
	(0.00130)	(0.00120)	(0.00129)	(0.00167)	(0.00132)	(0.00134)
Building Permit Lag 1 (IHS)	−0.430***	−0.0399***	−0.0686***	−0.273***	−0.313***	−0.0337***
	(0.00147)	(0.00146)	(0.00121)	(0.00189)	(0.00190)	(0.00151)
Code Enforcement Lag 1 (IHS)	−0.0607***	−0.594***	−0.322***	−0.0795***	−0.0952***	−0.136***
	(0.00118)	(0.00176)	(0.00144)	(0.00158)	(0.00170)	(0.00188)
Number of Vacant Lots	0.0582***	0.0107***	0.0294***	0.0170***	0.0122***	0.0183
	(0.000767)	(0.000602)	(0.000682)	(0.000918)	(0.000703)	(0.00960)
Land Use (ref. = Residential)						
Commercial	0.130***	0.0676***	0.161***	0.00842	0.0654***	0.0189**
	(0.00679)	(0.00522)	(0.00633)	(0.00764)	(0.00492)	(0.00601)
Industrial	−0.0890***	−0.0680***	0.00980	−0.0880***	0.0546*	−0.0000880
	(0.0119)	(0.00854)	(0.0140)	(0.0145)	(0.0247)	(0.0112)
Mixed Use	0.0692***	0.0586***	0.0918***	0.0818***	0.0287***	0.0402***
	(0.00337)	(0.00424)	(0.00368)	(0.00468)	(0.00498)	(0.00544)
Neighbors Crime Lag 1 (IHS)	0.0506***	0.274***	0.325***	0.324***	0.0196***	0.123***
	(0.00234)	(0.00176)	(0.00206)	(0.00270)	(0.00182)	(0.00199)
Neighbors Building Permit Lag 1 (IHS)	−0.0442***	−0.0493***	−0.00261	−0.122***	−0.0392***	−0.0355***
	(0.00187)	(0.00132)	(0.00137)	(0.00173)	(0.00150)	(0.00216)
Neighbors Code Enforcement Lag 1 (IHS)	−0.0120***	−0.104***	−0.217***	−0.0699***	−0.0244***	−0.0865***
	(0.00156)	(0.00130)	(0.00147)	(0.00167)	(0.00147)	(0.00190)
Neighbors Number of Vacant Lots	0.00510***	0.0000143	0.0176***	−0.00206***	−0.00176***	0.0225***
	(0.000309)	(0.000280)	(0.000302)	(0.000367)	(0.000327)	(0.00440)
Neighbors Land Use (ref. = Residential)						
Neighbors Commercial	0.101***	0.101***	−0.0174	0.0321	−0.116***	−0.0113
	(0.0215)	(0.0105)	(0.0143)	(0.0164)	(0.00696)	(0.0121)
Neighbors Industrial	0.0645*	0.00131	0.0111	−0.154***	−0.0633	0.0140
	(0.0306)	(0.0155)	(0.0280)	(0.0302)	(0.0666)	(0.0314)
Neighbors Mixed Use	0.0680***	0.191***	0.0839***	0.129***	0.00957*	0.0339***
	(0.00503)	(0.00356)	(0.00399)	(0.00513)	(0.00381)	(0.00403)
N	399,579	701,649	614,700	378,564	336,828	179,932
Adj. R-sq	0.468	0.674	0.587	0.509	0.391	0.342
Block group fixed effect	X	X	X	X	X	X
Tract-year fixed effect	X	X	X	X	X	X

Notes: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Robust standard errors in parentheses, clustered at the census tract level.

Table 4. Building permits, code enforcement, and property crime, spatial Durbin model.

	Chicago	Los Angeles	New York	Philadelphia	San Antonio	Seattle
Crime Lag 1 (IHS)	0.506***	0.711***	0.450***	0.479***	0.561***	0.384***
	(0.00137)	(0.000917)	(0.00130)	(0.00158)	(0.00154)	(0.00173)
Building Permit Lag 1 (IHS)	−0.518***	−0.128***	−0.0941***	−0.337***	−0.516***	−0.103***
	(0.00156)	(0.00112)	(0.00122)	(0.00179)	(0.00221)	(0.00194)
Code Enforcement Lag 1 (IHS)	−0.125***	−0.823***	−0.374***	−0.119***	−0.224***	−0.389***
	(0.00125)	(0.00135)	(0.00145)	(0.00150)	(0.00199)	(0.00241)
Number of Vacant Lots	0.0692***	0.0116***	0.0230***	0.0252***	0.0208***	0.0780***
	(0.000811)	(0.000459)	(0.000687)	(0.000871)	(0.000820)	(0.0123)
Land Use (ref. = Residential)						
Commercial	0.141***	−0.0224***	0.123***	0.0606***	0.172***	0.0329***
	(0.00717)	(0.00399)	(0.00637)	(0.00724)	(0.00574)	(0.00773)
Industrial	−0.0284*	−0.0259***	0.0662***	−0.00654	0.146***	−0.0934***
	(0.0126)	(0.00652)	(0.0141)	(0.0138)	(0.0288)	(0.0143)
Mixed Use	0.0531***	0.0289***	0.0541***	0.0720***	0.0629***	0.0486***
	(0.00356)	(0.00324)	(0.00371)	(0.00444)	(0.00581)	(0.00700)
Neighbors Crime Lag 1 (IHS)	0.0226***	0.135***	0.320***	0.249***	−0.0543***	0.254***
	(0.00247)	(0.00135)	(0.00208)	(0.00256)	(0.00212)	(0.00255)
Neighbors Building Permit Lag 1 (IHS)	−0.00747***	−0.0175***	−0.00911***	−0.101***	−0.0220***	−0.0680***
	(0.00198)	(0.00100)	(0.00138)	(0.00164)	(0.00175)	(0.00278)
Neighbors Code Enforcement Lag 1 (IHS)	−0.0240***	−0.0843***	−0.231***	−0.104***	−0.0598***	−0.217***
	(0.00164)	(0.000994)	(0.00148)	(0.00159)	(0.00171)	(0.00244)
Neighbors Number of Vacant Lots	0.00811***	0.000469*	0.00993***	−0.00591***	−0.00393***	0.0478***
	(0.000326)	(0.000214)	(0.000304)	(0.000348)	(0.000382)	(0.00566)
Neighbors Land Use (ref. = Residential)						
Neighbors Commercial	0.114***	−0.132***	0.0114	−0.0915***	−0.0311***	−0.0838***
	(0.0227)	(0.00798)	(0.0144)	(0.0156)	(0.00812)	(0.0155)
Neighbors Industrial	−0.0379	−0.0450***	0.0410	−0.272***	−0.00870	−0.0186
	(0.0324)	(0.0119)	(0.0282)	(0.0287)	(0.0776)	(0.0403)
Neighbors Mixed Use	0.0347***	0.0543***	0.0609***	0.149***	0.0629***	0.0636***
	(0.00532)	(0.00272)	(0.00401)	(0.00487)	(0.00445)	(0.00518)
N	399,579	701,649	614,700	378,564	336,828	179,932
Adj. *R*-sq	0.465	0.798	0.593	0.491	0.561	0.652
Block group fixed effect	X	X	X	X	X	X
Tract-year fixed effect	X	X	X	X	X	X

Notes: * $p < .05$, ** $p < .01$, *** $p < .001$. Robust standard errors in parentheses, clustered at the census tract level.

Table 5. Building permits, code enforcement, and disorder crime, spatial Durbin model.

	Chicago	Los Angeles	New York	Philadelphia	San Antonio	Seattle
Crime Lag 1 (IHS)	0.200***	0.0309***	0.220***	0.344***	0.265***	0.0773***
	(0.000989)	(0.000422)	(0.00111)	(0.00162)	(0.00127)	(0.00109)
Building Permit Lag 1 (IHS)	−0.182***	0.00287***	−0.0348***	−0.155***	−0.250***	−0.0182***
	(0.00113)	(0.000514)	(0.00104)	(0.00184)	(0.00182)	(0.00122)
Code Enforcement Lag 1 (IHS)	−0.0248***	−0.0321***	−0.171***	−0.0568***	−0.0319***	−0.0725***
	(0.000903)	(0.000620)	(0.00123)	(0.00154)	(0.00164)	(0.00152)
Number of Vacant Lots	0.0338***	0.000752***	0.0127***	0.0152***	0.00179**	0.00228
	(0.000586)	(0.000212)	(0.000586)	(0.000892)	(0.000675)	(0.00779)
Land Use (ref. = Residential)						
Commercial	0.117***	0.00188	0.0525***	−0.0123	0.0878***	0.0418***
	(0.00518)	(0.00184)	(0.00544)	(0.00742)	(0.00473)	(0.00488)
Industrial	0.0127	−0.00923**	0.0391**	−0.0449**	−0.0110	0.0425***
	(0.00906)	(0.00300)	(0.0121)	(0.0141)	(0.0237)	(0.00904)
Mixed Use	0.0620***	0.00528***	0.0402***	0.0733***	0.0425***	0.0314***
	(0.00257)	(0.00149)	(0.00316)	(0.00455)	(0.00479)	(0.00441)
Neighbors Crime Lag 1 (IHS)	0.0876***	0.0232***	0.207***	0.314***	0.121***	0.0830***
	(0.00179)	(0.000620)	(0.00177)	(0.00262)	(0.00175)	(0.00161)
Neighbors Building Permit Lag 1 (IHS)	−0.0755***	−0.00136**	−0.0102***	−0.0959***	−0.0858***	−0.0375***
	(0.00143)	(0.000463)	(0.00118)	(0.00168)	(0.00144)	(0.00175)
Neighbors Code Enforcement Lag 1 (IHS)	−0.00945***	−0.00981***	−0.120***	−0.0416***	−0.00352*	−0.0453***
	(0.00119)	(0.000458)	(0.00126)	(0.00163)	(0.00141)	(0.00154)
Neighbors Number of Vacant Lots	0.00247***	0.000114	0.00741***	0.0103***	0.00325***	−0.00600
	(0.000236)	(0.0000984)	(0.000259)	(0.000356)	(0.000314)	(0.00357)
Neighbors Land Use (ref. = Residential)						
Neighbors Commercial	0.0646***	0.0117**	−0.0367**	0.0133	0.0196**	−0.136***
	(0.0164)	(0.00368)	(0.0123)	(0.0160)	(0.00669)	(0.00981)
Neighbors Industrial	−0.00550	0.00402	0.0111	0.0142	0.0806	−0.0868***
	(0.0234)	(0.00546)	(0.0241)	(0.0294)	(0.0639)	(0.0254)
Neighbors Mixed Use	0.0265***	0.00979***	0.0286***	0.0487***	0.0223***	0.00358
	(0.00384)	(0.00125)	(0.00342)	(0.00499)	(0.00366)	(0.00327)
N	399,579	701,649	614,700	378,564	336,828	179,932
Adj. *R*-sq	0.435	0.109	0.551	0.497	0.393	0.323
Block group fixed effect	X	X	X	X	X	X
Tract-year fixed effect	X	X	X	X	X	X

Notes: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Robust standard errors in parentheses, clustered at the census tract level.

Table 6. Building permits, code enforcement, and other crime, spatial Durbin model.

	Chicago	Los Angeles	New York	Philadelphia	San Antonio	Seattle
Crime Lag 1 (IHS)	0.192***	0.306***	0.288***	0.559***	0.504***	0.132***
	(0.000977)	(0.00115)	(0.00121)	(0.00178)	(0.00144)	(0.00133)
Building Permit Lag 1 (IHS)	−0.190***	0.00588***	−0.0468***	−0.282***	−0.469***	−0.0367***
	(0.00111)	(0.00140)	(0.00113)	(0.00202)	(0.00206)	(0.00149)
Code Enforcement Lag 1 (IHS)	−0.00920***	−0.318***	−0.229***	−0.120***	−0.134***	−0.129***
	(0.000892)	(0.00169)	(0.00135)	(0.00169)	(0.00185)	(0.00185)
Number of Vacant Lots	0.0382***	0.00671***	0.0202***	0.0193***	0.00632***	0.0202*
	(0.000579)	(0.000577)	(0.000640)	(0.000982)	(0.000764)	(0.00949)
Land Use (ref. = Residential)						
Commercial	−0.00683	−0.0195***	0.152***	−0.00257	0.109***	0.0576***
	(0.00512)	(0.00500)	(0.00594)	(0.00817)	(0.00535)	(0.00594)
Industrial	−0.0569***	−0.0818***	0.0874***	−0.0577***	0.0297	0.0302**
	(0.00895)	(0.00818)	(0.0132)	(0.0156)	(0.0268)	(0.0110)
Mixed Use	0.00265	0.0210***	0.0675***	0.0862***	0.0318***	0.0267***
	(0.00254)	(0.00407)	(0.00345)	(0.00501)	(0.00542)	(0.00538)
Neighbors Crime Lag 1 (IHS)	−0.00178	0.181***	0.283***	0.423***	0.0777***	0.0991***
	(0.00176)	(0.00169)	(0.00194)	(0.00288)	(0.00198)	(0.00196)
Neighbors Building Permit Lag 1 (IHS)	−0.00744***	−0.0205***	−0.00865***	−0.138***	−0.0828***	−0.0356***
	(0.00141)	(0.00126)	(0.00129)	(0.00185)	(0.00163)	(0.00214)
Neighbors Code Enforcement Lag 1 (IHS)	0.00543***	−0.0749***	−0.175***	−0.0789***	−0.0161***	−0.0693***
	(0.00117)	(0.00125)	(0.00138)	(0.00179)	(0.00160)	(0.00188)
Neighbors Number of Vacant Lots	0.00184***	0.000269	0.0118***	0.00566***	0.000513	0.0103*
	(0.000233)	(0.000268)	(0.000283)	(0.000392)	(0.000356)	(0.00435)
Neighbors Land Use (ref. = Residential)						
Neighbors Commercial	0.0691***	0.0418***	0.0506***	−0.0357*	0.0475***	−0.0354**
	(0.0162)	(0.0100)	(0.0134)	(0.0176)	(0.00757)	(0.0120)
Neighbors Industrial	−0.00451	0.0375*	0.108***	0.113***	0.125	−0.0658*
	(0.0231)	(0.0149)	(0.0263)	(0.0323)	(0.0724)	(0.0310)
Neighbors Mixed Use	0.0152***	0.0448***	0.0607***	0.129***	0.0376***	0.0332***
	(0.00379)	(0.00341)	(0.00374)	(0.00549)	(0.00415)	(0.00398)
N	399,579	701,649	614,700	378,564	336,828	179,932
Adj. *R*-sq	0.249	0.379	0.492	0.564	0.587	0.268
Block group fixed effect	X	X	X	X	X	X
Tract-year fixed effect	X	X	X	X	X	X

Notes: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Robust standard errors in parentheses, clustered at the census tract level.

Discussion

There is now a well-established body of research documenting the concentration and general stability of crime at microplaces, leading to calls for focusing crime prevention at lower levels of geography for more efficient and effective intervention (e.g. Weisburd et al., 2014). While the evidence of such spatiotemporal patterns comes from numerous cities, research on what accounts for *change* in crime at a city's microplaces is limited. The results from our analyses of data from six U.S. cities reveal that two mechanisms for place-based improvements – private investment in the form of building permits and public regulation in the form of municipal code enforcement – were significantly associated with changes in crime at street segments over time in all six cities. We observed no evidence of immediate spatial displacement to adjacent segments. Rather, findings indicate moderate diffusion of benefits: code enforcement citations on neighboring segments were significantly associated with reductions in crime in all six cities, as were building permits in five of six cities.

While building permits and code enforcement were significantly related to changes in all types of crime across all study cities, additional research is needed to explore the extent and sources of crime type-specific and city-specific effects. For example, the effect sizes were consistently largest for property crime, perhaps indicating that property crime might be more susceptible to the potential criminal opportunity reduction and informal social control that accompanies place-based improvements. While effects were significant for all study cities, the effect size of building permits was largest in Chicago, San Antonio, and Philadelphia, while the effect size of code enforcement was largest in Los Angeles, Seattle, and New York. Although additional research is needed to explore the extent of cross-city differences and their sources, potential explanations include varying regulatory environments, development pace, and population growth. For example, research suggests that coastal markets are generally more highly regulated (Gyourko et al., 2008), and each city has different processes, procedures, and priorities for code enforcement that may change by administration. Bartram (2019) found building inspectors in Chicago tend to target professional landlords and wealthy homeowners in issuing code violations, which is counter to what is often discussed in the literature about the allocation of code enforcement functioning as an extension of the criminal justice system and reproducing economic and racial inequality (Huebner & Giuffre, 2022; Lieb, 2018).

Implications

Weisburd et al.'s (2012, 2014) findings from Seattle were pivotal in demonstrating the need to allocate scarce resources to smaller scales; in particular, they argued that their "results provide support for the application of formal social controls such as hot spots policing, and reason to consider applications of social prevention programs at the local level of chronic crime hot spots" (2014, p. 41). Our findings buttress theirs and suggest there is a case to be made for extending microscale intervention to include policies that incentivize and compel investment in high crime places. Such interventions could serve dual goals of improved public safety and economic development. High crime locations are often correlated with numerous physical and mental health consequences (e.g. Weisburd & White, 2019; Weisburd et al., 2018). While the mechanisms between these harms are not clearly understood, interventions that address safety and economic concerns seem promising and worthy of further investigation.

Indeed, the limited recent research on specific placed-based improvement programs indicates crime reduction can result from these practices outside of traditional policing strategies (e.g. Alonso et al., 2019; South et al., 2021). Policies do exist that incentivize and coerce place-based improvements, although they often target larger spatial scales. For example, the federal Tax Cuts and Jobs Act of 2017 incentivized development in underserved communities (Gelfond & Looney, 2018). Private investment in census tracts labeled as Opportunity Zones, certified by the U.S. Department of the Treasury as economically distressed neighborhoods, can defer tax on capital gains invested in a Qualified Opportunity Fund for up to nine years. That said, some observers have questioned whether the law permits state policymakers to designate relatively affluent areas as Opportunity Zones, and whether wealthy investors, not low-income communities and residents, largely accrue the benefits (e.g. Jacoby, 2019). Given that crime clusters at a small number of places *within* census tracts, incentivizing more targeted investment at may prove to be more efficient in both supporting local development and maximizing crime reduction.

As expressed by Worrall and Wheeler (2019), this does raise additional questions about *how* to target such action to avoid unintended negative consequences, such as exacerbating inequities that displace residents or differentially penalize underrepresented business owners. The aforementioned Basic Systems Repair Program, which offers small grants to low-income homeowners in Philadelphia, is one example of a program that provides direct investment to current residents (South et al., 2021). Moreover, targeted code enforcement might be best prioritized at those properties with owners who have multiple high crime properties. Recent work by Lee and Eck (2022) demonstrates how the long-observed relationships between place types and crime are diminished once land parcels are clustered by owner, highlighting the importance of poor management practices in producing crime at microplaces. Interventions with owners of multiple high crime properties may prove to be particularly efficient.

There is the opportunity to capitalize on existing programs and resources by prioritizing efforts on smaller spatial scales to maximize crime prevention benefits. Every city has programs that target community and economic development investment. The six cities included in this study have dozens of existing initiatives, from a series of home repair programs, such as Under 1 Roof, Owner-Occupied Rehabilitation and Reconstruction, and Green & Healthy Homes in San Antonio; retail business tax exempt programs like Accelerated Sales Tax Exemption Program (ASTEP) in New York City that supports the construction and renovation of spaces for food retail business in underserved communities; to entire citywide planning initiatives such as We Will Chicago and OurLA. Rarely, however, is crime reduction an explicit goal and measured outcome of these programs. Yet the results of this study suggest that leveraging these existing initiatives for crime prevention may yield additional public benefits. For example, working in conjunction with analysts from police departments, municipal community and economic development officials may want to consider including crime in the criteria for prioritization efforts. Furthermore, city personnel may challenge the notion of planning initiatives and programs at the emblematic neighborhood scale and instead apply these criteria at smaller scales for the most impactful allocation of resources.

Study Limitations and Future Research

Although the current study's methodology has many strengths, there are some limitations that warrant further discussion and offer directions for future research. While one strength of our study is the use of data from six cities, not all cities provide the same level of detail about permit activity (e.g. types of permits, dollar value of improvement) and code enforcement (e.g. types of violations, compliance, etc.). As such, the measurement of our key independent variables – counts of building permits and code enforcement citations – may not fully capture the variation in private investment and public regulation that spur subsequent place-based improvements. Although we observed significant effects across all cities, more precise measures of place-based improvements may in fact reveal more nuanced relationships than those reported in the current study. For example, Kim and Wo (2021), examining the effects of the demolition process and demolition types on crime in Los Angeles, found that different stages and types of demolition had varying effects on crime reduction (e.g. permitted demolition had a greater impact than completed demolitions on burglary reduction for residential but not commercial properties). Future research examining the effects of building permits should distinguish between residential versus commercial, new construction versus renovation, building permits over certain dollar amounts, and/or by trade (e.g. electrical, plumbing, etc.). Similarly, code enforcement can be further categorized by land use/zoning (residential, commercial, industrial, etc.) or code types (e.g. building safety concerns, illegal dumping of garbage, land use violations, noise disturbances, etc.).

The current study reports significant effects of building permits and code enforcement across a diverse set of cities, thus strengthening external validity. Moreover, we relied on observational data over a substantial period of time across six diverse cities. However, we did use data over a specific period of time marked by general urban growth, protests against the police, and decline in overall crime (although violent crime did begin to rise in 2014). It is unclear whether such relationships exist in different social and economic contexts. Research using data from the 1970s and 1980s (or data from specific cities that experienced continued decline into the 2000s and 2010s, or pandemic era data) would be useful to confirm whether the findings can be replicated in different historical periods. More research is needed to confirm whether similar effects are found using experimental or quasi-experimental approaches (e.g. South et al., 2021), as well as whether crime reduction can be linked to changes in *incentives* to invest in an area (e.g. Spader et al., 2016) or code violation enforcement policies.

Similar to many other studies examining the spatiotemporal crime patterns of cities, we used street segments as the unit of analysis, a decision guided by methodological and theoretical considerations. As Weisburd et al. (2014) have argued, the location accuracy of policing data coded to the segment is likely much better than that coded to the address or parcel. Moreover, every effort was made in the present study to create measurement consistency across the six study cities; we suspect that location accuracy differences across cities are mitigated by aggregating to the segment relative to the address or parcel. In addition, using address-years would have resulted in many more zeros for our measures of investment, code enforcement, and crime, with most addresses not experiencing these during the study. One criticism of using street segments is that investment and code enforcement are targeted at specific properties, not segments as a whole. Yet there are theoretical and empirical reasons to suspect that the potential public safety benefits are not limited to the specific property. For example, Linning and Eck (2021) recently proposed a "Neo-Jacobian perspective" that draws on Jane Jacobs' (1961) work and the importance of shop keepers, property owners, and government agencies in cities, arguing that management at "places" (i.e. addresses) by these actors can produce crime control along street segments and even larger areas. Empirically, the findings reported herein related to the effects of building permits and code enforcement on *adjacent* segments is consistent with the premise that nearby microgeographic units can influence one another. That said, we do encourage additional research that can distinguish the effects of place-based improvements on crime at the parcel versus street segment.

Finally, while our findings suggest place-based improvements to microplaces are a promising crime reduction tool, prior research suggests that microplace characteristics do not uniformly encourage or discourage crime, but rather can interact with other factors to influence crime patterns. Recent research by Tillyer et al. (2021), for example, tested hypotheses regarding the moderating influence of census block group-level characteristics on the relationship between block-level characteristics and crime. They found that particular place types often labeled as "crime generators" (e.g. bars, liquor stores, convenience stores, gas stations, etc.) were more strongly related to block-level crime in neighborhoods with high levels of concentrated disadvantage and vehicular traffic, while these same place types were less criminogenic on blocks in communities with high levels of civic engagement. This raises the question of whether there are factors that might amplify or depress the crime reductive benefits of economic investment and regulation. Indeed, two recent studies in Philadelphia suggest that the influence of place-based investments on crime at microplaces may vary depending on the broader context. MacDonald et al. (2022) estimated the impact of vacant lot greening on crime and the moderating influence of nearby land use. Vacant lot greening was associated with a decline in crime, although the effect was smaller near train stations and alcohol outlets and larger near active businesses. Similarly, the City of Philadelphia's Basic Systems Repair Program (BSRP), which provided grants to low-income homeowners to make structural home repairs, was associated with significant reductions in crime, with reductions greatest in areas in the highest crime quartile (South et al., 2021). Future research should explore the ways in which the effects of investment and regulation on crime might vary depending on context.

Conclusion

Prior work on the study of crime and place indicates that changes at relatively few microplaces can have an outsized impact on a city's overall crime level. The current study's findings reveal that two indicators of place-based improvements – private investment in the form of building permits and public regulation in the form of code enforcement – are significantly related to year-to-year changes in crime at microplaces across six large U.S. cities. These findings suggest public safety planning should go beyond policing strategies to include efforts that incentivize and compel physical improvements to high crime microplaces, including redirecting existing resources allocated for community and economic development investment typically distributed at the mesolevel.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Acknowledgement

Data provided by Zillow through the Zillow Transaction and Assessment Dataset (ZTRAX). More information on accessing the data can be found at http://www.zillow.com/ztrax. The results and opinions are those of the author(s) and do not reflect the position of Zillow Group. We thank Phil Hurvitz for facilitating access to the Ztrax data. Support for data access and analyses for this research through the UW Data Collaborative came from the UW's Population Health Initiative, UW's Student Technology Fee program, the UW's Provost's office, and a Eunice Kennedy Shriver National Institute of Child Health and Human Development research infrastructure grant, P2C HD042828, to the Center for Studies in Demography & Ecology at the University of Washington.

Funding

This material is based upon work supported by the U.S. Department of Homeland Security under Grant Award Number 17STCIN00001-05-00. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Department of Homeland Security.

References

Accordino, J., & Johnson, G. T. (2000). Addressing the vacant and abandoned property problem. *Journal of Urban Affairs*, *22*(3), 301–315. https://doi.org/10.1111/0735-2166.00058

Acolin, A., Walter, R. J., Tillyer, M. S., Lacoe, J., & Bostic, R. (2022). Spatial spillover effects of crime on private investment at nearby micro-places. *Urban Studies*, *59*(4), 834–850. https://doi.org/10.1177/00420980211029761

Alonso, J. M., Andrews, R., & Jorda, V. (2019). Do neighborhood renewal programs reduce crime rates? Evidence from England. *Journal of Urban Economics*, *110*, 51–69. https://doi.org/10.1016/j.jue.2019.01.004

Andresen, M. A., Curman, A. S., & Linning, S. J. (2017). The trajectories of crime at places: Understanding the patterns of disaggregated crime types. *Journal of Quantitative Criminology*, *33*(3), 427–449. https://doi.org/10.1007/s10940-016-9301-1

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*(1), 58–82. https://doi.org/10.1177/0022427810384136

Ariel, B., Sherman, L. W., & Newton, M. (2020). Testing hot-spots police patrols against no-treatment controls: Temporal and spatial deterrence effects in the London Underground experiment. *Criminology*, *58*(1), 101–128. https://doi.org/10.1111/1745-9125.12231

Bartram, R. (2019). Going easy and going after: Building inspections and the selective allocation of code violations. *City & Community*, *18*(2), 594–617. https://doi.org/10.1111/cico.12392

Bernasco, W. (2010). Modeling micro-level crime location choice: Application of the discrete choice framework to crime at places. *Journal of Quantitative Criminology*, *26*(1), 113–138. https://doi.org/10.1007/s10940-009-9086-6

Bernasco, W., & Block, R. (2009). Where offenders choose to attack: A discrete choice model of robberies in Chicago. *Criminology*, *47*(1), 93–130. https://doi.org/10.1111/j.1745-9125.2009.00140.x

Bernasco, W., & Block, R. (2011). Robberies in Chicago: A block-level analysis of the influence of crime generators, crime attractors, and offender anchor points. *Journal of Research in Crime and Delinquency*, *48*(1), 33–57. https://doi.org/10.1177/0022427810384135

Braga, A. A., Hureau, D. M., & Papachristos, A. V. (2011). The relevance of micro places to citywide robbery trends: A longitudinal analysis of robbery incidents at street corners and block faces in Boston. *Journal of Research in Crime and Delinquency*, *48*(1), 7–32. https://doi.org/10.1177/0022427810384137

Braga, A. A., Papachristos, A. V., & Hureau, D. H. (2010). The concentration and stability of gun violence at micro places in Boston, 1980–2008. *Journal of Quantitative Criminology*, *26*(1), 33–53. https://doi.org/10.1007/s10940-009-9082-x

Branas, C. C., Kondo, M. C., Murphy, S. M., South, E. C., Polsky, D., & MacDonald, J. M. (2016). Urban blight remediation as a cost-beneficial solution to firearm violence. *American Journal of Public Health*, *106*(12), 2158–2164.

Branas, C. C., South, E., Kondo, M. C., Hohl, B. C., Bourgois, P., Wiebe, D. J., & MacDonald, J. M. (2018). Citywide cluster randomized trial to restore blighted vacant land and its effects on violence, crime, and fear. *Proceedings of the National Academy of Sciences*, *115*(12), 2946–2951. https://doi.org/10.1073/pnas.1718503115

Branic, N., & Hipp, J. R. (2018). Growing pains or appreciable gains? Latent classes of neighborhood change, and consequences for crime in Southern California neighborhoods. *Social Science Research*, *76*, 77–91. https://doi.org/10.1016/j.ssresearch.2018.08.002

Brantingham, P. J., & Brantingham, P. L. (1981). *Environmental Criminology*. Sage Publications.

Brantingham, P. L., & Brantingham, P. J. (1995). Criminality of place: Crime generators and crime attractors. *European Journal on Criminal Policy and Research*, *3*(3), 5–26. https://doi.org/10.1007/BF02242925

Burbidge, J. B., Magee, L., & Robb, A. L. (1988). Alternative transformations to handle extreme values of the dependent variable. *Journal of the American Statistical Association*, *83*(401), 123–127. https://doi.org/10.1080/01621459.1988.10478575

Clarke, R. V., & Cornish, D. B. (1985). Modeling offenders' decisions: A framework for research and policy. *Crime and Justice*, *6*, 147–185. https://doi.org/10.1086/449106

Clarke, R. V., & Weisburd, D. (1994). Diffusion of crime control benefits: Observations on the reverse of displacement. In R. V. Clarke (Ed.), *Crime prevention studies* (Vol. 3). Criminal Justice Press.

Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*, *44*(4), 588–608. https://doi.org/10.2307/2094589

Cozens, P. (2008). Crime prevention through environmental design. In R. Wortley and L. Mazerolle (Eds.), *Environmental criminology and crime analysis*. Willan Publishing.

Curman, A. S. N., Andresen, M. A., & Brantingham, P. J. (2015). Crime and place: A longitudinal examination of street segment patterns in Vancouver, BC. *Journal of Quantitative Criminology*, *31*(1), 127–147. https://doi.org/10.1007/s10940-014-9228-3

de Chaisemartin, C., & D'Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review*, *110*(9), 2964–2996. https://doi.org/10.1257/aer.20181169

Delgado, M. S., & Florax, R. J. (2015). Difference-in-differences techniques for spatial data: Local autocorrelation and spatial interaction. *Economics Letters*, *137*, 123–126. https://doi.org/10.1016/j.econlet.2015.10.035
Dillman, K., Horn, K. M., & Verrilli, A. (2017). The what, where, and when of place-based housing policy's neighborhood effects. *Housing Policy Debate*, *27*(2), 282–305. https://doi.org/10.1080/10511482.2016.1172103
Eck, J. E. (1993). The threat of crime displacement. *Criminal Justice Abstracts*, *25*, 527–546.
Eck, J. E. (1994). *Drug markets and drug places: A case-control study of the spatial structure of illicit drug dealing* [Unpublished doctoral dissertation]. University of Maryland.
Eck, J. E. (1998). Preventing crime by controlling drug dealing on private rental property. *Security Journal*, *11*, 37–43. https://doi.org/10.1016/S0955-1662(98)00034-4
Eck, J. E. (2018a). Regulation for high-crime places: Theory, evidence, and principles. *The ANNALS of the American Academy of Political and Social Science*, *679*(1), 106–120. https://doi.org/10.1177/0002716218778764
Eck, J. E. (2018b). The opportunity structure for bad place management: A theory to assist effective regulation of high crime places. In J. E. Eck & D. Weisburd (Eds.), *Connecting crime to place: New directions in theory and policy*. Transaction.
Eck, J. E., & Eck, E. B. (2012). Crime place and pollution: Expanding crime reduction options through a regulatory approach. *Criminology & Public Policy*, *11*(2), 281–316. https://doi.org/10.1111/j.1745-9133.2012.00809.x
Eck, J. E., Gersh, J. S., & Taylor, C. (2000). Finding crime hot spots through repeat address mapping. In V. Goldsmith, P. G. McGuire, J. H. Mollenkopf, & T. A. Ross (Eds.), *Analyzing crime patterns: Frontiers of practice*. Sage Publications.
Elhorst, J. P. (2017). Spatial panel data analysis. In S. Shekhar, H. Xiong, & X. Zhou (Eds.), *Encyclopedia of GIS* (pp. 2050–2058). Springer.
Ellen, I. G., Lacoe, J., & Sharygin, C. A. (2013). Do foreclosures cause crime? *Journal of Urban Economics*, *74*, 59–70. https://doi.org/10.1016/j.jue.2012.09.003
Freedman, M., & Owens, E. G. (2011). Low-income housing development and crime. *Journal of Urban Economics*, *70*(2–3), 115–131. https://doi.org/10.1016/j.jue.2011.04.001
Friedline, T., Masa, R. D., & Chowa, G. A. N. (2015). Transforming wealth: Using the inverse hyperbolic sine (IHS) and splines to predict youth's math achievement. *Social Science Research*, *49*, 264–287.
Gelfond, H., & Looney, A. (2018). *Learning from opportunity zones: How to improve place-based policies*. Brookings Institution. https://www.brookings.edu/wp-content/uploads/2018/10/Looney_Opportunity-Zones_final.pdf
Getter, D. E. (2015). *The effectiveness of the Community Reinvestment Act*. Congressional Research Service.
Gill, C., Wooditch, A., & Weisburd, D. (2017). Testing the "law of crime concentration at place" in a suburban setting: Implications for research and practice. *Journal of Quantitative Criminology*, *33*(3), 519–545. https://doi.org/10.1007/s10940-016-9304-y
Groff, E. R. (2015). Informal social control and crime events. *Journal of Contemporary Criminal Justice*, *31*(1), 90–106. https://doi.org/10.1177/1043986214552619
Groff, E. R., Weisburd, D., & Yang, S. (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. https://doi.org/10.1007/s10940-009-9081-y
Guerette, R. T., & Bowers, K. J. (2009). Assessing the extent of crime displacement and diffusion of benefits: A review of situational crime prevention evaluations. *Criminology*, *47*(4), 1331–1368. https://doi.org/10.1111/j.1745-9125.2009.00177.x
Gyourko, J., Saiz, A., & Summers, A. (2008). A new measure of the local regulatory environment for housing markets: The Wharton Residential Land Use Regulatory Index. *Urban Studies*, *45*(3), 693–729. https://doi.org/10.1177/0042098007087341
Han, H., & Helm, S. (2020). Does demolition lead to a reduction in nearby crime associated with abandoned properties? *Housing Policy Debate*, 1–24. https://doi.org/10.1080/10511482.2020.1800776

Hesseling, R. B. P. (1994). Displacement: A review of the empirical literature. In R. V. Clarke (Ed.), *Crime prevention studies* (Vol. 3). Criminal Justice Press.
Huebner, B. M., & Giuffre, A. (2022). State monetary sanctions and the costs of the criminal legal System: How the system of monetary sanctions operates. *The Russell Sage Foundation. Journal of the Social Sciences*, *8*(1), 108–127.
Jacobs, J. (1961). *The death and life of great American cities*. Vintage.
Jacoby, S. (2019). Potential flaws of Opportunity Zones loom, as do risks of large-scale tax avoidance. *Center for Budget and Policy Priorities*. https://www.cbpp.org/sites/default/files/atoms/files/1-11-19tax.pdf
Jeffery, C. R. (1971). *Crime prevention through environmental design*. Sage.
Johnson, S. D., & Summers, L. (2015). Testing ecological theories of offender spatial decision making using a discrete choice model. *Crime and Delinquency*, *61*(3), 454–480.
Kim, Y., & Wo, J. (2021). A spatial and temporal examination of housing demolitions on crime in Los Angeles blocks. *Journal of Crime and Justice*, *44*(4), 441–457. https://doi.org/10.1080/0735648X.2020.1819376
Kondo, M. C., Keene, D., Hohl, B. C., MacDonald, J. M., & Branas, C. C. (2015). A difference-in-differences study of the effects of a new abandoned building remediation strategy on safety. *PLoS One*, *10*(7), 1–14.
Kreager, D. A., Lyons, C. J., & Hays, Z. R. (2011). Urban revitalization and Seattle crime, 1982-2000. *Social Problems*, *58*(4), 615–639.
Lacoe, J., Bostic, R. W., & Acolin, A. (2018). Crime and private investment in urban neighborhoods. *Journal of Urban Economics*, *108*, 154–169. https://doi.org/10.1016/j.jue.2018.11.001
Lambert, D. M., Brown, J. P., & Florax, R. J. (2010). A two-step estimator for a spatial lag model of counts: Theory, small sample performance and an application. *Regional Science and Urban Economics*, *40*(4), 241–252. https://doi.org/10.1016/j.regsciurbeco.2010.04.001
Lee, Y., Eck, J. E., O, S., & Martinez, N. N. (2017). How concentrated is crime at places? A systematic review from 1970 to 2015. *Crime Science*, *6*(1), 16. https://doi.org/10.1186/s40163-017-0069-x
Lee, Y., O, S., & Eck, J. E. (2022). Why your bar has crime but not mine: Resolving the land use and crime – risky facility conflict. *Justice Quarterly*, *39*(5), 1009–1035. https://doi.org/10.1080/07418825.2021.1903068
Lieb, E. (2018). Baltimore does not condone profiteering in squalor': The Baltimore Plan and the problem of housing-code enforcement in an American city. *Planning Perspectives*, *33*(1), 75–95. https://doi.org/10.1080/02665433.2017.1325774
Linning, S. J., & Eck, J. E. (2021). *Whose 'eyes on the street' control crime? Expanding place management into neighborhoods*. Cambridge University Press.
MacDonald, J. (2015). Community design and crime: The impact of housing and the built environment. *Crime and Justice*, *44*(1), 333–383. https://doi.org/10.1086/681558
MacDonald, J., Golinelli, D., Stokes, R. J., & Bluthenthal, R. (2010). The effect of business improvement districts on the incidence of violent crimes. *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention*, *16*(5), 327–332.
MacDonald, J., Nguyen, V., Jensen, S. T., & Branas, C. C. (2022). Reducing crime by remediating vacant lots: The moderating effect of nearby land use. *Journal of Experimental Criminology, 18*, 639–664. https://doi.org/10.1007/s11292-020-09452-9
MacDonald, J. M., & Stokes, R. J. (2020). Gentrification, land use, and crime. *Annual Review of Criminology*, *3*(1), 121–138. https://doi.org/10.1146/annurev-criminol-011419-041505
Madensen, T. D. (2007). *Bar management and crime: Toward a dynamic theory of place management and crime hotspots*. University of Cincinnati.
Montolio, D. (2018). The effects of local infrastructure investment on crime. *Labour Economics*, *52*, 210–230. https://doi.org/10.1016/j.labeco.2018.02.006
Moyer, R., MacDonald, J. M., Ridgeway, G., & Branas, C. C. (2019). Effect of remediating blighted vacant land on shootings: A citywide cluster randomized trial. *American Journal of Public Health*, *109*(1), 140–144. https://doi.org/10.2105/AJPH.2018.304752
Newman, O. (1972). *Defensible space: Crime prevention through urban design*. Macmillan.

O'Brien, D. T., & Winship, C. (2017). The gains of greater granularity: The presence and persistence of problem properties in urban neighborhoods. *Journal of Quantitative Criminology*, *33*(3), 649–674. https://doi.org/10.1007/s10940-016-9330-9

Papachristos, A. V., Smith, C. M., Scherer, M. L., & Fugiero, M. A. (2011). More coffee, less crime? The relationship between gentrification and neighborhood crime rates in Chicago, 1991 to 2005. *City & Community*, *10*(3), 215–240. https://doi.org/10.1111/j.1540-6040.2011.01371.x

Paternoster, R., Brame, R., Mazerolle, P., & Piquero, A. (1998). Using the correct statistical test for the equality of regression coefficients. *Criminology*, *36*(4), 859–866. https://doi.org/10.1111/j.1745-9125.1998.tb01268.x

Ramey, D. M., & Shrider, E. A. (2014). New parochialism, sources of community investment, and the control of street crime. *Criminology & Public Policy*, *13*(2), 193–216. https://doi.org/10.1111/1745-9133.12074

Rohe, W. M., & Galster, G. C. (2014). The community development block grant program turns 40: Proposals for program expansion and reform. *Housing Policy Debate*, *29*, 44–61.

Sampson, R. J. (1989). The impact of housing policies on community social disorganization and crime. *Bulletin of the New York Academy of Medicine*, *66*(5), 526–522.

Sampson, R. J., Eck, J. E., & Dunham, J. (2010). Super controllers and crime prevention: A routine activity explanation of crime prevention success and failure. *Security Journal*, *23*(1), 37–51. https://doi.org/10.1057/sj.2009.17

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science (New York, N.Y.)*, *277*(5328), 918–924.

Saporu, D. F., Patton, C. L., III, Krivo, L. J., & Peterson, R. D. (2011). Differential benefits? Crime and community investments in racially distinct neighborhoods. *Race and Justice*, *1*(1), 79–102. https://doi.org/10.1177/2153368710396381

Scott, M. S. (2004). Shifting and sharing police responsibility to address public safety problems. In N. Tilley (Ed.), *Handbook of crime prevention and community safety*. Willan.

Shaw, C. R., & McKay, H. D. (1942). *Juvenile Delinquency and Urban Areas*. University of Chicago Press.

Sherman, L. W., Gartin, P. R., & Buerger, M. E. (1989). Hot spots of predatory crime: Routine activities and the criminology of place. *Criminology*, *27*(1), 27–56. https://doi.org/10.1111/j.1745-9125.1989.tb00862.x

Shrider, E. A., & Ramey, D. M. (2018). Priming the pump: Public investment, private mortgage investment, and violent crime. *City & Community*, *17*(4), 996–1014. https://doi.org/10.1111/cico.12344

Smith, W. R., Frazee, S. G., & Davison, E. L. (2000). Furthering the integration of routine activity and social disorganization theories: Small units of analysis and the study of street robbery as a diffusion process. *Criminology*, *38*(2), 489–524. https://doi.org/10.1111/j.1745-9125.2000.tb00897.x

South, E. C., MacDonald, J., & Reina, V. (2021). Association between structural housing repairs for low-income homeowners and neighborhood crime. *JAMA Network Open*, *4*(7), e2117067.

Spader, J., Schuetz, J., & Cortes, A. (2016). Fewer vacants, fewer crimes? Impacts of neighborhood revitalization policies on crime. *Regional Science and Urban Economics*, *60*, 73–84. https://doi.org/10.1016/j.regsciurbeco.2016.07.005

Stacy, C. P. (2018). The effect of vacant building demolitions on crime under depopulation. *Journal of Regional Science*, *58*(1), 100–115. https://doi.org/10.1111/jors.12350

Tillyer, M. S., & Walter, R. J. (2019). Busy businesses and busy contexts: The distribution and sources of crime at commercial properties. *Journal of Research in Crime and Delinquency*, *56*(6), 816–850. https://doi.org/10.1177/0022427819848083

Tillyer, M. S., Wilcox, P., & Walter, R. J. (2021). Crime generators in context: Examining "place in neighborhood" propositions. *Journal of Quantitative Criminology*, *37*(2), 517–546. https://doi.org/10.1007/s10940-019-09446-5

Vega, H., & Elhorst, S. J. (2015). The SLX model. *Journal of Regional Science*, *55*(3), 339–363. https://doi.org/10.1111/jors.12188

Velez, M. B., Lyons, C. J., & Boursaw, B. (2012). Neighborhood housing investments and violent crime in Seattle, 1981-2007. *Criminology*, *50*(4), 1025–1056. https://doi.org/10.1111/j.1745-9125.2012.00287.x

Velez, M. B., & Richardson, K. (2012). The political economy of neighborhood homicide in Chicago: The role of bank investment. *British Journal of Criminology*, *52*(3), 490–513. https://doi.org/10.1093/bjc/azr092

Weisburd, D. (2015). The law of crime concentration and the criminology of place. *Criminology*, *53*(2), 133–157. https://doi.org/10.1111/1745-9125.12070

Weisburd, D., & Amram, S. (2014). The law of concentrations of crime at place: The case of Tel Aviv-Jaffa. *Police Practice and Research*, *15*(2), 101–114. https://doi.org/10.1080/15614263.2013.874169

Weisburd, D., Bushway, S., Lum, C., & Yang, S. (2004). Trajectories of crime at places: A longitudinal study of street segments in the city of Seattle. *Criminology*, *42*(2), 283–322. https://doi.org/10.1111/j.1745-9125.2004.tb00521.x

Weisburd, D., Cave, B., Nelson, M., White, C., Haviland, A., Ready, J., Lawton, B., & Sikkema, K. (2018). Mean streets and mental health: Depression and post-traumatic stress disorder at crime hot spots. *American Journal of Community Psychology*, *61*(3–4), 285–295.

Weisburd, D., & Eck, J. E. (2004). What can police do to reduce crime, disorder, and fear? *The ANNALS of the American Academy of Political and Social Science*, *593*(1), 42–65. https://doi.org/10.1177/0002716203262548

Weisburd, D., & Eck, J. E. (2018). Theoretical foundations and frontiers for understanding high crime places: An introduction. In D. Weisburd & J. E. Eck (Eds.), *Unraveling the crime-place connection* (Vol. 22). Routledge.

Weisburd, D., Gill, C., Wooditch, A., Barritt, W., & Murphy, J. (2021). Building collective action at crime hot spots: Findings from a randomized field experiment. *Journal of Experimental Criminology*, *17*(2), 161–191. https://doi.org/10.1007/s11292-019-09401-1

Weisburd, D., Groff, E. R., & Yang, S. M. (2012). *The criminology of place: Street segments and our understanding of the crime problem*. Oxford University Press.

Weisburd, D., Groff, E. R., & Yang, S. M. (2014). Understanding and controlling hot spots of crime: The importance of formal and informal social controls. *Prevention Science: The Official Journal of the Society for Prevention Research*, *15*(1), 31–43.

Weisburd, D., Morris, N. A., & Groff, E. R. (2009). Hot spots of juvenile crime: A longitudinal study of arrest incidents at street segments in Seattle, Washington. *Journal of Quantitative Criminology*, *25*(4), 443–467. https://doi.org/10.1007/s10940-009-9075-9

Weisburd, D., Telep, C. W., Hinkle, J. C., & Eck, J. E. (2010). Is problem-oriented policing effective in reducing crime and disorder? Findings from a Campbell systematic review. *Criminology & Public Policy*, *9*(1), 139–172. https://doi.org/10.1111/j.1745-9133.2010.00617.x

Weisburd, D., & White, C. (2019). Hot spots of crime are not just hot spots of crime: Examining health outcomes at street segments. *Journal of Contemporary Criminal Justice*, *35*(2), 142–160. https://doi.org/10.1177/1043986219832132

Weisburd, D., White, C., & Wooditch, A. (2020). Does collective efficacy matter at the micro geographic level?: Findings from a study of street segments. *The British Journal of Criminology*, *60*(4), 873–891.

Weisburd, D., Wyckoff, L. A., Ready, J., Eck, J. E., Hinkle, J. C., & Gajewski, F. (2006). Does crime just move around the corner? A controlled study of spatial displacement and diffusion of crime control benefits. *Criminology*, *44*(3), 549–592. https://doi.org/10.1111/j.1745-9125.2006.00057.x

Wheeler, A. P., Kim, D., & Phillips, S. W. (2018). The effect of housing demolitions on crime in Buffalo, New York. *Journal of Research in Crime and Delinquency*, *55*(3), 390–424. https://doi.org/10.1177/0022427818757283

Wheeler, A. P., Worden, R. E., & McLean, S. J. (2016). Replicating group-based trajectory models of crime at micro-places in Albany, NY. *Journal of Quantitative Criminology*, *32*(4), 589–612. https://doi.org/10.1007/s10940-015-9268-3

Wilcox, P., & Tillyer, M. S. (2018). Place and neighborhood contexts. In D. Weisburd & J. E. Eck (Eds.), *Unraveling the crime-place connection: New directions in theory and policy*. Routledge.

Woo, A., & Joh, K. (2015). Beyond anecdotal evidence: Do subsidized housing developments increase neighborhood crime? *Applied Geography*, *64*, 87–96. https://doi.org/10.1016/j.apgeog.2015.09.004

Wooldridge, J. (2021). Two-way fixed effects, the two-way mundlak regression, and difference-in-differences estimators. Available at SSRN 3906345

Wooldridge, J. M. (2019). Correlated random effects models with unbalanced panels. *Journal of Econometrics*, *211*(1), 137–150. https://doi.org/10.1016/j.jeconom.2018.12.010

Worrall, J. L., & Wheeler, A. P. (2019). Evaluating community prosecution code enforcement in Dallas, Texas. *Justice Quarterly*, *36*(5), 870–899. https://doi.org/10.1080/07418825.2018.1438497

Wortley, R., & Mazerolle, L. (2008). *Environmental criminology and crime analysis*. Willan Publishing.

Zillow (2021). Zillow Transaction and Assessment Dataset (ZTRAX). https://www.zillow.com/research/ztrax/