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Did the neighborhood really go?
An empirical analysis of the effects of affordable housing on neighborhood crime.

March 19th, 2021

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ABSTRACT

Using a quasi-experimental setting in San Francisco, I estimate the effect affordable housing projects developed from 2007 to 2014 had on crime in nearby block groups using a sophisticated and widely accepted difference-in-differences strategy. The potential for affordable housing projects to negatively impact nearby crime rates has driven the planning and development process for decades. While suffering in econometric rigor and biased by limitations in data, the historical study of this relationship has produced rather pessimistic results and largely vindicated negative attitudes towards affordable housing projects. Newly developed methods capable of teasing out the direction of causality, as compared to historical studies that were largely correlation based, have produced far more optimistic results in shedding light on the issue of whether affordable housing projects themselves are responsible for increases in crime post-opening. In this study, I employ the adjusted interrupted time-series difference-in-differences to determine whether or not affordable housing projects are responsible for increases in reported crimes in their vicinity post-opening. While I found that affordable housing projects are responsible for an initial slight increase in crime post-opening, I found no evidence that crime trended upwards post-opening and did find weak evidence for the contrary. These findings add to a body of knowledge that provides convincing evidence that affordable housing projects, if done well, can be a positive force for both the neighborhood and the residents themselves.

Keywords: Affordable housing, Crime, San Francisco, Neighborhood Effects, Criminogenesis, Quasi-experiment, Adjusted Interrupted Time-Series Difference-in-Differences.

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Introduction

Neighborhood activist have argued for decades that when the affordable housing comes, there goes the neighborhood. The more vocal residents often employ Not-In-My-Backyard (NIMBY) tactics and talking points. Arguments are generally made that point to affordable housing projects as sources of crime as well as a negative influence on nearby home values (Lance Freeman and Botein 2002). As such, the effects of affordable housing on nearby property values and crime rates have been the subject of intense study since at least the 1960s (Nguyen 2005; Lens 2013b). More specifically it has been well documented that NIMBYs often fear an influx of "undesirable" households (Ellen, Lens, and O'Regan 2012; Lens 2014; Nguyen 2005). NIMBY attitudes and tactics have often proven to be significant barriers in the development of affordable options (Lance Freeman and Botein 2002; G. C. Galster, Tatian, and Smith 1999; Santiago 2001). The challenge is that there is often at least a grain of truth to the most popular NIMBY arguments. A survey of the literature reveals a mixed bag of results with respect to affordable housing projects and nearby property values. Although projects generally prove beneficial for the neighborhood, this is not the case universally. Historically, the connection between crime and affordable housing projects is decidedly more controversial and pessimistic. Although leaving much to be desired in terms of econometric rigor, most early studies found crime rates to be elevated around affordable housing projects which all but vindicated many NIMBY talking points. Thus, the arguments made by concerned residents could not simply be dismissed out of hand.

With the advent of the Low-Income Housing Tax Credit program (LIHTC), affordable housing project development largely shifted from municipalities to private developers. The famous soviet style monolithic housing projects developed by mid-century housing programs would slowly become a thing of the past. The LIHTC program is unique in that it works to incentivize developers to use private equity to fund the development of affordable housing projects by awarding tax credits (Deng 2007; S. Van Zandt and Mhatre 2009). To date,

LIHTC projects have a strong track record of success and this is regularly attributed to the fact that they are often mixed-income facilities generally considered higher quality compared to the traditional publicly developed affordable housing projects (Deng 2009; Woo, Joh, and Van Zandt 2016). Despite the abundance of research on affordable housing projects and their effects on neighborhoods, the literature is fairly sparse with respect to studies focusing primarily on LIHTC projects. Additionally, the literature is far from consistent with respect to the effects of affordable housing on neighborhoods (Nguyen 2005; Lens 2013b). Earlier studies painted a rather dismal picture of how affordable housing projects affected the neighborhood whereas more recent studies have found more positive results (DeLone 2008; G. Galster et al. 2002; Griffiths and Tita 2009; McNulty and Holloway 2000; Holloway and McNulty 2003). The inconsistent findings have often been attributed to earlier studies employing methodologies both lacking in econometric rigor and incapable of determining the direction of causality. This thesis begins with an extensive review of the literature on the subject of affordable housing and its effects on neighborhood crime rates and adds to the body of knowledge contributing to the filling of the historical gap by employing a rigorous methodology capable of teasing out the direction of causality with respect to the effect the development of LIHTC projects have on nearby crime rates.

The goals of this thesis are twofold: 1) an extensive review of the literature to both understand the history of the study of the relationship between the development of affordable housing projects and their effects on nearby neighborhoods and 2) the application of a more rigorous methodology to determine the effects on crime LIHTC projects had on nearby neighborhoods in San Francisco to add to the knowledge gap. As there is often a grain of truth to the NIMBY arguments, a thorough survey of the literature is important to understand the basis of their arguments as well as their shortcomings.

Using crime data published by the San Francisco Police Department (SFPD) from 2004 to 2017 and LIHTC data available from HUD ("LIHTC Property Database," n.d.), this thesis employed the adjusted interrupted time-series difference-in-differences (AITS-DID) to

determine the effect on crime affordable housing projects had on neighborhoods post-opening. The AITS-DID method was originally applied in the context of affordable housing projects and home values but has since been applied to crime several times since introduction. While this study determined that the opening of an LIHTC project was associated with small increases in the level of total and property crime, no such increases were found for violent and nuisance crimes. Additionally, there was no statistically significant evidence that the opening of an LIHTC project produced upward trends in crime in nearby areas in the post-opening period. Contrary to that, there was weak evidence that the opening of an LIHTC project reduced the rates of nuisance crimes in nearby areas.

This thesis begins with a review and critique of the existing literature on the subject of affordable housing and its effects on neighborhoods. While the primary focus is on crime, it is important to briefly discuss the impact on housing values as well to further contextualize NIMBY opposition to affordable housing projects. Since nearby crime rates and property values could hardly be considered factors completely independent of each other, a discussion of one without acknowledging the other would be remiss. The literature review will address possible causal mechanisms of increased crime rates due to the development of affordable housing projects and the primary fear underpinning NIMBY opposition; an older wave of studies that, despite lacking methodological rigidity, found higher crime rates around affordable housing projects and provided empirical support for NIMBY arguments for decades; and a more recent wave of studies employing more econometrically rigorous methods and delivering more positive results. Special attention is paid to how a data dark-age so to speak of affordable housing data potentially biased the earlier wave of studies and its influence on perceptions of affordable housing for decades allowing NIMBY opposition to steer the conversation for quite some time. Following this will be an explanation of the quasi-experimental setting the AITS-DID model takes advantage of as well as thorough explanation of the intuition behind the model itself. Concluding the thesis will be a discussion and interpretation of the regression results and their significance.

Literature Review

While the opposition to affordable housing often takes on many forms and consists of several lines of argument, they are often categorized as NIMBY arguments. One could then ask what exactly is NIMBY? Given the broad range of issues and tactics generally considered to be NIMBY, the term escapes exhaustive and precise definition. However, in the context of urban planning and social services, it can be broadly defined as a resistance on the part of local residents to have projects, generally considered to be aggregate welfare increasing but with local negative externalities, located in their community or in close proximity to their home out of fear that their own quality of life could be negatively impacted (Kindler n.d.). Hence the "I may want this, but just not in my backyard" attitude. While a variety of projects can face NIMBY opposition (e.g., highway expansions, prison placements, commercial development, etc.), this thesis will focus on the arguments made against affordable housing projects in particular. Additionally, while a variety of factors potentially negatively impacting existing residents' quality of life will be briefly acknowledged and discussed, the particular focus will be on the relationship between crime and affordable housing projects.

The literature studying the opposition to affordable housing has spanned decades and has largely categorized the opposition as either economic or social in nature (Dear 1992; Takahashi and Dear 1997; Pendall 1999). The primary economic concern is the potential that affordable housing projects could depress nearby home values. The social concerns tend to be more widespread and range from simple concerns regarding increased traffic and noise to the fear that affordable housing projects may be crime generating facilities. The latter being a particularly hot button topic and difficult to address. The impact on home values will be surveyed briefly followed by a more thorough discussion of the connection between affordable housing projects and crime.

Affordable housing and property values

Like crime, the relationship between affordable housing and nearby property values as been the subject of intense scrutiny and research. While not the explicit focus of this thesis, it important to acknowledge this to help further contextualize the resistance residents put up against affordable housing projects. As will be demonstrated with crime, there has historically been a bit of a mixed bag of results with respect to affordable housing projects and nearby home values. The literature on affordable housing projects and nearby home values can be roughly divided into two waves that are largely delineated by the rigor of the employed methodologies and their use of data. The earlier wave, beginning in the 1960s, is frequently criticized for its lack of econometric rigor (G. C. Galster, Tatian, and Smith 1999). Studies often relied on simplistic matching schemes to compare changes in property values in neighborhoods with and without affordable housing projects to make causal claims. The ability of such simplistic matching schemes to make strong causal claims being dubious.

In the late 1990s, a resurgence of research on the link between affordable housing projects and property values began marked by an increase in the sophistication of employed quantitative techniques (Lyons and Loveridge 1993; Goetz, Lam, and Heidinger 1996; Briggs, Darden, and Aidala 1999; G. C. Galster, Tatian, and Smith 1999; Lee, Culhane, and Wachter 1999; Santiago 2001). Since this resurgence, several studies have demonstrated the positive impact on home values an affordable housing project can have (Albright, Derickson, and Massey 2013; Deng 2011a; Santiago 2001). However, others have demonstrated that this is not universally the case and that affordable housing projects can have negative impacts on nearby home values in certain situations (Deng 2011b; Funderburg and MacDonald 2010). With that being said, the same studies observing negative results often cited qualitative characteristics of the projects themselves that may explain this. Several studies have remarked that more actively managed and maintained properties with qualitatively good design features generally do not produce the negative results seen in projects more in line with historical

stereotypes of affordable housing projects, i.e., poorly managed monolithic high-rises (Albright, Derickson, and Massey 2013; Funderburg and MacDonald 2010; Deng 2011b). While positive impacts have generally been the result on home values near affordable projects, the fact that this is not universally the case must be considered when addressing NIMBY opposition to affordable housing projects.

Causal mechanisms explaining increased crime

Sociological

Sociologically, the connection between affordable housing projects and crime is very complex. Authors have posited that the fears of residents range from the new residents themselves being more prone to criminal activity to the breakdown of social enforcement mechanisms that maintain the neighborhood character and safety due to the influx of new residents (Dear 1992; Freudenburg and Pastor 1992; Takahashi and Dear 1997). On the one hand, attitudes are potentially prejudicial in nature towards hypothetical residents in affordable housing and stereotypes regarding their likelihood to commit crime. On the other hand, there is ample empirical evidence demonstrating that many affordable housing projects in large American cities suffer from higher crime rates in their vicinity. The concerns of current residents can be roughly categorized as follows: 1) increased crime resulting from a breakdown of social cohesion and collective efficacy or 2) increased crime due to affordable housing project residents themselves being more crime prone or the physical facilities enabling and attracting crime.

For at least two decades, collective efficacy has been identified as a neighborhood-level crime reducing mechanism. Collective efficacy enables communities to feel a sense of ownership and agency in their neighborhood to create and maintain a safe environment (Sampson 1997). The social structures that make up collective efficacy serve to, with some capacity, enforce norms of behavior to create an acceptable shared experience for the residents of a

community (Robert J. Bursik Jr and Harold G. Grasmick 2001). Behaviors include, but are not limited to, monitoring the children of neighbors, questioning strangers, calling the police when needed, and maintaining the physical environment that makes up the neighborhood (Uchida et al. 2014).

Collective efficacy is the product of social cohesion and results when there is a shared vision for and understanding of the community. Social cohesion is, more fundamentally, a situation in which the community feels united in common values and expectations (Uchida et al. 2014). Social cohesion is the result of the many interpersonal interactions and relationships amongst the members of the community. It is these ties to one another and the community that ultimately realize collective efficacy as a resource to maintain a safe community. Social cohesion is very commonly referred to as the "sense of community." Thus, collective efficacy can be interpreted as coming from a place of self-interest at the level of an individual community member. For both economic and non-economic reasons, individuals are highly motivated to protect their investments, so to speak, both emotional investment in the community and financial as well, to protect what they believe to be their own. With that in mind, it is much easier to understand why certain projects and programs are met with such passionate resistance if there is the potential to negatively impact the community. Affordable housing projects are but one potential facility type that often illicit this response.

Independent of any potential crime related argument, the thinking often goes that new residents, irrespective of their background or criminogenic potential, could be a disruptor to social cohesion and the eventual breakdown of collective efficacy. New elements into the community, not necessarily even "bad" ones, represent a potential disruption to the social cohesion of the neighborhood (Sampson 1997). This materializes in the form of social isolation and the concentration of economically disadvantaged individuals. These factors being some of the strongest that serve to break down social cohesion and ultimately collective efficacy (Taylor 2001). With the breakdown of collective efficacy comes the reduced capacity of the community to enforce social norms and behaviors to maintain the shared vision of the

community. This materializes in the form of increased mistrust in fellow neighbors and the shirking of village responsibilities so to speak (Dekeseredy, Alvi, and Tomaszewski 2003). It becomes a sort of every parent for themselves situation versus the children being raised by the entire village. Residents lose a shared sense of agency and ownership in the neighborhood and have less incentive to participate in collective efficacy and continued investment in the community.

Lending credence to the idea that an influx of new residents disrupts social cohesion is a body of literature suggesting that thresholds of voucher holders within a neighborhood can lead to increases in crime. This trend has been observed since at least as early as the 1990s (G. C. Galster, Tatian, and Smith 1999). Although the results from study to study have varied, the evidence has largely confirmed this possibility, albeit with nuances (Lens 2013b). An analysis of voucher holder residency patterns in Dallas revealed that clusters of ten or more within a single apartment complex was the point at which crime rates in the vicinity began to increase (S. S. Van Zandt and Mhatre 2013). A study that examined the residency patterns of voucher holders in both Atlanta and Chicago produced similar results (Popkin et al. 2012). Although the exact number varied by area, the results of the study suggest that crime did increase noticeably after an influx of voucher holders. However, both studies caution against inferring a simple direction of causality. Given limits on housing options, in addition to other socio-economic constraints, the possibility that voucher holders moved into already crime prone areas and how that may have impacted criminogenic potential in already disadvantaged individuals cannot be ignored. Additionally, the displacement of gang members and the ensuing turf wars has been suggested as another possible explanation for the observed increases in crime.

At face value, NIMBY opposition to affordable housing could be interpreted as pre-emptive and prejudicial. There is resistance to hypothetical residents and their potentially negative qualities. With that being said, such a simple reductive interpretation fails to consider that there is, perhaps, but a grain of truth to this line of thinking. As will be

discussed in the following paragraphs, there is an empirically demonstrable link between the presence of affordable housing and higher crime rates in the surrounding areas (Griffiths and Tita 2009). While housing projects are not universally plagued by relatively higher crime rates, there is enough evidence that makes the out of hand dismissal that affordable housing projects generate crime remiss. This is a particularly challenging line of argument to counter as it can become a bit of a prophesy of the self-fulfilling type. New residents move in, the existing ones are hesitant to integrate them, they become socially isolated, possibly economic as well, and thus become more likely to commit crimes. Although the scenario where newly developed affordable housing projects introduce new residents that contribute to the breakdown of social cohesion and collective efficacy and ultimately resulting in increased crime nearby is a hypothetical possibility that should be taken seriously, the newer wave of studies teasing out the direction of causality generally do not support this.

Direct criminogensis

Perhaps the most straightforward argument is that residents of affordable housing projects may themselves be more likely to commit crimes than the existing residents of the neighborhood and are thus directly the causal mechanism for increased crime rates. Or, that certain features of affordable housing projects attract or generate crime. These arguments must be taken seriously as there is significant evidence that affordable housing projects have historically been hotspots of crime relative to city-wide averages. Researchers have proposed three possible, non-mutually exclusive, lenses of analysis to consider when analyzing affordable housing projects as sources of crime (Griffiths and Tita 2009). In contrast to social cohesion and collective efficacy, the research on the potential for affordable housing projects to be criminogenic has tended to focus on mechanisms at and within singles sites as opposed to the sociological structure and features of the broader neighborhood.

Public housing as a hotbed of crime

There is substantial evidence that neighborhoods with affordable housing projects have crime rates exceeding those of similarly composed neighborhoods, i.e., socio-economically, but with non-public housing (Holzman, Hyatt, and Dempster 2001; Jacobs 1961; Newman and Franck 1980). Additionally, it has been found that youth are more likely to be offenders when living in affordable housing (Ireland, Thornberry, and Loeber 2003; Kling, Ludwig, and Katz, n.d.; Ludwig, Duncan, and Hirschfield 2001). Thus, the groups more likely to generate crime (e.g., single-parent households, high-adolescent-to-adult ratio) are concentrated in areas with little social cohesion and collective efficacy. This all adds up to create an environment where individuals more likely to commit crimes are concentrated in an area more unlikely to enforce social norms that work to prevent crime in the first place. Thus, researchers have posited that the physical environment of affordable housing projects cannot be considered the sole enabler of criminal activity when considering the concentration of disadvantaged populations (Weatherburn, Lind, and Ku 1999). It is in this sense that affordable housing projects are considered potential hotbeds of crime.

Public housing as a magnet of crime

Historically, affordable housing projects have been environments in which crime could potentially be attracted to and could thus be considered magnets of violence. Research has shown that in the presence of social agents actively working to prevent and report crime, e.g., concerned residents and property managers, criminal activity is generally kept to a minimum (Mazerolle, Kadleck, and Roehl 1998). Alternatively, communities, especially individual housing facilities, lacking in strong community crime prevention and active management can create situations in which criminal elements are attracted to the location. It has been argued that places failing to actively guard against criminal activity and opportunities for crime to occur can become crime attractors and enablers (Brantingham and Brantingham 1995). Additionally, even the particulars of management can enable criminal activity as exampled by

the reluctance of women living illegally with boyfriends to report domestic abuse (Raphael 2001). Their reluctance to report due to their possible eviction if they are not listed on the lease.

Public housing as a generator of crime

Lastly, there is the potential that crime within the housing projects could spill out into the neighborhood thus becoming a source, a generator, of crime in the community. Studies in both Atlanta and Brooklyn have demonstrated as much and this phenomena has been termed the "spread effects" of crime from housing projects into the community (Fagan and Davies 2000; Holloway and McNulty 2003). Even here, it is difficult to determine whether the housing project and its residents are themselves responsible for increases in crime. There is evidence that, despite increases in criminal activity around housing projects, it is more likely that criminals have been attracted to the areas and less so that the residents themselves are committing the crimes (G. Galster et al. 2002). The literature is particularly silent on the topic of the perpetrators themselves being residents of the nearby affordable housing projects. Many studies openly acknowledge the failure to directly assign responsibility for the increase in criminal activity to the residents. With that in mind, several studies have determined that the residents themselves are more likely to be victims of crimes than actual perpetrators of crimes.

One line of evidence that directly challenges the possibility that the residents of affordable housing projects are more likely to commit crimes in the neighborhood is the fact that they are themselves more likely to be victims of crime (Keyes 1992; Garbarino, Kostelny, and Dubrow 2005; DuRant et al. 1995). With respect to perceptions of crime, residents in affordable housing, especially black families, perceive far more crime than their non-public housing counterparts (DeFrances and Smith 1995). Actual crime victimization tracks similarly as well. Residents in affordable housing, especially black families, report higher rates of victimization. Additionally, one of the earlier studies to control for the race and gender

of victims found similar results. It was observed that women, especially black women, were more likely to experience aggravated assault than their counterparts who lived in non-public housing (Holzman, Hyatt, and Dempster 2001). Despite the fact that higher crime rates have been observed around affordable housing projects, several studies have demonstrated that residents are more likely to be the victims of crimes rather than the actual perpetrators.

History of the literature

Previous studies on the effect of affordable housing projects on nearby criminal activity have offered a rather mixed bag of results in addition to lacking econometric rigor (Holzman 1996). Holzman (1996) argued for what he called an information gap stemming from a U.S. Department of Housing and Urban Development (HUD) decision to stop publishing statistics on affordable housing providers and tenants. Keyes (1992) noted that during the Reagan administration, research into crime and public housing more or less ground to a halt. The information gap would last well into the 1990s (Holzman 1996). The result was that what little research into affordable housing and crime that was produced during this data dark age, so to speak, relied heavily on smaller data sets that provided snapshots that were both limited geographically and temporally. Data and reports were generally limited to a few densely populated areas (Newman 1972; William Brill Associates. and United States. 1977a; 1977b; 1975; 1976; Sally E. Merry 1981; Sally Engle Merry 1986; Roncek 1981; Farley 1982). During this dark age of affordable housing facility and tenant data, research shifted primarily to focusing on single-site large high-rise affordable housing projects (Newman 1972). The stereotype that affordable housing projects are large, monolithic soviet style buildings riddled with crime and poverty is in no doubt attributable, at least in part, due to the extensive focus on such projects in the absence of regularly updated data (Holzman 1996). Unsurprisingly, this wave of research did little to help counter the stereotypes typically associated with affordable housing projects and did, in some capacity, vindicate NIMBY arguments.

Advances in both data availability and technologies would allow a sort of renaissance in the study of affordable housing and crime research to begin anew in the 1990s (Holzman 1996; Holzman, Hyatt, and Dempster 2001). More specifically, Holzman (2001) identifies improvements in GIS technologies and software to analyze crime over arbitrarily delineated geographic boundaries (e.g., neighborhoods, zones of influence) whereby previous research was often limited to census specified geographies (e.g., census blocks, tracts, etc.). This trend has continued into the 21st century with the wider availability of open-source software packages (e.g., QGIS, R and Python spatial analysis libraries) and dozens of cities making crime data, alongside numerous other types of data, available on open data portals. Thus, processes that used to take weeks to perform such as geocoding and geographically aggregating data can now be done in a matter of hours and sometimes even minutes. Building off of the 1990s resurgence in affordable housing and crime research, a newer wave of studies began to emerge in the early 2000s utilizing larger datasets and employing more rigorous econometric methods.

While the newer wave of research produced studies with decidedly more positive results, not all results were as optimistic about the relationship between affordable housing and nearby crime. Even when controlling for various neighborhood socio-economic characteristics, affordable housing projects still appeared to strongly explain the presence of nearby crime. However, the use of more econometrically sophisticated techniques allowed for the unpacking of the complex relationship between affordable housing facilities and other criminogenic facilities and the combined effect on neighborhoods. Highlighting the nuances of this complex relationship would finally give policy makers actions items, so to speak, that could be addressed.

One of the earlier studies in the newer wave to investigate the relationship between affordable housing projects and their effects on crime examined the relationship in Atlanta and produced results largely in line with the older wave of studies. The authors found that neighborhoods in close proximity to affordable housing projects experienced higher rates of

crime relative to the city-wide average compared to those located farther away (McNulty and Holloway 2000). The authors developed a weighted least-squares regression using 1990 Census block-group-level data, three-year (1990-92) average crime data, as well as affordable housing location data to determine the extent proximity to an affordable housing project influenced crime. The results of the regression suggested that, after controlling for differences in poverty rates, female headship, unemployment rates, and public assistance receipt, neighborhoods in closer proximity to affordable housing projects had the highest levels of crime in Atlanta. They further noted that the effect of race was significant in explaining crime within one mile of public housing sites. In an appeal to social disorganization, the authors argued that the observed results were likely due to the geographic anchoring of poverty in affordable housing projects and cautioned against simple causality. It is openly acknowledged that the affordable housing projects cannot be ruled the exclusive source of this crime despite the observed relationship.

Utilizing a quasi-experimental setting, researchers were able to take advantage of relocated affordable housing project tenets to determine the impact on crime, more specifically homicides, in the areas of relocation throughout Louisville, Kentucky (Suresh and Vito 2009). They used reported crime data, the locations of existing affordable housing, and the locations of relocated tenets to study changes in homicide cluster locations. The city of Louisville engaged in a phased large-scale renovation of housing projects from 1989 to 2007. A spatial regression was performed on the data to determine the extent to which median income, housing vacancy, and the clustering of public housing tenants impacted homicide rates. The authors found that during the periods of relocation, homicides were not eliminated but rather moved around the city. The study concluded that areas with public housing, lower incomes, and high rates of voucher utilization were the factors most significant in explaining the location of homicide clusters. The authors appealed to social disorganization theory to explain how affordable housing and clusters of voucher users can create environments in which crime can thrive by concentrating economically disadvantaged individuals. The authors make clear

the limitations of the study and their data which did not allow for them to parse out whether or not the perpetrators or even the victims were themselves residents of affordable housing projects. While they demonstrated that certain features typically associated with affordable housing projects, i.e., high-density arrangements and the clustering of low-income individuals, can explain elevated crime rates, they argue that the significance of the environmental features and their influence on nearby crime rates does not necessarily extend to the residents of affordable housing projects.

Researchers studying the effects of affordable housing on nearby crime rates in relation to their proximity to other facility types in Philadelphia produced more nuanced results (Haberman, Groff, and Taylor 2013). The model used crime data provided by the Philadelphia Police Department and public housing locations and select characteristics provided by HUD as well as The Philadelphia Public Housing Authority. Buffers of varying sizes were created around the housing projects in order to tease out the effect of housing project characteristics, as well as the effect of various nearby facilities of different types on nearby crime rates. A multilevel model was developed using the aforementioned data with the level 1 data being housing buffers and the level 2 data housing communities. Given their selection of model, they were able to determine that while some housing projects appeared to be sources of increased crime in the surrounding areas, this was not the case universally. In other areas, housing projects appeared to depress the levels of crime in the surrounding areas. Furthermore, the results suggested that facilities such as beer establishments and pawn brokers may do more to explain the presence of elevated crime rates around affordable housing projects than the actual residential facilities themselves. While some housing projects did appear to be a source of crime, this study helped challenge the notion that affordable housing projects are universally sources of crime and criminogenic in nature. This study further reaffirmed the importance of considering the historical and environmental context in which affordable housing projects have been built. Affordable housing projects have often been built around other facility types that tend to produce crime, and this has undoubtedly colored the his-

torical perception that affordable housing projects and the residents are directly responsible for the elevated crime rates in nearby areas.

A recent study in Cincinnati attempted to parse out the effects of public housing, nearby facility types, as well as urban typology in order to better understand the impact affordable housing projects themselves have on nearby crime (Kelsay and Haberman 2020). A negative binomial regression was developed using data on crime, nearby facility types, public housing projects, and information on the street networks surrounding the affordable housing projects. The researchers attempted to demonstrate how the design of the streets and intersections surrounding affordable housing projects might influence crime in addition to the usual contenders of facility types such as liquor establishments and pawn shops. Their results were twofold in that proximity to public housing, as well as the connectedness of the nearby street network were both significant in explaining the observed crime. The authors explained the results in the framework of environmental criminology. While there was variation in the number of crimes committed throughout the street networks surrounding the public housing projects, crime was generally higher in areas nearer to them. Additionally, it was posited that busier street networks were more attractive environments for criminal elements as they provided more opportunities for crime. Consistent with the idea that criminals are rational, the risks were likely outweighed by the possible rewards in busier areas, especially those nearer public housing projects. Once again, despite the apparent significance affordable housing projects have in explaining nearby crime rates, such projects often exist in a context that cannot be ignored. The proximity to other criminogenic facilities as well as features of the street grid itself play a strong role in generating and attracting crime to areas near affordable housing projects.

The aforementioned studies demonstrate the difficulty in countering the NIMBY arguments against affordable housing projects with respect to concerns for crime as there is a demonstrably strong link between crime and proximity to affordable housing projects. Even when controlling for socio-economic characteristics and the presence of other facilities,

affordable housing projects do have the appearance of being criminogenic. Thus, despite possibly being prejudicial in nature, NIMBY concerns about crime cannot be dismissed out of hand as there does appear to be at least a grain of truth to the argument. With that being said, these studies have generally failed to demonstrate that the affordable housing projects themselves have been the sole source of crime in nearby areas and unambiguously assign causality. There are several factors historical and present, the study of which is beyond the scope of this thesis, that could likely contribute to higher crime rates around affordable housing projects. The interplay of affordable housing projects and nearby facilities is complex and the historical perceptions surrounding affordable housing could partly be attributed to mistaking strong correlations for causation. Independent of the direction of causality, the degree of correlation is quite strong. However, several studies from the second wave employed rigorous econometric methodologies in quasi-experimental settings in an attempt to reveal the direction of causality in the relationship between affordable housing and nearby crime rates, both actual and perceived. The models capable of teasing out the direction of causality have generally produced more positive results.

With increased data availability and advances in computational power, several studies since the early 2000s have taken advantage of these improvements in order to make stronger claims about the relationship between affordable housing and crime as well as discern the direction of causality i.e., do affordable housing projects, themselves, generate crime post-opening or have they historically been located in areas that were already high crime to begin with. Two studies in Denver in the early 2000s were a couple of the first to implement a more rigorous econometric method capable of discerning the direction of causality. When studying the impact of newly permitted supportive housing (a broad category of housing support given to those needing assistance) from 1992 to 1995, they found no statistically significant difference in crime, as reported by the Denver Police Department, in areas surrounding the supportive housing projects post-opening (G. Galster et al. 2002). They developed an Adjusted Interrupted Time Series Difference in Differences (AITS -DID) model to detect the

impact the opening of a supportive housing project had on nearby crime while controlling for city-wide trends and area fixed effects. Using a similar study design, (Santiago, Galster, and Pettit 2003) were also unable to determine that the opening of dispersed affordable housing sites from 1990 to 1997 had any statistically significant impact on nearby crime rates post-opening.

Similar results were observed when studying the opening of affordable housing projects at the unit level in New York City (Lens 2013a). A negative binomial regression was developed with crime in nearby blockfaces, a small geographic unit created by the author that included the area in close proximity to the housing unit, as the dependent variable and the independent variable being the number of affordable housing units in that blockface. While New York is significantly larger in size than almost all US cities, that size provided one of the largest datasets to date (n = 4,260) in the study of the direction of causality between affordable housing and crime. Additionally, the heterogeneity of New York neighborhoods, to use the words of the author, "is akin to having multiple cities in my sample." (Lens 2013a, 215). This, the author argued, made the case for the generalizability of the results. Several regressions were run in order to control for the effect affordable housing units may have had on different crime types. The results suggested that the presence of affordable housing units, when controlling for time and area fixed effects, did not have a statistically significant effect on nearby crime rates. Like the earlier studies in Denver, this study, too, appears to support the notion that housing projects in and of themselves are not necessarily generators of crime.

Employing an AITS -DID methodology to determine the effect on nearby crime after the opening of affordable housing projects developed using the Low-Income Housing Tax Credit (LIHTC) program in Austin, Texas from 2000 to 2009, researchers once again found no statistically significant evidence that the opening of affordable housing projects increased crime in nearby areas (Woo and Joh 2015). Contrary to that, they did find evidence that there were slight decreases in crime in nearby areas suggesting a positive impact on crime after the opening of an affordable housing project. The regression was developed using crime

data reported by the Austin Police Department and LIHTC housing data from HUD while controlling for time and area fixed effects. While previous studies have generally shown that affordable housing projects had nearly zero effect on crime post-opening, this study demonstrated the potential for housing projects to positively impact nearby crime rates. This is in light of the fact that, LIHTC projects developed during the study period were developed in neighborhoods with crime rates higher than the city-wide average.

A recent study in Seattle further supported the idea that affordable housing projects and investment in them can lead to reductions in crime as well as large reductions in the perception of crime (Albertson et al. 2020). Using crime data, data on the timing of investments and renovation phases, and community survey data, the authors developed a linear mixed-effects model with a first-order autoregressive (AR1) process to adjust for serial correlation. The results of the model suggest that there were generally no increases in criminal activity around the housing project as well as decreases in some crime categories. In particular, some areas experienced promising drops in larceny theft and motor vehicle theft. With respect to the perception of crime, there was a substantial decrease as noted by survey respondents living in the improved facilities. Not only have the results of this study continued to demonstrate the potential for affordable housing projects to positively affect nearby crime rates, it also demonstrated the effect qualitative features can play in reducing nearby crime rates. Accompanying the improvements in the physical facility were expanded services provided to residents. The apparent positive effect on crime the improvements and expanded services had are consistent with the aforementioned sociological mechanisms often invoked to describe criminality in neighborhoods and facilities.

While studies in the past demonstrating a significant relationship between affordable housing and elevated nearby crime rates cannot be ignored, the recent wave of studies since the early 2000s has increasingly helped researchers understand the nuances of that relationship and the direction of causality. The employment of more econometrically rigorous methodologies has helped researchers and policy makers alike understand that, while many

affordable housing projects are associated with higher crime rates in their vicinity, the affordable housing projects and residents themselves are not likely fundamentally criminogenic and the observed crime rates more likely attest to pre-existing crime trends in the neighborhoods where affordable housing projects have been developed. In the context of affordable housing projects and nearby crime, the importance of understanding the direction of causality and the value of studies performed on different cities and geographies has been recognized since the early 2000s (Nguyen 2005; Lens 2013b). Contributing to the body of knowledge aimed at further understanding the direction of causality between nearby crime rates and affordable housing projects is where this thesis aims to contribute. This thesis seeks to add to the body of knowledge on the relationship between affordable housing and nearby crime rates by employing an econometrically sophisticated methodology, AITS-DID, capable of teasing out the direction of causality to study the relationship between LIHTC projects and nearby crime rates in San Francisco to further understand the relationship more generally.

Data

The study area comprises the consolidated city-county of San Francisco, California. At just over 880,000 residents, San Francisco is the 16th most populous city in the US and California's 4th most populated ("QuickFacts, San Francisco," n.d.). Covering roughly 47 square miles on the northern tip of the San Francisco Peninsula, the relatively small size of the city and its large population make it one of the densest jurisdictions in the US. While the city has experienced tremendous economic growth in the last couple of decades, this has been accompanied by significant increases in the cost of housing. Home prices and rental rates are amongst the highest in the nation and thus developing affordable housing projects to provide opportunities for the city's most vulnerable communities to continue to call San Francisco home is a top policy priority (SF Planning 2015).

This study estimated the effects of LIHTC housing projects based on longitudinal crime

data and LIHTC openings. The crime data was sourced from the San Francisco Police Department (SFPD) and made publicly available by the city's Open Data Portal. The study period was from 2004 to 2017. The crime data covered 2,160,000 incidents and included information such as the location of the crime, description of the crime, and the outcome. The data reports all incidents the SFPD responded to including unfounded incidents. Incidents that were categorized as unfounded were excluded from the analysis. The regression was run for all categories of crimes, as well as property crimes, violent crimes, and nuisance crimes. Table 1 shows the annual crime rates from 2004 to 2017. Figure 1 shows the spatial variation in crime rates by block group throughout the city for all crime categories. Figures 2, 3, and 4 show variations in crime rates per block group for property, violent, and nuisance crimes respectively. The LIHTC inventory was obtained directly from HUD through their HUD User online portal. Information includes year developed, facility location, number of units, and much more.

Methodology

History

The importance of teasing out the direction of causality with respect to affordable housing projects and nearby crime rates has been recognized in the literature since the earliest studies on the subject (Nguyen 2005; Lens 2013b). Although originally applied in the context of how the presence of voucher holders affected nearby home values, it did not take long for scholars to recognize the generalizability of the AITS-DID model and extend it crime (G. C. Galster, Tatian, and Smith 1999). The value of the methodology was quickly realized and applied in New York City to study the effects of affordable housing projects on nearby property values (Ellen et al. 2001). Ellen (2001) was the first to recognize the model as being of the Difference in Differences (DID) variety originally made famous by Card and Krueger in 1994. Not long after, the methodology would be applied in the context of affordable

housing and crime (G. Galster et al. 2002). Given the model's ability to tease out pre/post-intervention counter-factual crime trends and levels, the model has also been referred to as an adjusted interrupted time-series approach (AITS) (G. Galster et al. 2004). The model has since been named an adjusted interrupted time-series difference in differences (AITS-DID) and has been used several times over in both the context of property values and crime with respect to affordable housing (Santiago, Galster, and Pettit 2003; G. Galster, Tatian, and Pettit 2004; Koschinsky 2009; Woo and Joh 2015). As will be discussed below, the model has proven particularly attractive because it is both econometrically rigorous and flexible.

Benefits

Prior to the introduction of the AITS-DID model and widespread data availability, studies generally only examined the effects of a single or a few affordable housing projects (Babb, Pol, and Guy 1984; Baird 1980; DeSalvo 1974; Schafer 1972). In addition to the biases discussed surrounding the typical selection of affordable housing sites that were studied, the limited scope of the research offered very few insights into the heterogeneity of effects. At the forefront of the affordable housing data and research renaissance were several regression based studies (Cummings and Landis, n.d.; G. Galster and Williams 1994; Goetz, Lam, and Heidinger 1996; Lee, Culhane, and Wachter 1999). Although representing an improvement in model sophistication, the study designs could only tease out the effects at the citywide level and did not control for pre/post-opening periods. Thus, the ability of the AITS-DID model to detect pre/post intervention trends at the neighborhood level represented a significant improvement in the insights that could be generated. The coincidental increases in the availability of large civic datasets as well as advancements in GIS software making said datasets more easily workable undoubtedly played a part in the rise in prominence AITS-DID models have experienced as well.

Intuition behind the model

The regression is designed to estimate the level and trend of the variable of interest before and after an intervention. In this case, the variable of interest being nearby crime rates and interventions being the opening of affordable housing sites. These openings can be thought of as a treatment. The model is able to tease out the pre-intervention level and trend of crime in the areas of interest into the post-development period, while also accounting for citywide crime trends. This model specification allows for an estimation of the amount of crime that would have happened in the areas of interest but for the development of the affordable housing projects. The test of impact being this estimate of a counter-factual compared to the observed levels and trends of crime post-intervention.

In order to take advantage of the quasi-experimental scenario, the housing sites, which would serve as the centers of the zones of influence, had to be categorized according to two criteria in order to generate meaningful pre/post-development trends. Firstly, there had to be enough crime data before and after opening in order to detect a trend. Given that crime data was available for 2004 to 2017, and three years of data was desired both before and after opening, only housing sites opened from 2007 to 2014 were considered. Secondly, only the first housing site opened during aforementioned period in any given area would be considered. As explained below, this allows for a like-to-like comparison of block groups with one set of block groups serving as the control and the other as the set to be "treated" i.e., having an affordable housing project open in the vicinity.

The aforementioned criteria would serve as a scheme to classify all of the census block groups, the units of analysis, in San Francisco. The set of block groups in the vicinity of an affordable housing project will be referred to as neighborhoods. One set of neighborhoods were those block groups falling within a 2,000-foot radius circle centered on housing projects meeting the previously mentioned criteria. A second set of census block groups were those not in the vicinity of an affordable housing project during the entire study period. A third

set were block groups completely excluded from the analysis.

Delineation of neighborhoods

Using the R programming language and the sf package, all of the census block groups were categorized into three mutually exclusive categories. Category 1 were those census blocks within a circular area with a radius of 2,000 feet centered on housings sites that opened: 1) before 2007, 2) after 2014, or 3) or during 2007 to 2014 and with at least one other such site within 1,000 feet of opening. Category 2 were those block groups that were within a radius of 2,000 feet centered on housing site that opened from 2007 to 2014 and had no other such sites within 1,000 feet at the time of opening. Category 3 areas were those that did not meet any of the aforementioned criteria.

The regression model was run only on category 2 and 3 census block groups. Category 1 block groups were excluded because: 1) data limitations on crime did not allow for three years of pre and post crime trend calculation, or 2) the housing site was built within the aforementioned threshold of an existing affordable housing site and the crime rate would have been contaminated by said project. Category 3 areas served as the control group and allowed for the calculation of San Francisco wide crime trends as they were not affected by the opening of an affordable housing project. Category 2 areas served as the treated units of analysis.

Crime rates were calculated for all category 2 and 3 areas using crime data published on SF's Open Data Portal provided by the San Francisco Police Department (SFPD). The crime data provides the longitude and latitude of each crime. Raw crime counts per block group were then standardized to crimes per 100 residents using census block group population data available from the US Census data portal.

Model specification

$$Crime_{it} = a + [\mathbf{Year}_t][b] + [\mathbf{Area}_j][c] + d \cdot space\_lag + e \cdot CRAll + f \cdot CPost + g \cdot Time + h \cdot TrPost + \epsilon \quad (1)$$

- Model components
  - $Crime_{it}$: annual report of crimes of type I per 100 residents during year t in a specified geographic area.
  - a: constant term to be estimated by regression.
  - $[\mathbf{Year}_t]$: vector of dummy variables indicating each t - 1 year; a measure of intertemporal variations in crime for all areas of Denver.
  - $[\mathbf{Area}_j]$: vector of dummy variables denoting each of j – 1 category 3 and category 2 census block groups; a fixed-effect measure of the average level of crime during the 2004-2017 period reflecting time-invariant idiosyncrasies in each.
  - $CRAll$: dummy variable equaling one if the census block group was a category 2 area; a fixed-effect measure of the average level of crime during the 2004 to 2017 period for all category 2 areas during the study period.
  - $CPost$: dummy variable equaling one for all category 2 areas after the opening of the nearby housing project; a fixed-effect measure of the average level of crime during the post-opening period in the neighborhoods around the housing sites.
  - $Time$: trend variable for all category 2 areas; equaling 1 in the first year of the study period (2004), 2 in the second year of the study period (2005): zero otherwise; a measure of crime trends in all category 2 areas during the entire study period (2004 to 2017).
  - $TrPost$: post-opening crime trend variable for all category 2 areas; equaling 1 in the first year of the study period (2004), 2 in the second year of the study period

(2005): zero otherwise; a measure of post-opening crime trends in category 2 areas.

- *space_lag*: a spatial lag variable with a distance cutoff of 1,600 meters; corrects for spatial autocorrelation (see discussion below).
- ϵ: random error terms.

All lower-case letters represent coefficients to be measured. The coefficients of most interest are $CPost$ and $TrPost$. Their statistical significance, or lack thereof, and value indicate the effect affordable housing projects had on nearby crime rates. That is, positive and statistically significant coefficients would suggest that the opening of affordable housing projects increased crime in nearby areas. The inclusion of both a dummy and trend variable allow for the distinction between a one-time increase, or decrease, versus a change in the trend in crime rate. A comparison to the $CRAll$ and $Time$ coefficients allows for the teasing out of crime in category 2 areas that would have happened but for the opening of the affordable housing project. The **Year** coefficients allow a further comparison of crime to the citywide trends. Specifying the model as such prevents the possible inflation of crime rates due to the opening of affordable housing facilities opened in areas that were already high crime to begin with.

The various hypothetical scenarios are depicted in figure 5 and are useful in grasping the intuition behind the econometric tests. Consider a category 2 block group with a higher than citywide average crime rate pre-placement of an affordable housing project (the gap between lines A-B and C-C' shown by positive $CRAll$ coefficient), although its trend (the slope of the line A-B, the $Time$ coefficient) was no different from those in the metro area (coefficients for the **Year** dummies). If the affordable housing projects do increase crime in nearby areas, one or more of the following may happen. The level of crime at the time of opening may remain constant but the post-development trend ($TrPost$) could increase (compare the slopes of A-B and B-B'). The trend of crime in the neighborhood could remain constant but represent

a relative increase if the citywide average crime rate were to fall (compare A-B-B" and C-C'-C"); a positive value of the coefficient $TrPost$ indicates an increase in the trend of crime in a category 2 neighborhood beyond a trend that may have already been occurring (represented by B-B'). Finally, a positive $CPost$ coefficient would represent an initial increase of crime in a category 2 neighborhood post-opening of an affordable housing project. However, it is important to note that such an increase could be accompanied by a decrease in the crime trend (see A'-A").

Econometric issues

There were strong reasons to suspect that several assumptions of ordinary least squares (OLS) might be violated because of autocorrelation and heteroskedasticity given that the data represents a time-series of cross-sectional observations of varying sizes. The inclusion of area fixed effects (**Area**) serves as a correction to both of the aforementioned problems. Additionally, the model used weighted least squares with population data at the block group level serving as the weights for an additional correction for heteroscedasticity.

When performing a spatial regression, it is important to consider the possibility of spatial dependence, sometimes known as spatial autocorrelation between observations (Pace and LeSage 1998). Spatial dependence refers to the possibility that observations in the dependent variable may be influenced by other observations nearby in space. Thus, the observations would not be completely independent. Spatial autocorrelation could lead to biased parameter estimates as well as misleading t-tests for statistical significance if left uncorrected.

This study follows the precedent set by Galster (2002) in the use of a spatial lag term to correct for spatial autocorrelation. Prior to that, no studies had incorporated such a correction into the construction of multivariate predictive models (Griffith 1987; Bailey and Gatrell 1995). The spatial lag was calculated for each census block and is an average of all

neighboring block groups within a certain threshold weighted by the inverse of the distance between block group centroids. $Crime_{it}$ is the crime rate in the ith area during period t for which the spatial lag is being calculated; D_{ij} is the distance between the centroids of areas i and j; and, $Crime_{jt}$ is one of the set of all areas $j - i$, within range assumed to influence the given area. This study used 1 mile as the zone of influence.

$$space\_lag(Crime_{it}) = \Sigma_j \frac{\frac{1}{D_{ij}}}{\Sigma_j \frac{1}{D_{ijt}}} Crime_{jt} \tag{2}$$

Results

As can be seen in table 1, the total reported crime rate in San Francisco fell from 17.8 crimes per 100 residents to a low of 15.7 in 2011 with an upward trend beginning in 2012 to 17.5 in 2017. Property crimes largely mirrored the total crimes trends. Violent crimes remained largely flat during this period with a rate of 2.0 violent crimes per 100 residents in 2004 to 2.1 in 2017. Additionally, nuisance crimes (a category that includes noise complaints, loitering, and other low-level crimes) also remained relatively flat during this period with 1.0 crimes reported per 100 residents in 2004 to 0.9 crimes per 100 residents in 2017.

Figures 1 through 4 show considerable variation in crimes rates across block groups in San Francisco that cannot be communicated in a simple summary such as table 1. With respect to total crimes, unsurprisingly the block groups with the highest crime rates are those that are generally the most densely populated. These block groups tended to be located in neighborhoods such as the Tenderloin as well as parts of SOMA and the northern fringes of the Mission District. An interesting outlier is the block group which contains Golden Gate park due to the combination of a high quantity of reported crimes in the park as well as a relatively small population within the block group. Similar trends were observed for property, violent, and nuisance crimes as well. Albeit with even greater variance in crime rates over geography for violent and nuisance crimes.

The estimates for the regression coefficients are summarized in table 2 with separate models developed for total, property, violent, and nuisance crime reports per 100 residents as the dependent variable. Based on the adjusted R-squared values, the models performed very well. Adjusted R-squared values ranged from 0.84 for total crimes to 0.608 for nuisance crimes; the latter being the least frequently reported crime type.

The results of this model suggest that there was no tendency for affordable housing projects developed during the study period to be located in areas with crime rates higher than the city wide average as evidenced by the negative sign of the $CRAll$ coefficient. This result makes sense as the LIHTC projects developed during the study period were fairly dispersed throughout the entire city and do not appear especially concentrated in any one part. Additionally, the negative sign and statistical significance (at least for total crime) of the $Time$ coefficient suggests that crime rates in the analysis block groups were trending downwards. While comparing figures 1 and 6 suggest that the entire inventory of LIHTC projects in San Francisco may be disproportionately located in higher crime areas, many of those were built before the study period and since at least 2004, the city of San Francisco does appear to be doing a good job of creating a policy and planning environment encouraging dispersed development of LIHTC projects throughout the city. This is consistent with the more contemporary approach of housing programs aiming to enable people to move to opportunity. It is worth noting that this may not be the case throughout the US as there may still be political forces at work leading to the development of affordable housing projects, not just LIHTC projects, in areas with higher crime rates pre-development.

The significance of $space\_lag$, as well as its positive value, does indicate the presence of crime spillover effects at least for total crimes and property crimes. That is, the real-world implication of spatial autocorrelation in this case appears to be that crime rates are strongly related to those in nearby areas. Interestingly, there seems to be the opposite effect for nuisance crimes. The negative sign would suggest that nuisance crimes in any one area may crowd out other nuisance crimes in nearby areas. A similar result was observed by

Santiago et al. (2003) in Denver. The significance of the spatial lag variable demonstrates the existence of spatial autocorrelation and suggests that studies failing to control for this may have serious econometric problems.

The results of the regression suggest that the opening of LIHTC housing projects do increase the levels of crime post-opening but ever so slightly. Albeit small in magnitude, the $CPost$ coefficient is significant at the 95 percent level for total and property crimes. However, the null hypothesis cannot be rejected for the violent crime and nuisance crime models. The situation for post-opening trends due to the LIHTC project themselves, i.e., the TrPost coefficient, is a little more mixed. There is weak evidence the opening of the LIHTC projects increased ever so slightly the rates of total and property crimes but decreased the rate of violent crimes. However, none of these coefficients are significant at the most commonly accepted levels and thus should not be interpreted as strong evidence. The case is a bit different for nuisance crimes as there does appear to be evidence at the 90 percent level that the opening of LIHTC projects does decrease, ever so slightly, the rate of nuisance crimes reported to the SFPD. Thus, it can be said that the post-opening crime trends in block groups surrounding the LIHTC projects do not appear to be worse than the trends observed city-wide.

Despite the initial increase in the level of crime observed in nearby block groups post-opening, these results suggest the research hypothesis that LIHTC projects increase crime rate trends in nearby areas post-opening can be rejected. There is weak evidence for the contrary. Although the explanation of this result can only be speculated, it is likely that the relative lack of concentration of housing projects built during the study period in any one part of the city helps prevent a possible threshold being reached. That is, the placement of affordable housing projects is such that socio-economically disadvantaged residents are not being concentrated in any one part of the city. Additionally, the fact that LIHTC projects are generally mixed income likely also serves to help buffer against the possible concentration of the city's most disadvantaged residents.

Conclusions

This thesis investigated the effects of LIHTC affordable housing projects on neighborhood crime rates throughout San Francisco. Using a widely accepted rigorous econometric model, this study found statistically significant evidence that suggests a small increase in the level of total crimes and property crimes relative to the city-wide levels in nearby block groups post-opening of an LIHTC project. On the other hand, there was no statistically significant evidence that the rate of crime in block groups nearby LIHTC projects trended upwards post-opening. Additionally, there was no statistically significant evidence for increases in violent or nuisance crimes. On the contrary, there was weak evidence that nuisance crimes decreased in nearby block groups ever so slightly. Although this study took advantage of a quasi-experimental setting, given data limitations, (occupant information, neighborhood collective efficacy, etc.), unambiguous causal claims cannot be made. More specifically, given the complex nature of the relationship between crime and affordable housing, it can be said with no certainty that the residents of the affordable housing projects are, themselves, responsible for the increases in crime. It is also possible that certain characteristics of LIHTC projects are potentially attracting crime from other parts of the city.

These results are in general agreement with similar studies done elsewhere and add to a body of knowledge that potentially holds provocative implications for policy makers and developers. For decades, countless NIMBY arguments based on concerns for crime and property values have stalled and canceled projects entirely. Although the original developers of this model cautioned against the generalizability of the initial positive findings based on the unique setting of their study and the novelty of the model, the repeated application of this model has received widespread acceptance and generated varied but generally positive results. Thus, the findings from this body of work should be taken seriously by policy makers. Alongside studies of affordable housing and nearby home prices, the trend in this body of knowledge for the last couple of decades has largely refuted the most popular NIMBY talking

points. While these concerns from existing residents cannot be dismissed out of hand, the body of literature suggests that affordable housing projects themselves are not generally a new source of crime nor depressing factor on home values. With that being said, not all affordable housing projects are created equally, and special attention must be paid to the design and management of said facilities. Thus, NIMBY activism in the form of holding projects to high design and management standards are possible avenues are ways in which the intense NIMBY opposition can be channeled to develop projects that ultimately increase the welfare of the entire neighborhood.

Despite the positive effect affordable housing projects appear to have on nearby crime, the placement of affordable housing projects should continue to be dispersed throughout San Francisco, and in a similar fashion in other cities, so as to avoid possible threshold effects due to concentrated poverty as well as ensure access to goods and services providing opportunities for upward mobility (L Freeman 2004; S. Van Zandt and Mhatre 2009). While this study did not find evidence that LIHTC projects were placed in areas with higher crime rates, policy makers must ensure that this does not become the case moving forward. The placement of affordable housing projects in more mixed-income neighborhoods can help ensure access to services such as quality education and healthcare, access to better paying jobs, safety from crime, and other benefits that are often associated with moving to opportunity and upward mobility. Thus, affordable housing projects and related policy have the potential to be mechanisms of both neighborhood revitalization and upward mobility.

Limitations

Although the methodology in this paper has been employed several times over, there are limits to the causal claims that the model itself can make as well as any given study based on data limitations. For example, the density of San Francisco does make it a rather unique study area and the results there do not necessarily generalize everywhere. Additionally,

LIHTC projects do cover a variety of facility congifurations with differences in sizing and resident income requirements varying by property. While similar, LIHTC projects are not all alike and thus any one project could produce effects that do not align with the general findings of this study. Further controls for project characteristics and income requirements could offer more nuanced insight into how any given affordable project might affect the neighborhood. Lastly, this, and most other studies, do not control for neighborhood characteristics. While the model does control for time-invariant idiosyncrasies, characteristics such as neighborhood median income are not explicitly controlled for and could be important explanatory factors.

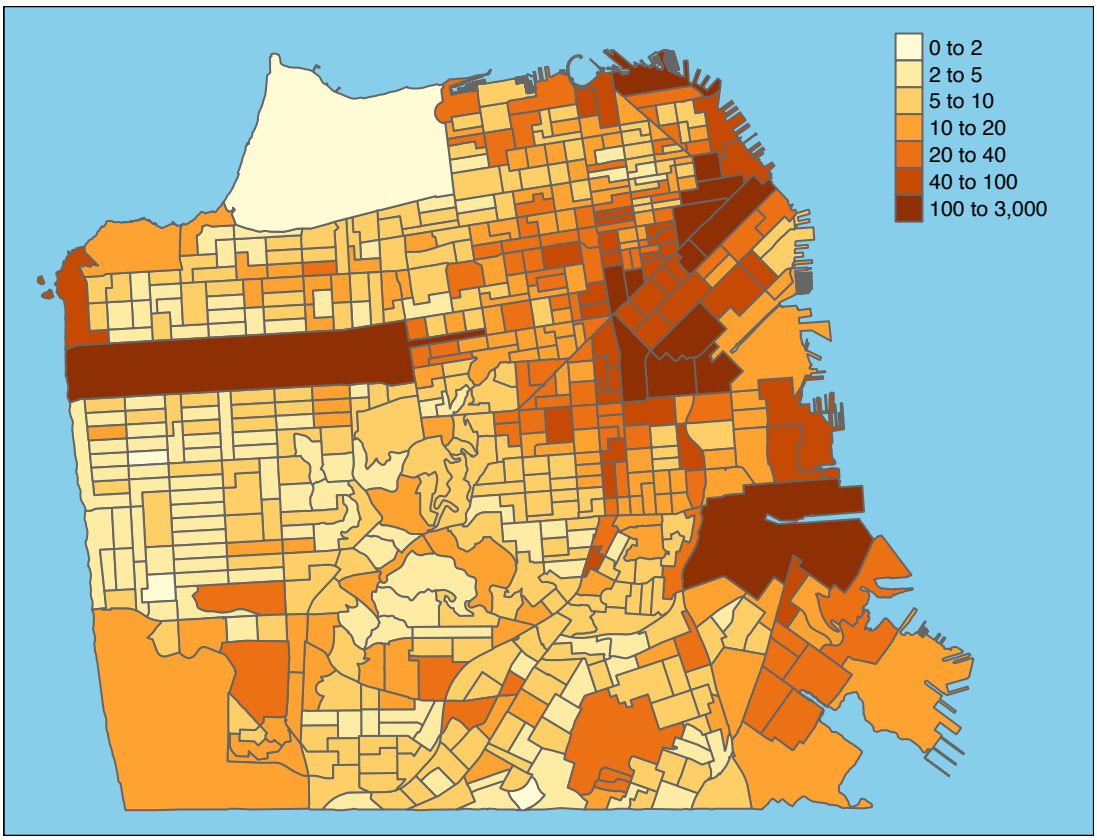

Figure 1: Total crimes per 100 residents, San Francisco, 2017.

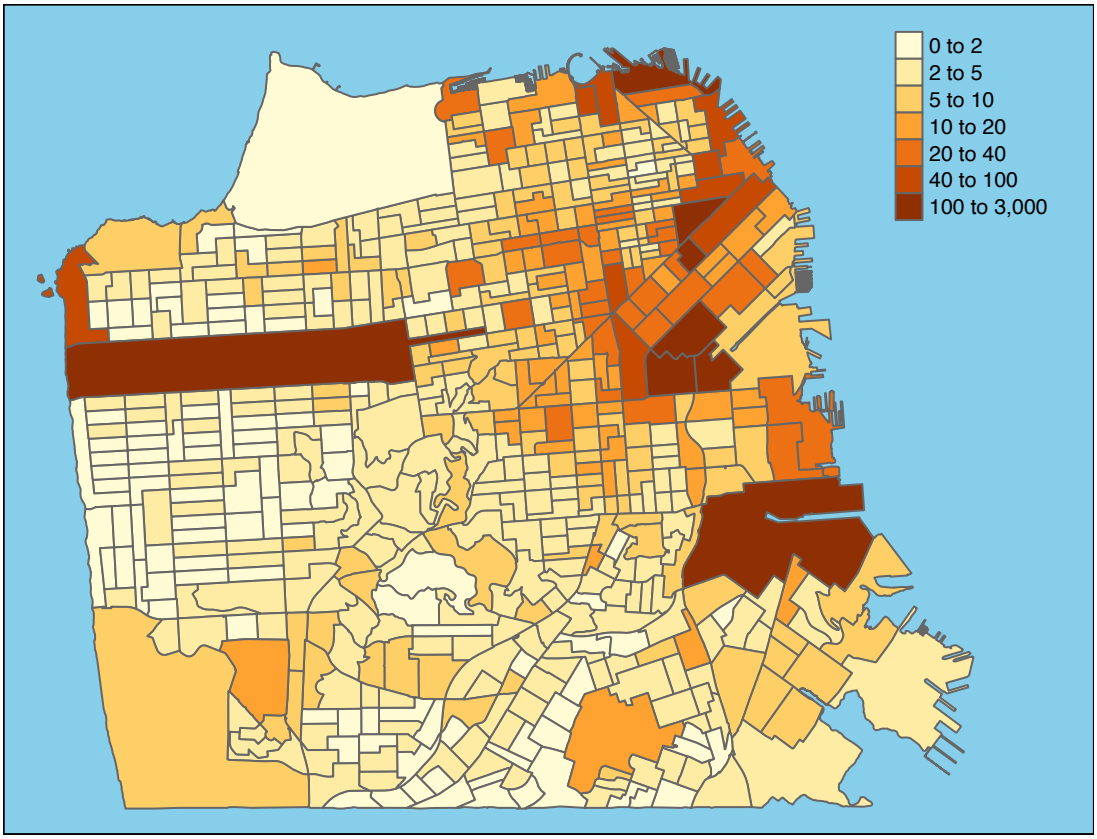

Figure 2: Property crimes per 100 residents, San Francisco, 2017.

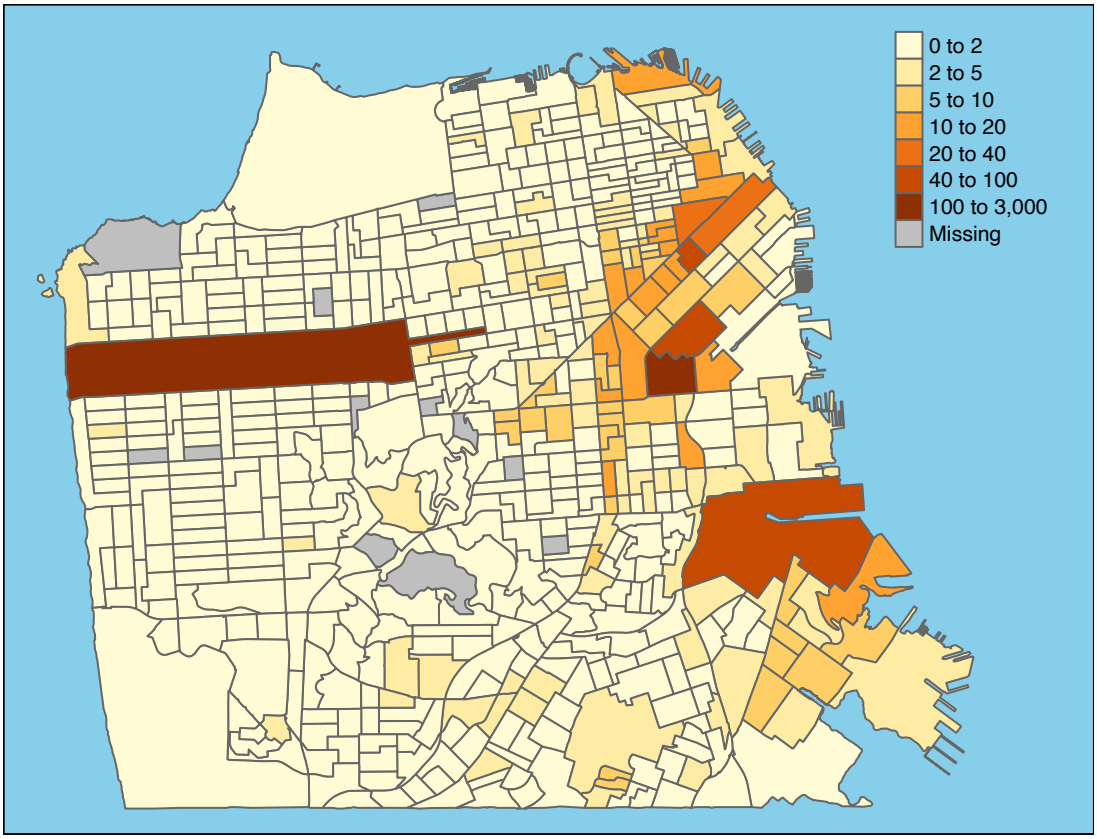

Figure 3: Violent crimes per 100 residents, San Francisco, 2017.

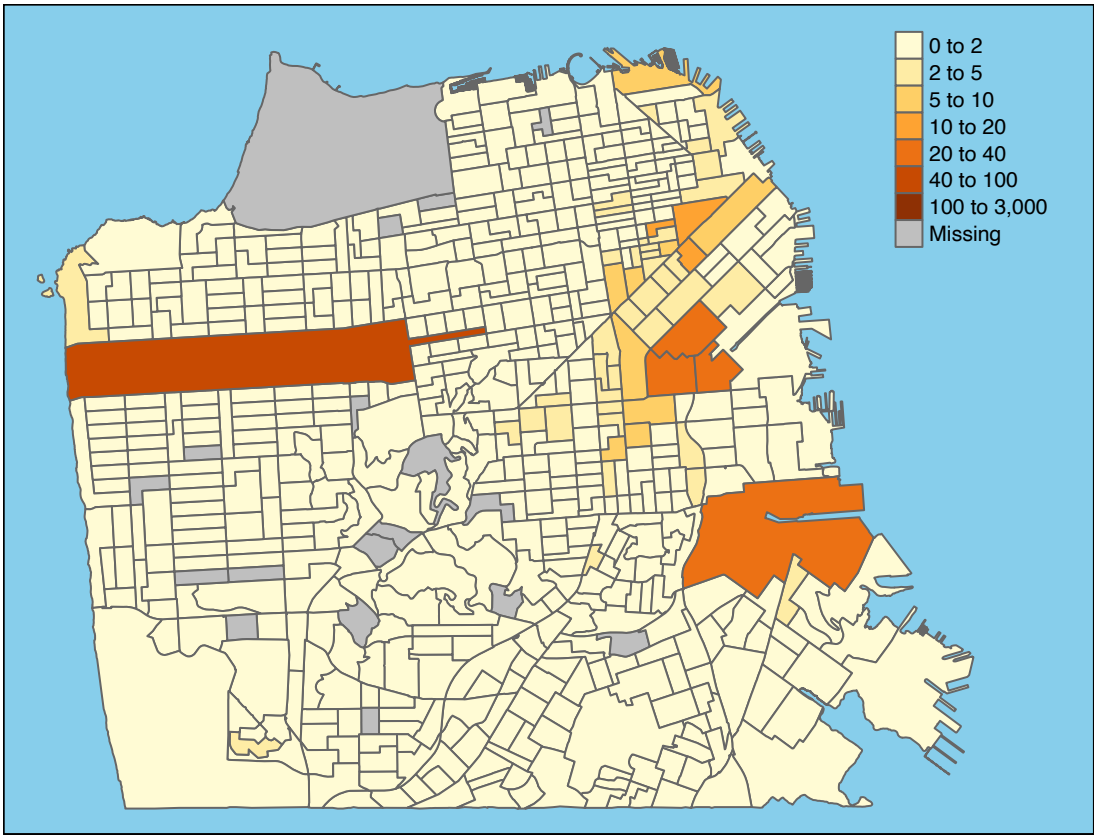

Figure 4: Nuisance crimes per 100 residents, San Francisco, 2017.

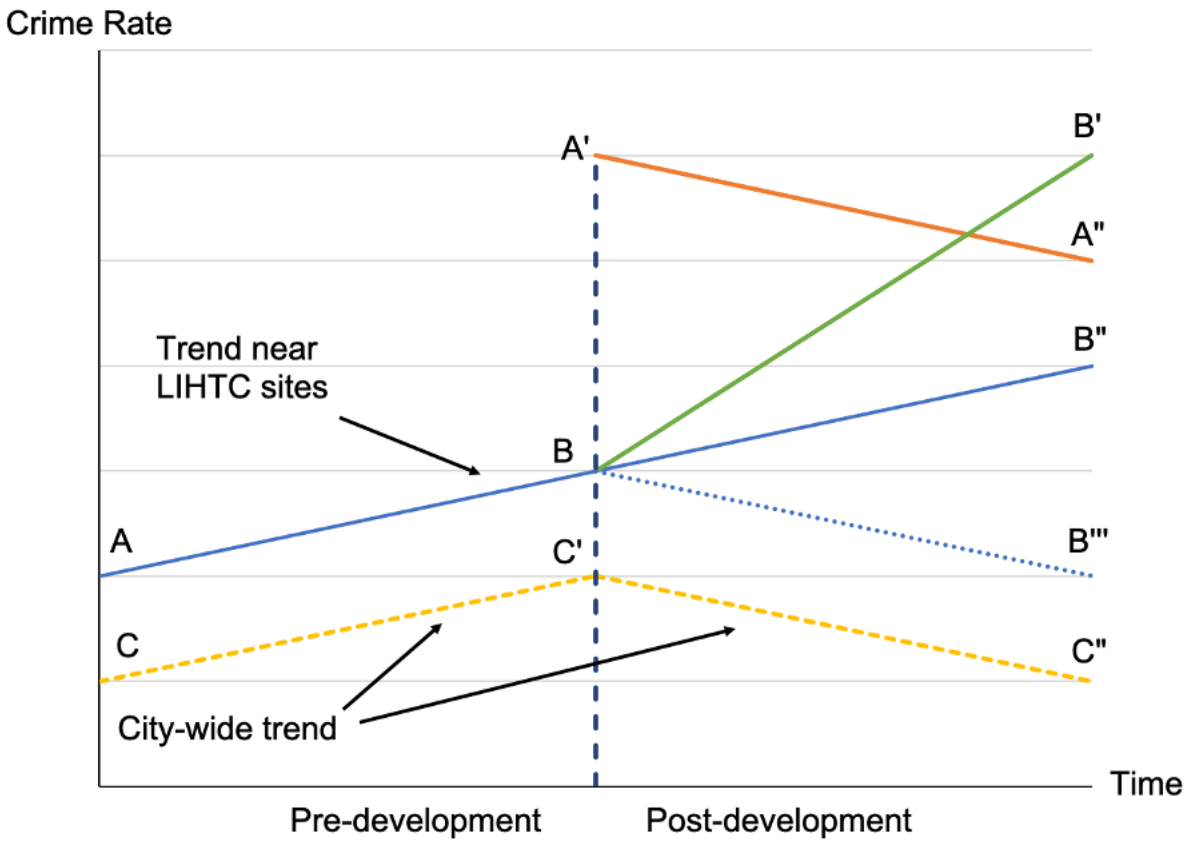

Figure 5: Illustration of potential types of crime impact on block group crime trends from LIHTC projects.

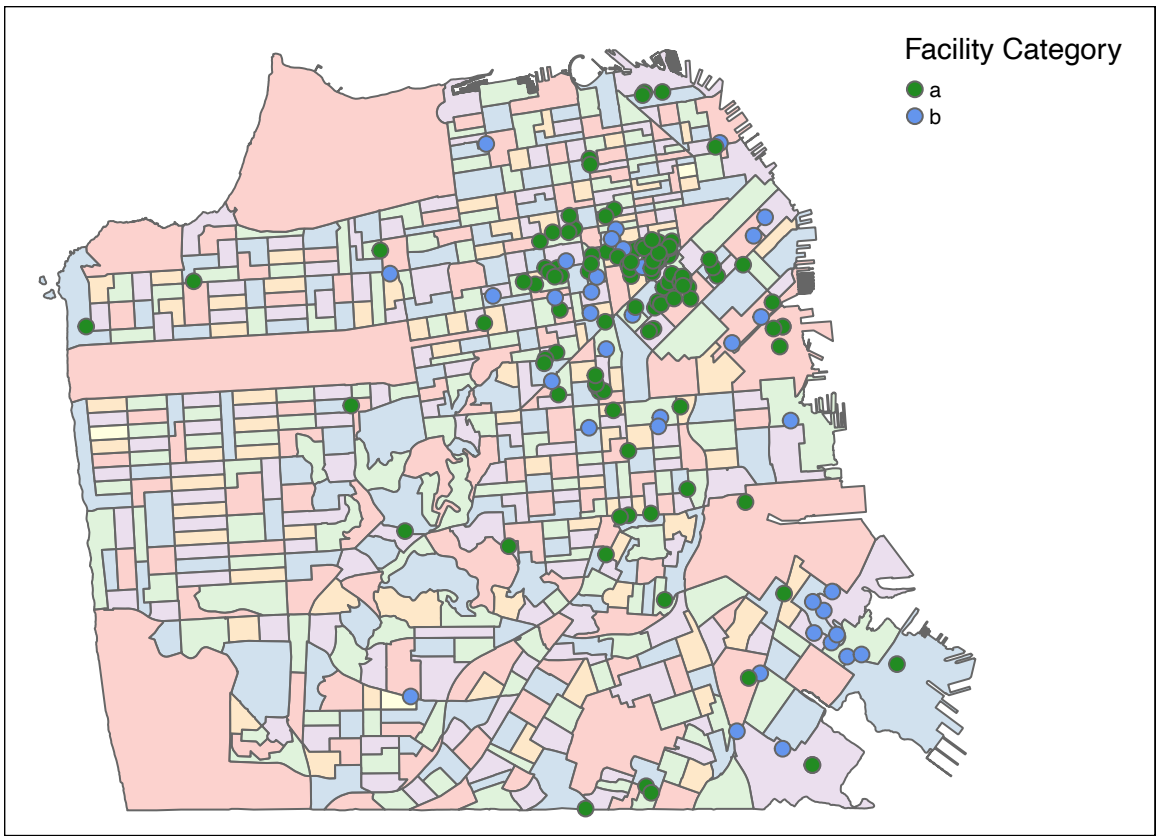

Figure 6: Distribution of LIHTC sites in San Francisco. Type a facilities were those excluded from the study. Type b facilities were used to classify block groups appropriately.

Table 1: San Francisco reported crime rates per 100 residents by year and type

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Crimes	17.8	16.9	16.2	16.0	16.4	16.2	16.5	15.7	16.2	17.0	16.1	16.2	15.2	17.5
Property	7.0	7.2	6.2	5.6	5.5	5.4	5.5	5.4	6.3	6.6	6.7	7.0	6.6	8.3
Violent	2.0	1.9	2.0	2.0	2.1	1.9	2.0	1.9	1.9	2.0	1.8	1.9	1.8	2.1
Nuisance	1.0	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.0	0.9	0.7	0.7	0.8	0.9

Source: San Francisco Police Department via SF Open Data Portal

Table 2: Regression coefficients of neighborhood crime impact variables, by crime type

	Total Crimes	Property Crimes	Violent Crimes	Nuisance Crimes
	(1)	(2)	(3)	(4)
CRAll	−20.378***	−17.245***	−0.961***	−0.102
	(0.952)	(0.532)	(0.156)	(0.139)
CPost	1.069**	0.802***	0.033	0.059
	(0.473)	(0.263)	(0.103)	(0.085)
Time	−0.089**	−0.009	−0.002	−0.008
	(0.039)	(0.022)	(0.008)	(0.006)
TrPost	0.122	0.084	−0.037	−0.045*
	(0.161)	(0.090)	(0.036)	(0.026)
space_lag	0.026***	0.054***	0.064	−0.004
	(0.009)	(0.010)	(0.039)	(0.040)
year2005	−0.154	0.007	−0.050	0.035
	(0.223)	(0.124)	(0.042)	(0.041)
year2006	−0.982***	−0.836***	−0.047	0.049
	(0.223)	(0.125)	(0.048)	(0.043)
year2007	−1.359***	−1.241***	0.016	−0.029
	(0.223)	(0.125)	(0.049)	(0.043)
year2008	−1.030***	−1.122***	0.021	−0.007
	(0.223)	(0.125)	(0.041)	(0.039)
year2009	−1.054***	−1.167***	−0.018	−0.006
	(0.223)	(0.125)	(0.048)	(0.040)
year2010	−1.195***	−1.286***	−0.054	0.064
	(0.228)	(0.127)	(0.054)	(0.045)
year2011	−1.129***	−1.208***	−0.102**	0.020
	(0.226)	(0.127)	(0.047)	(0.042)
year2012	−0.802***	−0.916***	−0.076	0.016
	(0.225)	(0.126)	(0.046)	(0.047)
year2013	−0.672***	−0.939***	−0.152***	−0.048
	(0.224)	(0.125)	(0.050)	(0.047)
year2014	−1.036***	−0.979***	−0.172***	−0.029
	(0.223)	(0.125)	(0.048)	(0.052)
year2015	−0.800***	−0.831***	−0.142***	−0.008
	(0.221)	(0.123)	(0.048)	(0.038)
year2016	−1.546***	−1.186***	−0.119**	−0.032
	(0.221)	(0.123)	(0.049)	(0.040)
year2017	−0.760***	−0.792***	−0.046	0.098**
	(0.227)	(0.127)	(0.051)	(0.049)
Constant	30.361***	20.838***	2.273***	0.646***
	(0.763)	(0.428)	(0.133)	(0.117)
Adjusted R^2	0.840	0.792	0.742	0.608
F Statistic	69.721*** (df = 258; 3129)	50.845*** (df = 258; 3129)	21.494*** (df = 258; 1577)	7.326*** (df = 245; 755)

Note: *p<0.1; **p<0.05; ***p<0.01

Software Attributions

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