The Effect of Zoning on Crime

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Abstract

Laws and policies regulating the built environment have played a critical role in the development of modern cities and the idea of utilizing them to combat crime is not unusual. However, research on the effects of zoning on crime is only starting to take off and more empirical work is needed. This article explores the relationship between zoning and crime in the city of Los Angeles by using a Quasi-Poisson regression to estimate the impact of different zoning types on total crime effects of zoning on crime in Los Angeles, at the census block level, by calculating the percent of major zoning types out of total parcels and calculating the Herfindahl index to measure diversity of zoning distribution within each block. Additionally, the article will review literature on social ecological theories of crime, zoning, and how the built environment has impacted other social problems, such as inequality, segregation, and access to resources. Results of the study demonstrate most zoning is associated with significantly less crime; however, manufacturing is the only zoning associated with significantly more crime and increased diversity in land use is associated with more crime.

Keywords: zoning, crime, Los Angeles, land use, built environment, social impacts

Introduction

Zoning ordinances regulate land, the buildings on it, and are critical for the development of the built environment of cities and the welfare of their residents. As discussed in ecological theories of crime, changing the built environment has the potential to shape criminal behavior within cities and zoning has been one strategy to address the issue of crime, but it has not received as much attention as other strategies. The city of Los Angeles is a prime example for examining the relationship between zoning and crime, not only because it passed the first municipal zoning ordinance in 1908, but because it is a well-studied area at the center of several research studies. Additionally, Los Angeles has a unique dense urban center with less dense suburbs encompassing it, a very different layout compared to older east coast cities found in the literature on this topic, and should be included in the data (Boone & Modarres, 1999; Anderson, MacDonald, & Bluthenthal, 2013).

The present study examines the effects of zoning on crime in the city of Los Angeles using 1,959 census blocks throughout the city, varying in zoning composition and total crime incidents. Within each census block I calculate the percentage of each zoning type within the block, and the total number of crime incidents, which are also sorted into one of the following categories: violent, property, or other categories. Additionally, I use a measure of dissimilarity, the Herfindahl Index, to assess the relationship between zoning diversity and total crime within blocks. This study, therefore, speaks to the potential role zoning may have in impacting crime by influencing the built environment in Los Angeles neighborhoods and as a tool for combating crime by shaping the built environment through zoning laws.

Lastly, while it is beyond the scope of the current research, the present study on zoning and crime has an important place in the discussion of gentrification, which has become a growing concern in Los Angeles. Tenants and housing justice activists have brought attention to the gentrification occurring throughout several parts of Los Angeles, which they argue has led to an increase in rent spikes, displacement, evictions, and homelessness particularly amongst people of color (Housing is a Human Right, 2018). Additionally, several studies and researchers have argued zoning regulations have played a role in facilitating gentrification and the continued segregation and displacing of people into geospatially less desirable areas (Marcuse, 1984; Dubin, 1992; Essoka, 2010). However, other studies have argued that while gentrification causes large-scale neighborhood changes, it may cause a reduction in crime over time (Papachristos, 2011; David, Palmer & Pathak, 2017). Being that zoning plays a role in shaping the built environment and in processes such as gentrification, it is important to consider its relationship with crime or any other issues affecting the welfare of residents. Exploring the relationship between zoning and crime offers several pathways for future research studies to take.

Background on Zoning

Today, zoning is briefly defined as a type of land use law in which the government divides land into various zones and prescribes regulations for how this land can be used. Zoning regulations can dictate a variety of building features, including size, dimensions, placement, and compatibility, depending on the desired layout for an area. Zoning is often interchangeably used for land use and vice versa but it is important to note that while zoning is a type of land use law land use does not exclusively refer to zoning. Land use regulations also refer to things such as

housing codes and historic preservation laws, but both have influenced the built environment and the social conditions of different areas for some time.

The roots of zoning have long existed as common law but formal zoning laws reflective of zoning regulations today developed in the period following the industrial revolutions of the late 1800s and the early 1900s (Whitnam,1931; Silver, 1997; Shertzer, Twinam, & Walsh, 2018). During this period, US cities were experiencing dramatic growth, due largely to industrial expansion and immigration, and city officials sought to use scientific and technical strategies to manage the radically changing landscape. For example, in 1909 the United States Supreme Court endorsed Boston's authority to create differential height districts in *Welch v. Swasey*; a first in a series of events that would revolutionize land use regulations and planning (Silver, 1997; Anderson, MacDonald, Bluthenthal, & Ashwood, 2013). In the same year, Los Angeles became the first city in the country to 'use zoning', although New York is typically credited as the first, by dividing its residential and industrial districts (Silver 1997; Anderson et al., 2013). Furthermore, the First National City Planning Conference was held in Washington, D.C in the same year (Anderson et al., 2013). Finally, New York city adopted the first zoning ordinance in 1916 recognized by most scholars, although the author argues Los Angeles to be the first, and over 700 cities would follow thereafter (Shertzer, Twinam, & Walsh, 2018).

However, while zoning and land use regulations were developed to "shape the built environment and to stabilize land values", it is important to highlight the more menacing objectives behind these regulations (Silver, 1997, p.1). It is important to discuss the impacts, explicit and implicit, zoning and land regulation have had on the social conditions of residents, especially on immigrants and Black folks, at the beginning of the 20th century. Policies and objectives of this era for regulating the built environment contributed to many of the social

conditions cities still endure today that have not been remedied and it is equally, if not more, important to examine these historical roots as well.

As previously mentioned, cities in the early 1900s were not equipped with the appropriate infrastructure to sustain the unprecedented number of people in them and the living conditions were appalling. Residential housing units were overcrowded, sanitation conditions (including plumbing, waste management, ventilation, and quality of water) were terrible, and, as a result, disease ran rampant. Even innovations, such as skyscrapers, automobiles, and public transit, created to resolve some of the issues that came with accommodating a growing number of residents within a geographically limited space, produce other problems. For example, residents living in surrounding buildings stated skyscrapers blocked sunlight and airflow, leading to potential negative health effects (Shertzer, Twinam, & Walsh, 2018).

Several groups have experienced adverse consequences in this era of urbanization. Immigrants were often deemed as "undesirable" and were often associated with higher rates of crime in many theories of crime, such as that of Park and Burgess (Bursik, 2006). As Brown (2016) explains, tropes falsely linking immigrants to crime, violence, and drugs have existed since the America's inception and have greatly affected the perceptions, treatment, and welfare of immigrants (Brown. For example, many Jewish, Asian, and European immigrants were shown living in horrible conditions and impoverished areas in the ghettos of New York city in the late 1880s (Gandall, 1997, p.8). While the conditions for immigrants were indeed horrendous, immigrants were often blamed for creating these conditions rather than being victims of it and for opponents of migrants or open-border policies it served as evidence to confirm their existing negative sentiments about immigrants, including their perceived inferiority.

Similarly, Black folks in America experienced similar, if not more, adversity. Many Black individuals experienced poor living conditions, lack of resources, and racial prejudice as a result of implicit and explicit zoning regulations, which W.E.B Du Bois documents in *The Philadelphia Negro* (1899) (Du Bois, 1899; Morris, 2017). In what is arguably "the first study of an urban Black community", Du Bois demonstrated how the design of the built environment of Philadelphia was not a naturally occurring phenomenon, as later theorists of the Chicago school would argue, but a product of racial dynamics (Brown, 2011). He argued the high levels of racial segregation in the city and segregation "resulted from decisions made by economic elites to protect white interests" (Morris, 2017, p. 49). Additionally, Du Bois attributed the social conditions plaguing Black communities, including poverty and crime, to the surrounding racial power relations that left them in a position of subordination (Du Bois, 1899; Morris, 2017).

As exemplified through the experiences of immigrants and Black people of the early 19th century, zoning was utilized not only as a tool for social reform but also for racialized land use control. Zoning, as social reformers believed "offered a way to not only exclude incompatible uses from residential areas but also to slow the spread of slums into better neighborhoods"; however, it also became a mechanism for protecting property values and excluding those deemed as undesirables (Silver, 1997, p.1). Several scholars have examined and discussed various examples of cities in the 20th century utilizing zoning in order to enforce racial segregation, including Southern cities (Silver, 1997). Other cities utilized what Silver (1997) and Rabin (1999) describe as "expulsive zoning", which permitted "the intrusion into Black neighborhoods of disruptive incompatible uses that have diminished the quality and undermined the stability of those neighborhoods". Essentially, this type of zoning allowed, even encouraged, industrial facilities to congregate in neighborhoods of color, "excessively increasing exposure to lead, air

pollution, or other hazards among those less able to deal with them" (Whittemore, 2017, p. 237). For example, Whittemore (2017) documents the following cases are a few examples of expulsive zoning throughout the 20th century identified by other scholars in which planners and elected officials targeted communities of color with zoning for industry: (1) 800 residential acres of a Black neighborhood were rezoned for industrial use in LA in 1990, despite availability of other land in the area, (2) several Black neighborhoods rezoned for industrial in 1947 in Charlotte, NC to promote their redevelopment, and (3) another area was rezoned in Milpitas, CA following a union proposed building housing for Black workers there (Whittemore, 2017, p. 237). Cases such as these demonstrate the impact zoning has had on the lives of Black folks and helps explain how zoning found in cities today continue to impact communities of color.

This brief history of zoning, while not the central point of the analysis presented in this paper, is still an important facet of the literature on zoning, crime, and the built environment. Additionally, as the author mentioned, it would not be appropriate to present an analysis on crime and zoning, without acknowledging the differential impacts zoning has had on various racial and ethnic groups. The history of zoning is also important for the discussion of theories of space and crime that follows.

Theories on Space and Crime

The connection between the built environment and crime is by no means new. There is a long history of literature, starting with the work of W.E.B. Du Bois, examining how the built environment can shape crime (Wilson, Early, Lewis, Anderson, Blackwell, Walters, & Stone, 1996; MacDonald, 2015; Morris, 2017). Utilizing zoning or land-use laws is a topic which has been examined in the previous literature but has received very little objective research to

examine its effects. Additionally, despite the previous literature, policymakers continue to debate the effect city planning and zoning can have on crime and have typically criminal law has sought to reduce crime by deterring, rehabilitating, or incapacitating criminals (Anderson, MacDonald, & Bluthenthal, 2013). Utilizing zoning laws offers a potential solution by shaping the environment in a lasting and meaningful way to help reduce crime without overburdening the criminal justice system. Additionally, zoning can serve as a proxy for further examining and understanding how complex geospatial processes, such as gentrification, may also influence and interact with crime. Lastly, further research in this area is needed, as the precise mechanism explaining how changes in the zoning influences crime is still unknown.

Among the most influential theories guiding the reasoning behind contemporary research on the effects of zoning and the built environment on crime are social disorganization theory, broken windows, and routine activity theory. These theories each provide different explanations on how the built environment or features of it, such as zoning, can influence crime rates. Before discussing these theories it is important to begin with Du Bois' pioneering work in The Philadelphia Negro (1899), which arguably pioneered not only the field of sociology but also discussed what could be considered conditions of social disorganization within the city of Philadelphia (Du Bois, 1899; Morris, 2017; Reed, 2019).

Dubois' analysis of the urban Black community ultimately demonstrated that the resulting social conditions, including crime rates, poverty, and living conditions, of this community were not a result of its inhabitants but of the larger politics shaping the built environment to segregate and subordinate Black folks (Morris, 2017). In *The color of law: A forgotten history of how our government segregated America*, Rothstein provides examples of how racial zoning continued to be used by city planners who designated, or zoned specifically

for Black residents, and these sites were chosen to “remove the entire colored population” (Rothstein, Richard, 2017, p. 21). Black people were left to live in “ghettos”, where they were castaway and restricted, with spatial separation, such as through zoning and land use regulations, by the state (Marcuse, 1997, p. 2). While Du Bois’ claims regarding the built environment and its impact on the social conditions of Black residents were true and pioneering, they would be ignored as the Chicago School of sociology would come into fruition. The Chicago school would rise to prominence, while Du Bois’ work would go largely dismissed, as Park and Burgess’ work on concentric zones would become the roots for Shaw and McKay’s Social Disorganization theory (Morris, 2017).

As Morris and other scholars have highlighted, Robert Park was a proponent of social Darwinism and this was reflected in his work on concentric zones. Park and Burgess used concentric zones to “explain the existence of social problems such as unemployment and crime in certain districts of Chicago”; however, Park, and other scholars, saw enclaves of Black and immigrant populations as problems unto themselves and as lesser copies of White communities (Brown, 2011, p.2; Morris 2017). Most problematic was “Park and Burgess suggested that the struggle for scarce urban resources, especially land, led to competition between groups and ultimately to the division of the urban space into distinctive ecological niches or "natural areas" in which people shared similar social characteristics because they were subject to the same ecological pressures”(Brown, 2011, p.2). The belief that immigrants, but especially Black people, were subordinate to Whites led Park to believe that it was a necessary part of assimilation and how groups were divided was natural; notions that reaffirmed his beliefs of maintaining a racial hierarchy of white supremacy (Morris, 2017).

Next, building on the work of Park and Burgess, Shaw and McKay's theory of social disorganization similarly focus on the effects of place on crime in Chicago neighborhoods (1942, 1969). The researchers observed high rates of delinquency in certain neighborhoods and came to the conclusion that the neighborhoods' ecological features, including low economic status, ethnic heterogeneity, and residential mobility, disrupted the community's ability to organize and solve issues like crime (Sampson & Groves, 1989; Kubrin & Weitzer, 2003). The theory became tremendously popular and inspired further research in this area, but the theory fails to consider issues around culture and larger forces relating to politics and economics that influence community crime rates. For example, just as industrialization was important for the increasing population of cities, deindustrialization and a lack of investment in communities can have indirect effects on crime by increasing levels of poverty and unemployment. Additionally, the theory neglects to consider the direct ways political and economic decisions may affect crime rates through zoning laws which designate where public housing projects or high -rise luxury apartment may be built and which may be rewritten depending on the goals of city officials.

Kubrin and Weitzer (2003) explain that although recent theoretical and empirical work on social disorganization theory has led to important refinements to the theory, there continue to be methodological deficiencies in this body of work. The researchers explain understanding the dynamics leading to disorganization can only be perceived when long-term processes of urban development are considered, but most of the studies testing the theory utilize cross-sectional data (Kubrin and Weitzer, 2003). The researchers point out it is impossible to study change in environment and the effects of processes, such as gentrification and segregation, on crime without longitudinal data (Kubrin and Weitzer, 2003).

Similarly, broken windows theory, coined by Wilson and Kelling (1982), explains that unchecked disorder in a community can signal potential offenders that the neighborhood is ideal for victimization because it lacks surveillance and care, and relay the message that unlawfulness is tolerated in the community (Wilson & Kelling, 1982). This theory highlights how neighborhood design, upkeep, and infrastructure may affect crime by attracting or deterring criminals to certain areas. Zoning fits the idea of this theory because it affects the built environment of a community and may indirectly influence crime rates. For example, if a neighborhood is primarily zoned for industrial use there may be less trash, increased surveillance, and less people in general.

Several studies provide support for broken windows theory and continue to suggest a connection between crime and community disorder. Perkins and Taylor (1996) found a correlation between residents' fear of crime and observable signs of disorder among neighborhoods in Baltimore and Philadelphia. In another study using broken windows theory, Sampson and Raudenbush (1999) measured physical disorder in Chicago using a combination of police records, census data, survey data, as well as videotaping and a systematic rating of more than 23,000 street segments (Sampson & Raudenbush, 1999). The researchers controlled for measures such as collective efficacy, concentrated poverty, and other factors, and, ultimately, found only an insignificant association between observed disorder and self-reported household victimization (MacDonald, 2015). There continues to be debate regarding the casual mechanisms behind disorder and how it affects crime and historically it have been used to justify arresting people for minor offenses and "stop and frisk" policing strategies, which disproportionately target people of color (Fagan, Geller, Davies, & West, 2010).

Last, routine activity theory essentially explains that crimes occur when there is a convergence in space and time of offenders, suitable targets, and the absence of effective guardians (Felson & Cohen, 1979). This theory highlights how neighborhood design, building structures, and land use may affect crime. For example, areas with a constant flow of people, such as areas zoned for commercial or residential use, may increase opportunities for crime because there are more suitable targets (people, stores, etc.), less guardians compared to victims (e.g. mall or apartment building). However, the opposite may also be true, because areas with more people may attract more guardians in the form of police, surveillance, or witnesses willing to interfere. Areas with less people, such as manufacturing or industrial areas, may theoretically have a reduced probability for crimes to occur just because of the sheer reduction in people, which reduces the number of potential offenders as well as targets, but could also increase the possibility for a criminal act to be committed as target and offender may find themselves in an area without any witnesses or guardians (Felson & Cohen, 1979). This theory calls into question the role zoning laws plays may have in influencing what structures, and subsequently the population density, an area has, which may shape the opportunity for crimes to occur

Contemporary research in this area has examined how the built environment may affect crime through land use planning (MacDonald, 2015). While it is not a new concept, zoning changes may protect against crime through mechanisms explained in routine activity theory by mixing residential and commercial buildings to help generate a higher flow of people (guardians or natural surveillance). On the other hand, changes in zoning may also increase decay or disorder in a community with higher commercial buildings and lead to more crime, which is explained in broken windows theory. Additionally, examination of changes in zoning may also signal that processes, such as gentrification, are occurring in a neighborhood and if analyzed over

time, may be used to test social disorganization theory in a way cross-sectional data does not allow.

Most studies examining zoning primarily use cross-sectional data, which help capture a snapshot how zoning effects other outcomes, such as crime, in a given time period but are nevertheless limited in its predictive abilities or establishing causality. For example, Taylor et al. (1995) found blocks in Baltimore and Philadelphia with more commercial uses had higher rates of vandalism, litter, abandoned property, and deteriorating buildings (MacDonald, 2015). Similarly, Harrell and Roman (1994) found that among census tracts in Washington, DC with higher percentages of commercially zoned lots rates of robbery were higher (MacDonald, 2015). Additionally, results from Stucky and Ottensmann (2009) demonstrated higher rates of violent crime in small street grids in Indianapolis where areas were zoned with high-density residential units and commercial land use (Stucky & Ottensmann, 2009). Interestingly, high-density residential units, when concentrated in poor areas, were associated with higher rates of violent crime, but the opposite was true for commercial land use (MacDonald, 2015).

Few studies on zoning have examined whether variation in zoning within similar areas are correlated with differences in crime with large samples. One of the few examples is Anderson et al. (2013), which compared over 200 blocks in eight Los Angeles neighborhoods with crime rates higher than the city average (MacDonald, 2015). Blocks were compared to make sure they were similar in demographic compositions but varying by types of zoning, to reduce the risk of differences in crime result from demographic differences (MacDonald, 2015). Results from the study found that blocks zoned for single-use residential had the lowest crime compared with blocks zoned for commercial or mixed use in the same neighborhoods (MacDonald, 2015).

The central question this study aims to answer is whether differences in land use zoning are associated with different levels of crime in the same neighborhoods. Additionally, it examines whether differences in land use zoning diversity are associated with different levels of crime in the same neighborhoods. The general strategy in this study is to compare the crime rates within census blocks with different types of zoning parcels throughout different neighborhoods in Los Angeles. Lastly, the study calculates land use zoning diversity within census blocks in Los Angeles, by calculating the Herfindahl index.

Data Description

For this study, data on crime, zoning, census blocks, and neighborhood boundaries were obtained from the following three open sources: Los Angeles Open Data, Los Angeles County GIS Data Portal, and Los Angeles Times Mapping L.A. Boundaries API Data. First, the Los Angeles crime data, which is provided by the Los Angeles Police Department (LAPD) and is refreshed weekly, was joined with the 2010 census block data, provided by LA county GIS data portal, by geographic location. The crime data includes geographic location (latitude/longitude), date of occurrence, and description of crime committed (crime code and description) for all crime incidents from *2010* to *2018* (up to March). Before joining these data by geographic location, which results in the creation of a dataset that provides crime counts per census block, the crime data is converted into spatial data, resulting in the crime-census dataset.

Next, zoning data from the Los Angeles zoning map is utilized. The zoning map contains data, including the geographic location, of zoning parcels and land use zoning classifications for all parcels. Then the zoning data is joined with the census block data by geographic units, as they are both spatial data frames, therefore no conversion is needed for either, to create a separate

dataset, the zoning-census dataset, which contains land use zoning data for each census block. Next, the zoning-census data was aggregated to obtain the total count of zoning parcels within each census block and make it wide by each of the zoning types. Lastly, data on Los Angeles county neighborhoods boundaries, which provides the geographic location of neighborhoods and their names, was utilized but did not need any manipulation or joining to the census block dataset as the previous datasets required because these data contained census block information and numbers for each neighborhood.

Next, the crime-census dataset, zoning-census dataset, and neighborhood dataset were all joined by census block numbers, resulting in the final data frame. Additionally, four additional columns were created within the final dataset, one column containing the year in which each crime occurred and three more columns to calculate crime totals for the three primary crime types (total crime, property crime, violent crime, and miscellaneous (other) crimes). Other additional columns were created to calculate total number of parcels within census blocks (Total Parcels) and the total number of parcels dedicated to primary zoning classifications (agriculture, commercial, manufacturing, open land, public facilities/parking, residential) and all other remaining zoning classifications. Once the total count of all zoning parcels per block and each different type of parcel per block was calculated, the percentage of each of the primary zoning types/classifications out of all the parcels (total parcels) was calculated (e.g. total # of parcels dedicated to residential zoning per block/total # of parcels per block). Once all these steps were taken the final dataset was complete, containing 1959 observations (census blocks), and analysis of the key variables was possible.

Table 1 below displays average crime counts per year in Los Angeles (LA) from 2010-early 2018 across all 1959 census blocks. When examining crime, all crimes were sorted into one

of the following three categories: total property, total violent, and total other (miscellaneous). Crimes were sorted into each of the categories at personal discretion, closely following the definitions given by the FBI and the state of California, to qualify each crime into property, violent, or other (miscellaneous) crime. Overall, total crime in LA appears to have increased from 2012-2017, only decreasing for short periods between 2010-2011 and 2012-2013. Total crime in LA is made up primarily of property and other (miscellaneous) crimes while violent crimes make up the lesser part, but there is still lots of variation in crime across all census blocks, as shown by the standard errors.

Table 1. Average Crime Counts Across All Census Blocks by Year

Year		Total Crime	Total Property	Total Violent	Other (Miscellaneous Crimes)
2010	Mean (standard deviation)	3218.17 (3017.05)	1232.86 (1113.05)	450.04 (435.83)	1535.27 (1472.56)
2011	Mean (standard deviation)	3098.52 (2921.71)	1096.28 (995.24)	423.13 (419.13)	1579.11 (1510.35)
2012	Mean (standard deviation)	3116.54 (2943.92	1076.45 (979.64)	397.90 (391.96)	1642.18 (1575.34)
2013	Mean (standard deviation)	3012.08 (2815.12	1046.57 (934.31)	361.13 (351.60)	1604.38 (1532.69)
2014	Mean (standard deviation)	3042.17 (2868.06)	1007.27 (922.65)	400.27 (386.69)	1635.64 (1562.11)
2015	Mean (standard deviation)	3394.78 (3142.84)	1138.95 (1032.86)	475.37 (455.54)	1780.46 (1675.05)
2016	Mean (standard deviation)	3540.13 (3290.36)	1227.31 (1112.14)	511.01 (489.62)	1891.81 (1648.84)
2017	Mean (standard deviation)	3551.99 (3271.10)	1260.94 (1127.40)	521.65 (498.38)	1769.40 (1648.84
2018	Mean (standard deviation)	605.12 (542.50)	221.6274 (194.53)	84.30 (29.54)	299.20 (269.97)

Overall	Mean (standard deviation)	2961.14 (2990.64)	1036.99 (1017.02)	403.84 (425.28)	1520.32 (1556.52)

N = 1959 census blocks, *Crime counts for this year only available for the first 3 months

Next, **Table 2** examines how zoning classifications are distributed among all census blocks. When examining zoning, only the primary zoning classifications (agriculture, commercial, manufacturing, open land, public facilities/parking, and residential) were analyzed because these made up the biggest part of zoning within census blocks, and all other zoning types were examined together under the category of 'Other' because individually each category only made up about less than 1-2% of the zoning within most census blocks. On average, most blocks zoning parcels are dedicated to residential and commercial zoning, which make up about 65% and 20%, respectively, of all zoning within census blocks. Additionally, **Table 2** shows that all census blocks contain some residential zoning but some blocks had an absence of one or more of the other zoning types, which results in an 0% value when calculating the minimum value of the zoning types with each block. For example, while all census blocks have residential, some blocks do not contain agriculture, commercial, or manufacturing zoning in them.

Table 2. Average Zoning Classifications Across all Census Blocks

	Agriculture	**Commercial**	**Manufacturing**	**Open Land**	**Public Facilities/ Parking**	**Residential**	**Other**
Mean	1.6%	19.8%	5.3%	2.3%	2.3%	65.6%	3.4%
Min	0%	0%	0%	0%	0%	33.3%	0%
Max	7.1%	66.6%	20.0%	8.0%	4.9%	100%	10.5%
Standard Error	.71%	3.5%	3.5%	1.7%	0.9%	3.8%	1.2%

N=1959 (census blocks)

Analysis Strategy

The empirical strategy measured the effect of zoning on crime by comparing total crime counts among census blocks, which have different distributions of the primary zoning parcels. A quasi-Poisson regression model, displayed below, was then utilized to estimate the impact of different zoning classifications on total crime outcomes, while controlling for neighborhood name and year variables. Additionally, another quasi-Poisson regression model was used to estimate the impact zoning diversity within each block had on crime by calculating the Herfindahl index, which is simply utilized to measure the diversity of zoning classifications within each block, for each census block while controlling for neighborhood name and year. The Herfindahl index is simply calculated by squaring the percent of each of the primary types of zoning, adding them all together, and subtracting the sum from one. The Herfindahl Index is measured on a scale from 0-1, 1 describing perfect equal distribution of all primary types of zoning and 0 describing no diversity in zoning (e.g. census block solely containing residential zoning and no other type). Larger values indicate more diversity in land zoning as the number is closer to 1.

Regression Models:

$$(1)\ Total\ Crime_{ijt} = B_0 + B_1\ Agriculture_{ijt} + B_2\ Commercial_{ijt} + B_3\ Manufacturing_{ijt} + B_4\ Open\ Land_{ijt} + B_5\ Public\ Facilities/Parking_{ijt} + B_6\ Residential_{ijt} + B_7 Other_{ijt} + Neighborhood_j + Year_t + E_{ijt}$$

(All zoning variables calculated as percentages of total parcels, e.g. Agriculture/Total Parcels)

$$(2)\ Total\ Crime_{ijt} = B_0 + B_1 Herfindahl_{ijt} + Neighborhood_j + Year_t$$

Results

After running the first regression model, the findings demonstrate that, overall, most zoning types are associated with less crime, as shown in **Table 3**. Specifically, agriculture, open land, and residential zoning had significantly ***less crime*** across all crime categories. However, manufacturing zoning is associated with having significantly ***more crime***.

Table 3. Average Change in Crime Count Associated with Different Zoning Types

Zoning Type		Total Crime	Total Property	Total Violent	Total Other
Agriculture (Agr/Total)	Estimate Standard Error t-value	-79.8*** (8.32) -9.59	-70.6*** (8.95) -7.85	-38.9*** (11.8) -3.30	-10.9*** (14.1) -7.74
Commercial (Com/Total)	Estimate Standard Error t-value	-9.45 (6.30) -1.50	-8.97 (7.31) -1.23	-17.4* (8.36) -2.08	-12.3 (9.99) -1.23
Manufacture (Man/Total)	Estimate Standard Error t-value	48.6** (14.8) 3.28	5.40** (1.77) 3.06	28.4 (22.2) 1.28	55.9** (1.99) 2.81
Open Land (Open/Total)	Estimate Standard Error t-value	-113.1*** (12.3) -9.20	-113.7*** (12.9) -8.81	-73.5*** (16.2) -4.53	-141.4*** (23.2) -6.10
Public Facilities/ Parking (P/Total)	Estimate Standard Error t-value	-60.7*** (16.6) -3.67	-58.1*** (18.8) -3.08	-16.9 (22.4) -0.75	-94.2*** (27.1) -3.48
Residential (Res/Total)	Estimate Standard Error t-value	-25.8*** (5.11) -5.03	-24.6*** (6.17) -3..98	-17.4* (7.05) -2.46	-32.7*** (7.64) -4.28
N=1959 census blocks, *p<.05, **p<.01,***p<.001, All models control for neighborhood and year effect					

Next, the results of the 2nd regression model, which examines the effect of parcel diversity on crime among census blocks, are analyzed. As shown in **Table 4**, a higher score on the Herfindahl Index, increased diversity among parcels, was significantly associated with **more crime** across all crime categories, with a p-value of .001.

Table 4. Change in Crime Associated with Herfindahl Index

		Total Crime	Total Property	Total Violent	Total Other
Herfindahl Index	Estimate	17.9***	18.7***	7.79***	20.5***
(0-1)	Standard Error	(1.10)	(1.25)	(1.48)	(1.59)
	t-value	16.3	14.9	5.26	12.9

Discussion

In conclusion, the results of this study suggest zoning matters when it comes to crime. The results suggest most types of zoning types are associated with significantly less crime, especially agriculture, open land, and residential, which are significant across all primary crime categories, but manufacturing zoning is associated with significantly more crime. Additionally, the findings show an increase in diversity of land use zoning within census blocks is significantly associated with more crime. Overall, the results suggest zoning matters when it comes to crime and policymakers may want to consider strategic decisions, such as reducing zoning diversity within blocks to reduce crime in high crime areas or avoid certain types of zoning, such as manufacturing, which is associated with increased crime.

However, the results of this study are exploratory and only prove an *association* between zoning and crime, at best, and not a causal relationship. Furthermore, the results of this study should not be used to make policy recommendations considering it is only preliminary, does not control for other confounding variables that may also be associated with different zoning, such as in demographics, income levels, or policing, and contains other important limitations the author was not able to address. First, the crime data utilized is only a cross section of all Los Angeles crime data and contains only official crimes reported to the police, which does not account well for crimes that largely go underreported, such as sexual assault crimes. Additionally, the author did not account for important racially disparate impacts any prior forms of zoning, explicit or

implicit, have had on social conditions, such as crime. Lastly, the final dataset utilized in this analysis was a result of mapping individual crime incidents within the city of Los Angeles based on the geographic location (latitude and longitude) police document as the location of the crime. However, the location of where a crime occurred may not necessarily represent reality, as this location may have been coded to the nearest recognizable area, based on officer or victim descriptions/reports, or may be where the criminal occurrence ended (e.g. where arrest was made following a chase), although the crime may have begun or taken place at a different or nearby location. As mentioned previously, the study does not control for differences in demographics, income levels, or policing within different or census blocks, which may be affecting the amount of crime and reporting within an area. Lastly, there was not a lot of heterogeneity among zoning of census blocks to begin with, as most parcels were zoned for residential and commercial (both taking up about 75-80% of all zoning).

Looking forward, the results of this study are preliminary steps in a growing area and do not supply any final answers, but suggest strategic decisions on zoning could be used as part of the overall crime prevention strategy and highlight other avenues for future research on this topic. Future research may want to use zoning as a proxy for studying gentrification, which has widely affected immigrant and Black enclaves with displacement, or to examine the long-term impacts racial zoning has had on the social outcomes of segregated areas, especially within cities such as Los Angeles, containing areas that have continued to be segregated while others have had allowed for more residential and racial diverse integration. Additionally, future research may replicate this study in other cities to gain further understanding of the effects of zoning on crime, to examine the generalizability and robustness of the results found in this study (controlling for factors such as the level of policing within blocks, population size,

socioeconomic characteristics, etc.), and examine the longitudinal effects of zoning on crime or other social conditions of cities or even smaller units of analysis.

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