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Crime Concentration at Buildings: Nordic Evidence on the Impact of Housing Ownership on Crime

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Abstract

This study examines the concentration of crime at residential buildings and investigates whether housing ownership has an impact on such a concentration. Using Geographic Information Systems (GIS), police-recorded crime data were geocoded at the building level and combined with socio-demographic and land use variables in Poisson regression models. The results indicate that a small percentage of buildings is responsible for a large proportion of crimes. This pattern persists even after offences are standardised by the number of apartments. Buildings under private housing ownership are generally associated with lower crime levels than those under rental; however, this relationship is not uniform across private housing companies and different types of crime. Findings point to the need for further research into how building-level management practices interact with neighbourhood-wide policing strategies and other micro-level factors, such as a building's design, location, and accessibility, in shaping crime outcomes.

Keywords Crime concentration · Risky facility · GIS · Modelling · Place management

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Introduction

In contrast to the century-old tradition of focusing on neighbourhood patterns of crime (Sampson et al., 1997; Shaw & McKay, 1942), more recent studies have shown evidence that within these neighbourhoods, certain places, including specific streets, bars, or residential buildings, are the ones that generate and/or attract disproportionately high amounts of crime (Eck et al., 2007; Sherman et al., 1989; Weisburd, 2015). These studies consistently show that a small fraction of places in any neighbourhood account for a large share of local crime. This shift from area to place highlights the importance of place-level features in shaping crime opportunities. In this paper, we focus on residential buildings, more specifically on housing ownership in these buildings. By examining the relationship between housing ownership and crime concentration, we aim to understand the role of housing companies as owners and place managers in the criminology of place.

Overall, studies indicate that areas with a significant proportion of residents living in public housing/rental apartments often experience more crime, even when controlling for factors related to the population (Kling et al., 2005; Schill, 1993). Housing ownership is generally thought to have both direct and indirect influences on people's behaviours and sense of control, as well as property management quality, although variations can be found within tenure and ownership types (Disney et al., 2023; Rephann, 2009; Rohe et al., 2002). One reason is that some buildings can function as 'risky facilities', marked by frequent rule violations, signal a breakdown of order that can attract further offending (Eck et al., 2007). In poorly managed properties, for instance, lax oversight can normalise deviant behaviour, allowing patterns of crime and disorder to take hold and persist over time (Eck & Madensen-Herold, 2018). The evidence regarding the extent to which housing ownership influences crime distribution is limited in the Nordic context, but international evidence suggests that differences in incentives for property maintenance in public housing compared to privately owned housing do affect crime in these buildings (e.g. Disney et al., 2023).

The present study aims to fill an important gap by first assessing the concentration of crime in residential buildings and later examining whether this concentration is influenced by housing ownership in Stockholm, Sweden's capital, while controlling for area-level features and building-specific characteristics. Using Geographic Information Systems (GIS), police-recorded crime data were geocoded at the building level and combined with socio-demographic and land-use variables in Poisson regression models to assess the potential effect of housing ownership on crime patterns. Although this study does not measure management practices directly, as previous research shows, ownership type is closely linked to differences in management capacity, incentives, and regulatory obligations. Public housing companies, private firms, and condominium associations vary in the resources they can deploy, their flexibility in tenant screening, and their approaches to maintaining order (e.g. see (Disney, Gathergood, Machin, & Sandi, 2023); (Rohe, McCarthy, & Van Zandt, 2002)). As suggested by place management theory, these differences are expected to shape crime opportunities and define patterns of crime concentration (Eck & Madensen-Herold, 2018). By comparing buildings under different ownership structures, we implicitly investigate how variations in management practices can influence crime

concentration—an approach similar to the logic used in other risky facility studies (Lee et al., 2022; O'Brien & Ciomek, 2023; O et al., 2025; Zoorob & O'Brien, 2024). Through this analysis we seek to uncover potential linkages between housing ownership, management practices, and design features, and the broader mechanisms that sustain long-term crime patterns. While Weisburd (2015) and others show how crime concentrates along street segments, a parallel line of research has examined facilities such as bars, libraries, and apartment buildings, where similar concentration patterns occur (Eck et al., 2007; Townsley et al., 2014). This study adds to the latter tradition by focusing on residential buildings.

The paper is divided into six parts. Following the introduction, Sect. 2 provides the working definitions of this study and a review of research on the effect of housing ownership on crime. Section 3 introduces the research design, including the study area, data and methods used. Section 4 presents the study's results, which are then discussed and reflected upon in Sect. 5. In Sect. 6, we conclude with recommendations for future research.

Theoretical background

Crime concentration and housing ownership

Research has long shown that crime tends to concentrate in specific parts of the city and that such concentrations are closely tied to the social and environmental characteristics of neighbourhoods, including socioeconomic conditions, land use, and signs of disorder (Sampson et al., 1997; Shaw & McKay, 1942). Beyond differences in socioeconomic contexts, several studies attribute the crime concentration to variations in place management. Poorly managed properties, where landlords and property managers fail to enforce regulations, maintain buildings, and screen tenants, can foster crime, whereas well-managed apartment complexes experience significantly lower crime rates (Clarke & Bichler-Robertson, 1998; Eck et al., 2007; Eck & Madensen-Herold, 2018; Rephann, 2009). Other studies have found that apartment buildings tend to follow the patterns of risky facilities, the idea that for a set of facilities of the same type, only a small proportion concentrates the majority of crime (Clarke & Bichler-Robertson, 1998; Eck et al., 2007; Lee et al., 2022; Townsley et al., 2014). While the nature of the relationship between crime and facilities may vary, these patterns have been found to be persistent across different crime types (Eck et al., 2007; Rephann, 2009).

Closely linked to place management is the role of housing structures, which can be considered along two dimensions: household-level tenure and ownership/management. The first body of research examines tenure, focusing on how the proportion of renters versus owners in a neighbourhood influences crime. For example, Hegerty (2017) found that higher percentages of renters were associated with thefts and robberies, although length of tenure had no significant effect. These studies emphasise resident characteristics and stability, but they are not directly comparable to research on housing ownership.

The second line of research examines ownership and management, which is more directly relevant to the present study. Rephann (2009) showed that landlords living far from their rental properties were associated with higher crime rates, suggesting weaker oversight. Similarly, research on public housing agencies highlights how organisational capacity, bureaucratic constraints, and resource levels shape crime outcomes (Kolodny et al., 1983; Rouse, 1979). Disney et al. (2023) found that transferring public housing to private ownership models could reduce property crime, both by changing tenant incentives and by encouraging property improvements. Together, this literature demonstrates how different ownership types and the management practices associated with them help explain variations in crime across residential buildings. It is to this tradition of ownership and management research that the present study contributes. These patterns may be partially explained by how different ownership models shape management practices, which, according to the ORCA-model (Organisation of space, Regulation of conduct, Control of access, and Acquisition of resources), are key to preventing crime opportunities (Madensen, 2007). Private housing managers may be more likely to implement stricter security and tenant vetting, while small-scale part-time private owners, particularly those residing far from the properties, may lack the skills or resources to properly manage rental properties (Apgar, 2004; Rephann, 2009). At the same time, public housing has historically been managed by local authorities bound by limited resources and highly bureaucratic decision-making (Kolodny et al., 1983; Rouse, 1979), which could lead to less flexibility in controlling crime opportunities. Additionally, there have been examples in which the transition from public housing to private tenure led to notable reductions in property crime, primarily driven by tenant behaviour changes and public property renovations (Disney et al., 2023). Compared to private tenants, public housing residents may have fewer incentives to maintain security and monitor neighbourhoods (Disney et al., 2023). Traditional neighbourhood studies often treat the proportion of renters as a key factor influencing crime, interpreting higher renter shares as a sign of disadvantage, instability, or weaker social control (e.g., Hegerty, 2017). From a place management perspective, however, the critical mechanism is not simply the presence of renters but the entity that owns and manages the building in which they reside. A single landlord or company controlling many rental units can exert disproportionate influence over crime risks, regardless of neighbourhood-level tenure rates. This study, therefore, situates itself within the place management tradition, focusing on ownership as a building-level feature. By treating buildings as facilities, rather than embedding them solely within neighbourhood tenure compositions, we aim to identify how ownership structures, and the management capacities they imply, shape the concentration of crime.

Environmental criminology can also help explain the connection between housing ownership, residential behaviour, and crime. Crime Prevention through Environmental Design (CPTED) suggests that features such as street layouts, fences, gates, and well-maintained gardens enhance territoriality, define public-private boundaries, and regulate access, thereby reducing crime (Jeffrey, 1971). Such features are more common in privately owned housing, while public housing, often high-rise and multi-family, typically lacks a sense of residential ownership and control (Newman, 1972). Likewise, residents who feel a greater sense of ownership

over their homes tend to provide better guardianship and surveillance of potential offenders and targets, key elements in the Routine Activity Approach to crime (Cohen & Felson, 1979). Furthermore, areas with high concentrations of rental apartment blocks are often linked to lower community engagement and higher levels of visible disorder. This aligns with collective efficacy theory (Sampson, Raudenbush, & Earls, 1997), which emphasises how weak social ties and a low willingness to intervene can contribute to increased crime. The Broken Windows theory (Wilson & Kelling, 1982) similarly suggests that visible disorder signals a lack of control, thereby inviting further criminal activity. High tenant turnover and limited property management in rental-dominated areas may contribute to these conditions. Conversely, private home ownership is associated with more civic-minded residents and regular property maintenance, largely due to greater financial investment and housing stability (Da Costa & Ceccato, 2015; McCabe, 2013; Rephann, 2009; Rohe et al., 2002).

Socio-economic, demographic, and physical factors also influence crime and vary by housing tenure. Young people, who are more likely to rent (Cournède & Plouin, 2022), have higher crime involvement (as both offenders and victims), particularly male youth (Finkelhor & Hashima, 2001; Perkins, 1997). Public housing, while linked to academic improvements, is generally associated with concentrated disadvantage, including poor educational opportunities (Han & Schwartz, 2024). In contrast, neighbourhoods with higher education levels have been linked to a reduction in violent crime consistently over time (Boessen et al., 2023). Additionally, violent crime rates rise in areas with a high density of alcohol-serving outlets, which are more common in lower-income public housing (Gorman & Speer, 1997; Gruenewald et al., 2014). Evidence on the effect of vegetation on crime is both positive and negative, with well-maintained green areas providing recreational and health benefits for residents (Ceccato & Ioannidis, 2024; Chen et al., 2016).

Research Questions

While establishing a direct causal relationship between housing ownership and crime remains challenging, research indicates that housing ownership and management practices have a significant influence on crime patterns within residential areas. In this study, housing ownership refers to the entity that owns a residential building, rather than forms of housing tenure. Private ownership includes buildings owned by private companies, either through land leases (*tomträtt*) or full ownership of both land and building, while public ownership means both are owned by a municipal company. Although this study does not directly address management practices, housing ownership type is employed here as a proxy to capture their potential effects, controlling for selected building and neighbourhood characteristics and answering the following research questions:

1. To what extent does crime concentrate at the building level, and can these residential buildings be classified as 'risky facilities' as defined by Eck et al. (2007)?
2. Does crime concentration vary by crime type and between private and public housing companies?

3. How does housing ownership influence crime levels when controlling for local and citywide land use and socioeconomic factors?

To address these questions, the study draws on detailed geocoded data on reported crimes, housing characteristics, and socioeconomic indicators of the Swedish capital city. By combining administrative records with spatial data at the building level, the analysis identifies patterns of crime concentration across different types of housing ownership. The methodological approach involves both descriptive and multivariate techniques to assess how housing ownership relates to crime, while accounting for broader neighbourhood and land use characteristics.

Data and Methodology

As this study examines crime at the building level, we need to introduce some basic information about how ownership and tenure are organised within Swedish housing types, such as rental apartments (public and private), condominiums, and owner-occupied homes. These distinctions affect management practices, levels of control, resident turnover, and informal social monitoring, all of which may influence the presence or absence of crime.

Introduction To the Swedish Housing Market Context

Understanding Sweden's housing system, particularly the distinction between public and private ownership, is essential to interpreting crime patterns. Unlike in many other countries, Swedish public housing (allmännyttan) is not exclusively for low-income residents and is intended to serve the general public. This diverges significantly from contexts like the UK or the US, where public housing is more strongly associated with socioeconomic disadvantage and marginalisation. In the UK, public housing is commonly referred to as 'council housing' or 'social housing'. Social housing tenancies are also provided by co-operatives and local housing associations rather than private homeowners (Disney et al., 2023). In Sweden, while regulated by municipal authorities, public housing companies function independently, often reinvesting profits into housing development and maintenance to promote a balanced housing market (Sveriges Allmännytta, 2023). Rental apartments constitute approximately 29% of the housing stock, 39% of owned houses, and other types, which comprise 11%.

Private housing in Sweden refers to properties owned by individuals or private companies. Private houses are divided into three categories: owner-occupied housing (äganderätt), condominiums (bostadsrätt), and private rental (privat hyresrätt) (Boverket, 2022). Private housing can be rented or owned, offering options for both tenants and homeowners. In condominiums, owners of private units are responsible for their maintenance. They can make decisions about renovations and leasing arrangements, whereas tenants typically sign leases that define the terms of their occupancy. Condominiums compose 21% of the housing stock. In the Swedish con-

text, dwellings with more than three apartments are considered multiple apartment buildings (SCB, 2023).

The Study Area

The Stockholm municipality is home to nearly 1 million inhabitants, making it the most populous city in the Nordics (Statistikmyndigheten, 2023). It is divided into 544 demographic zones, which are used as the unit of analysis. Stockholm is socioeconomically segregated, with educational level, income, unemployment, and demographic composition varying across different parts of the city (Stockholms Stad, 2023). Stockholm's layout is shaped by several suburban centres, linked by a strong public transport system of metro lines, commuter trains, and buses that connect back to the city centre. Most residents live within walking distance of a park, while shops, bars, and other services often cluster near major transit stops. Overall, the city's design supports easy access to public transport, services, and social interactions.

Roughly 70% of the land in Stockholm is owned by the municipality, while the rest is owned by private actors (Stockholms Stad, 2023). Private actors may also lease municipal land while owning and managing the buildings situated on it. Stockholm's housing market consists of 39% rental apartments, 52% cooperatively owned apartments (i.e. condominiums), and 9% owner-occupied houses (Stockholms Stad, 2023). In the Swedish housing system, public and private housing is not concentrated in specific areas, but rather integrated into mixed-tenure neighbourhoods. In total, the city has approximately 64,000 buildings with at least one apartment, totalling around 510,000 apartments. In the current study, we focus exclusively on multi-residential buildings as the unit of analysis, in line with Swedish definitions that include only buildings with more than three apartments, because anything smaller is typically managed individually rather than by a company. We have identified 16,398 such buildings, comprising a total of 462,116 apartments, with an average of 28 apartments per building. Of these buildings, 13,421 are owned by private companies, and 2,977 are owned by municipal companies. Municipal (public) buildings consist solely of rental apartments, whereas privately owned multi-residential buildings may contain either rental units or condominiums. In terms of apartment numbers, privately owned buildings comprise 370,551 units, while public buildings account for 91,565 (see Table 1). Of the 8,576 multi-residential buildings located on municipal land, 2,977 are owned and operated by municipal companies, and the remaining 5,599 are managed by private companies or individuals. We have created categories for the three largest municipal companies and the three largest private companies owning buildings on municipal land.

Like many other European cities, poverty and unemployment are concentrated in the suburbs, where unemployment rates are three times higher and income is two

Table 1 Apartment distribution per type of housing ownership in Stockholm, 2022

	Type of ownership		
	Private	Public	Total
Building count	13,421	2,977	16,398
Apartment count	370,551	91,565	462,116
Apartment per building	27.61	30.76	28.18

Source: Authors

times lower than in the rest of the city (Stockholms Stad, 2023). Previous studies on the geography of crime in Stockholm have shown stable patterns of concentration of violence and property crimes over four decades, corroborating the principles of social disorganisation and the routine activity approach (Ceccato et al., 2002; Ceccato & Uittenbogaard, 2014; Levine & Ceccato, 2021; Wikström, 1991). Property crimes, such as theft, robbery, and burglary, occur more frequently in the afternoons, mainly within the city centre and regional commercial areas in the southern and western parts of Stockholm. In contrast, violent crimes such as assault and threats are more common at night and are heavily concentrated throughout much of the city centre. Both types of offences see higher incidence rates on weekends compared to weekdays. Regardless of the day, the central urban core consistently contains the most significant clusters of crime, which also extend into commercial and socially disorganised areas in western and southern Stockholm (Uittenbogaard & Ceccato, 2012).

The building is the primary unit of analysis in this study. Crime counts are geocoded to individual residential buildings. To capture broader social and environmental conditions, we also include variables measured at the neighbourhood level (DeSO zones). These secondary measures, such as the proportion of young males or the share of residents with higher education, are attributed to buildings based on their location. In this way, building-level outcomes are analysed in relation to both direct building attributes (ownership, size, type) and contextual characteristics derived from the surrounding area. We now turn to an overview of the steps undertaken to execute the study.

Data Preparation

Crimes recorded by the police (2019–2023) that overlapped with residential buildings (polygons) were counted for each building and each crime category, serving as our dependent variables. Total crimes (N=263 151), excluding financial crimes and traffic accidents, crimes of vandalism (N=73 979), violent crimes (N=16 970), residential burglaries (N=14 882), street theft (N=27 236) and narcotic crimes (N=16 482) are the crime categories investigated here. Crime events have been provided by Stockholm's Police Authority, with information about the location, the time and the type of crime event.

To capture variation across the largest housing providers, we created dummy variables for the largest public housing companies and for the largest private companies. The reference group includes all remaining private buildings, such as those owned by individuals or small-scale landlords. This classification allows us to distinguish the effects of major public and private actors from the broader private housing stock while maintaining the anonymity of specific companies.

Land use variables collected from Open Street Map (OSM) and Open Dataportalen of Stockholm Stad, such as bars/nightclubs/restaurants Alcohol Selling Business (ASB) have been counted in a 50 m radius from each building. The distance to the closest park and the distance to public transport stations are also calculated for this study. Additionally, some socioeconomic (educational level of population) and demographic information (young male population) are included. This information has been extracted from SCB, the Swedish National Bureau of Statistics.

Information was acquired at the neighbourhood level (DeSO) and assigned to each building. Finally, in a 100 m radius, we have counted the amount of different road network categories present (main roads, secondary roads, local roads) and of different types of buildings, such as residential, public function (for public administration purposes, education, culture etc.), industrial and commercial as categorized by Lantmäteriet (the Swedish national land monitoring agency). Road network was accessed through Trafikverket and buildings from Open Dataportalen of Stockholm Stad. We have created three road network classes (main arterial roads, secondary roads, and local roads) and four building categories (residential, public function, industrial, and commercial).

Creating the Distribution Curve

We used Lorenz curves to indicate the distribution and concentration of various crime categories at buildings. This approach is related to the J-shaped distributions described by Eck et al. (2007), where a small number of high-crime locations account for the vast majority of incidents (80/20 rule). In our case, residential buildings vary in vulnerability to crime partly as a function of the number of apartments. To enable comparisons between public and privately owned buildings, we normalized by apartment count before constructing the Lorenz curves. We also calculated Gini coefficients from the Lorenz curves as a summary measure of crime concentration.

Modelling Crime by Buildings

To understand the relationship between housing ownership and crime concentration by building, we utilise various crime counts (total crimes, violent crimes, theft, narcotics, residential burglary, and vandalism). Because buildings vary greatly in size, we included the number of apartments as an offset in the regression models, representing exposure to potential crime events. An offset is a fixed component of the model that accounts for different levels of exposure, ensuring that predicted crime levels are expressed as rates per apartment rather than raw counts. However, since the CrimeStat software does not directly support the use of offset functions, intensity was used to control for exposure by population size (apartment count). To isolate the effect of housing ownership, we control for land-use and socioeconomic variables at the neighbourhood level as control variables. These controls, which include the number of bars, nightclubs, and restaurants (ASB), the distance to parks, counts of various road types (local, secondary, and main roads), and the mix of nearby building types (residential, public function, industrial, and commercial), assist in capturing the physical and urban design context in which the buildings are situated. Similarly, socioeconomic factors such as the level of higher education and the proportion of young males, foreign-born population, unemployment rate, and average income in the area are considered to account for other influences on crime concentration. A bivariate correlation analysis was conducted in SPSS to assess potential multicollinearity among the independent variables. Variables exhibiting a correlation coefficient below 0.6 ($r<.6$) were selected for inclusion in the subsequent modelling process. These selected independent variables, along with the dependent variable, were then

incorporated into a Poisson-Gamma regression model to account for overdispersion in the count data. The variables of distance to the city centre (centrality), proportion of foreign-born population, unemployment rate, average income per statistical area (DeSO), and safety scores were excluded. For more details, see Appendix 1.

CrimeStat software was used for modelling in this study (Levine, 2015). In CrimeStat IV, the Poisson-Gamma model, also known as the Negative Binomial (NB) model, is utilized to address overdispersion in count data, where the variance exceeds the mean. This model is particularly effective in crime analysis for modeling the frequency of incidents across different spatial units.

The NB model, a common parameterization of the Negative Binomial distribution, is defined by the following probability density function (f):

$$f(yi;\mu_i,\psi) = \frac{\Gamma(y_i+\psi)}{\Gamma(y_i+1)\,\Gamma(\psi)} \cdot \left(\frac{\psi}{\mu_i+\psi}\right)^{\psi} \cdot \left(\frac{\mu_i}{\mu_i+\psi}\right)^{y_i}$$

Where:

yi: Number of occurrences (e.g., crime events).

μ_i: Mean of the distribution (expected number of occurrences for a given area).

ψ: Dispersion parameter (controls the level of overdispersion).

Γ: Gamma function, generalizing the factorial function

This formulation accounts for overdispersion by introducing the dispersion parameter ψ, allowing the variance to exceed the mean, which is a common characteristic in crime data.

For the model, the mean and variance are given by:

$$Mean = \mu_i$$

$$Variance = \mu_i + \left(\frac{{\mu_i}^2}{\psi}\right)$$

This indicates that as ψ increases, the variance approaches the mean, reducing overdispersion. Conversely, smaller values of ψ allow for greater overdispersion.

The log-likelihood function for the model, which is maximized to estimate the model parameters, is expressed as:

$$lnL(\psi,\beta) = \sum_{i=1}^{n} y i ln(\mu_i) - (\psi + y_i)\, ln(\psi + \mu_i) + \psi\, ln(\psi) + ln\left(\frac{\Gamma(\psi + y_i)}{\Gamma(y_i+1)\,\Gamma(\psi)}\right)$$

Where:

yi: Observed count for the i^{th} observation

μ_i: $\exp(X_i\beta)$:expected mean, modeled as function of covariates X_i and coefficients β

ψ: Dispersion parameter

$\Gamma(x)$: Gamma function

n= Total number of observations

This function is applied within the framework of Maximum Likelihood Estimation (MLE) to identify the parameter values that provide the best fit to the observed data. A detailed explanation and derivation of the relevant formulas can be found in Appendix C of the CrimeStat IV manual (Levine, 2015). In the next section, we present the results of the analysis, following the research questions as outlined in Sect. 2.

Results

Crime Concentration at Buildings

Figure 1 shows that violent crime is highly concentrated: 80% of incidents occur in just 14% of privately owned buildings and 25% of publicly owned buildings. Other crime types, such as theft, display a smaller disparity (30% of private and 32% of public buildings account for 80% of thefts). For total crimes, differences by ownership are modest, with 41% of private and 46% of public buildings accounting for 80% of incidents. Gini coefficients confirm these patterns, with high concentration across categories. In private housing, the Gini was 0.58 for total crimes, 0.87 for narcotics, and 0.85 for violent crimes, while vandalism (0.75), theft (0.68), and burglary (0.79) also showed strong clustering. Public housing displayed a similar but somewhat lower pattern (total crimes 0.53; vandalism 0.69; narcotics 0.77; theft 0.66; violent crimes 0.73; burglary 0.73). Overall, both housing types exhibit high levels of concentration, with narcotics and violent crimes especially clustered in private housing.

Mann–Whitney U tests were performed to compare crime counts between buildings classified as public and those identified as private. The results indicated that public buildings experienced significantly higher crime counts across all categories. For instance, in the case of total crime, the test yielded $U = 14{,}048{,}718.0$, $Z = -25.40$, $p < .001$. Similar significant differences were noted for vandalism ($U = 13{,}735{,}440.0$, $Z = -27.32$, $p < .001$), narcotics ($U = 16{,}350{,}421.5$, $Z = -18.76$, $p < .001$), theft ($U = 18{,}721{,}310.0$, $Z = -5.63$, $p < .001$), violent crimes ($U = 15{,}386{,}332.0$, $Z = -23.12$, $p < .001$), and residential burglary ($U = 18{,}210{,}643.0$, $Z = -8.71$, $p < .001$). The consistently higher mean ranks for the public category suggest that these locations tend to experience more crimes compared to their private counterparts.

Figure 2 shows that in average violent crime rates are nearly twice as high in public housing (6 crimes per 100 apartments in public housing and 3 per 100 apartments in condominiums) and public housing experiences more than double the rate of vandalism (85 crimes per 100 apartments in public housing and 50 crimes per 100 apartments in private housing companies).

Figure 3 illustrates the variation in crime concentration within a portion of our study area, highlighting that certain multi-apartment complexes experience markedly higher crime levels than others. In this area of Södermalm, buildings shaded in darker blue represent higher recorded crime levels, typically found in larger multi-apartment buildings situated at intersections or along major streets. White and light blue indicate buildings with fewer crime counts. They seem to be more dispersed and are often positioned within inner residential blocks, possibly benefiting from reduced traffic

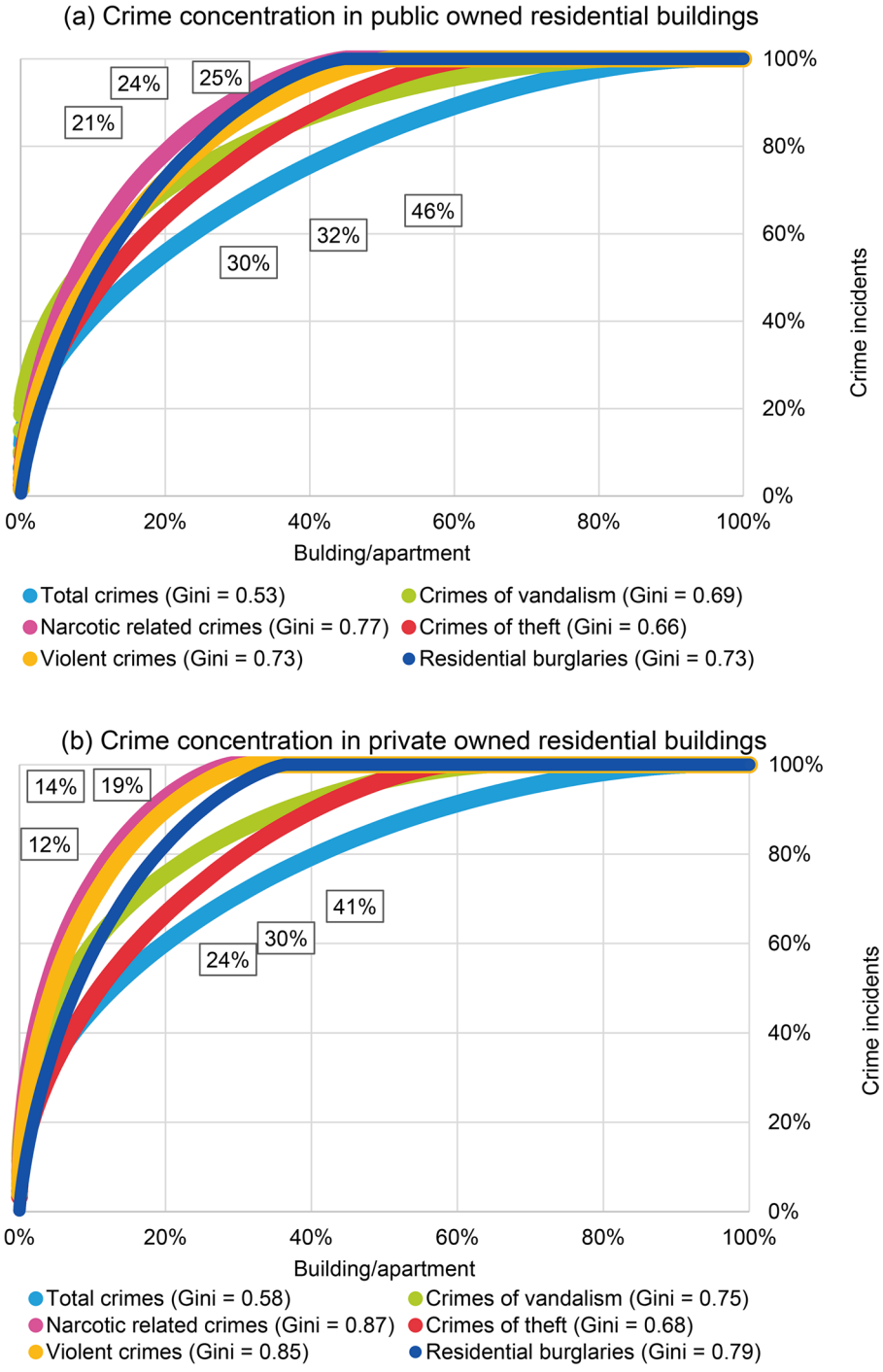

Fig. 1 Crime concentration in residential buildings owned by (**a**) public companies and (**b**) private companies (The Lorenz-curve normalised by apartment count). Source. Authors

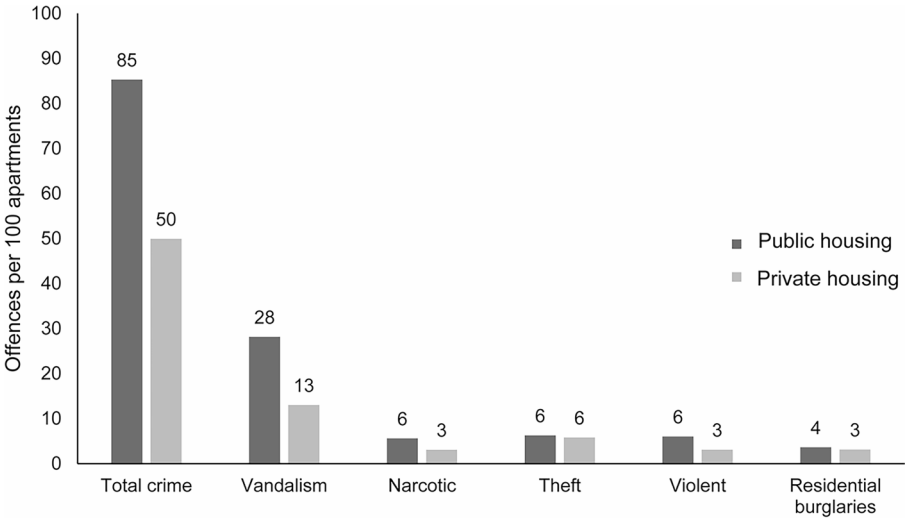

Fig. 2 Crime by number of apartments and type of housing ownership (Dark grey = Public housing and light grey = private housing). Source. Authors

Fig. 3 The geography of crime per building in Stockholm – counts of police recorded data. Data source: Stockholm police headquarters, 2024. Source: Authors

and more controlled access. Road intersections with more than two roads merging also seem to concentrate more counted crimes. Corner buildings with direct access to main roads are also found to have more reported crimes, when compared to local and secondary roads.

If we analyse the crime distribution for Stockholm by housing ownership, either private or public, we notice that public housing consistently concentrates more crime than private housing across all crime categories, particularly total crime, vandalism, and violent crime. This persists even when normalised with the number of apartments per building. Furthermore, Fig. 1 shows that public housing has fewer zero-crime buildings than private housing. Smaller differences are observed in theft and residential burglaries, but the trend remains.

Modelling Results by Type of Ownership and Crime

Table 2 demonstrates that the negative binomial modelling addressed over-dispersion across all types of crime. The models are ranked based on prediction accuracy, fit metrics, and their ability to manage over-dispersion. The residential crime model ranks first, exhibiting the lowest prediction errors (MAD: 1.035, MSPE: 3.229) and a strong fit (AIC: 36,479.724, BIC: 36,639.817), although it reports a relatively high level of over-dispersion (2.207). The violence model closely follows, showing good predictive performance (MAD: 1.278) despite a higher degree of over-dispersion (2.759). Theft comes in third, with a good fit (dispersion: 1.080) and reasonable prediction accuracy (MAD: 1.542, MSPE: 15.909). The vandalism and narcotics models, ranking fourth and fifth respectively, exhibit moderate to extreme over-dispersion (1.883 and 3.285) but had higher prediction errors (MAD: 4.731 and 1.311, MSPE: 1,414.967 and 14.795). The total crimes model ranked last due to its significant prediction errors (MAD: 13.602, MSPE: 5,951.843), although it maintained a low dispersion multiplier (1.116). Overall, the negative binomial models proved robust for modelling over-dispersed crime data, with the residential crime and violence models standing out as the best performers.

Housing ownership impacts crime levels reported by the police, even when accounting for other factors such as land use and socioeconomic conditions. Publicly owned housing tends to be associated with higher crime rates than private housing. For example, Public Company 2 has a strong positive relationship with vandalism (1.243) and violence (0.919). Public Company 1 and Public Company 3 also exhibit high associations with overall crime, vandalism, and violence, although their effects on theft and narcotics-related crimes are smaller. In contrast, private housing companies show a considerably different pattern. Private Company 2 has a strong negative impact on violence (−0.644) and narcotics (−0.781), suggesting it helps reduce these types of crime. Conversely, Private Company 1 has small positive effects on crimes such as vandalism (0.148) and residential crimes (0.256). Private Company 3 has little influence on most crimes, and in some cases, such as residential crimes, it exhibits a negative association (−0.422). Overall, public housing is more strongly linked to higher crime rates, while private housing, particularly Private Company 2, contributes to the reduction of certain types of crime.

Land use and socioeconomic variables, included as controls in the analysis, help to isolate the effect of housing ownership on crime. These variables have independent effects that align with established patterns in criminology. For instance, the presence of parks bears a strong negative association with crime, as evidenced by its significant coefficients (−0.794 for total crimes and −1.325 for narcotics). Road types exhibit varied effects; secondary and local roads are positively linked to crime (0.025 and 0.012, respectively, for total crimes), while main roads have a larger positive effect (0.076). Public function buildings (administrative municipal buildings, schools, sports, and leisure facilities) are consistently and positively associated with crime; for example, the presence of these buildings is linked to higher total crime (0.052) and vandalism (0.030), with the most substantial effect observed for violence (0.061). Industrial buildings also exhibit positive relationships with crime, particularly total crime (0.090) and vandalism (0.065). In contrast, residential buildings display a consistent negative association across all crime types; for instance, total crime (–0.018), vandalism (–0.025), and violence (–0.024) all decrease as the number of nearby residential buildings increases. Economy buildings show no consistent pattern, with largely insignificant or weak effects across models. Socioeconomic factors, an area-derived measure attributed to buildings, also play a role; a higher proportion of young males is strongly associated with increased violence (13.226), while higher education levels positively influence vandalism (7.087) but negatively influence violence (−2.709). These controls demonstrate that land use and socioeconomic context significantly shape crime patterns, thereby allowing for a more accurate measurement of the role of housing ownership.

Discussion of Results

A small percentage of buildings is responsible for a large proportion of crimes. This pattern persists even after offences are standardised by the number of apartments. Violent crime, for instance, is highly concentrated at the building level, with 14% of privately owned buildings and 25% of publicly owned buildings accounting for 80% of incidents. This striking concentration aligns with the concept of "risky facilities" (Eck et al., 2007), which indicates how certain places, often due to weak management, poor oversight, or inadequate control measures, become magnets for crime. While theft is more evenly distributed, the clustering of violent crime highlights specific properties as persistent crime hotspots. Even when considering total crime, concentration remains notable; 41% of private buildings and 46% of public buildings account for 80% of incidents, underscoring the relevance of targeted interventions at the facility level. The analysis reveals that public housing is associated with higher crime rates compared to private housing. For specific crime categories, such as violent crimes, the crime distribution follows the Lorenz curve paradigm, with private housing concentrating more crimes in fewer buildings. Visual observations of crime distribution show specific patterns. Corner buildings and road intersections exhibit higher crime counts compared to other typological configurations. In nearly every tested crime category, public housing has higher crime rates, except for theft, where minimal differences are observed between public and private housing. These find-

Table 2 The negative binomial model: Y = Total crime and crime by types

Dependent variables	Total crimes		Vandalism		Violence		Theft		Narcotics		Residential	
	Gamma Poisson		Gamma Poisson		Gamma Poisson		Gamma Poisson		Gamma Poisson		Gamma Poisson	
N	15,116		15,116		15,116		15,116		15,116		15,116	
DF	15,095		15,095		15,095		15,095		15,095		15,095	
Log-likelihood	−54133.073		−34868.292		−18499.890		−24869.967		−17657.162		−18218.862	
AIC	108308.146		69778.585		37041.780		49781.935		35356.324		36479.724	
BIC	108468.240		69938.679		37201.874		49942.029		35516.417		36639.817	
Mean absolute deviation (MAD)	13.602		4.731		1.278		1.542		1.311		1.035	
Mean squared predicted error (MSPE)	5951.843		1414.967		12.034		15.909		14.795		3.229	
Dispersion multiplier	1.116		1.883		2.759		1.080		3.285		2.207	
Independent variables	Coeff	Std error	Coeff	Std error	Coeff	Std error	Coeff	Std error	Coeff	Std error	Coeff	Std error
Intercept	1.123***	0.102	−0.791***	0.137	−0.886***	0.19	−1.064***	0.118	−1.474***	0.204	−1.294***	0.166
Residential building	−0.018***	0.001	−0.017***	0.001	−0.025***	0.001	−0.015***	0.001	−0.024***	0.002	−0.015***	0.001
Public company 1	0.876***	0.041	1.138***	0.055	0.852***	0.071	0.36***	0.049	0.862***	0.078	0.338***	0.069
Public company 2	0.900***	0.038	1.243***	0.05	0.919***	0.065	0.367***	0.045	0.806***	0.07	0.209**	0.064
Public company 3	0.600***	0.041	0.713***	0.055	0.710***	0.07	0.262***	0.05	0.701***	0.077	0.516***	0.067
Public other company	0.335***	0.059	0.534***	0.079	0.298**	0.108	0.062	0.071	0.228*	0.116	−0.046	0.104
Private company 1	0.142**	0.045	0.148**	0.062	0.246	0.081	0.087	0.057	−0.125	0.093	0.256***	0.075
Private company 2	−0.266***	0.068	−0.127	0.093	−0.644***	0.142	−0.303***	0.09	−0.781***	0.156	−0.083	0.117
Private company 3	0.082	0.097	0.275**	0.13	−0.193	0.195	−0.173	0.128	−0.228	0.206	−0.422*	0.186
ASB50	0.216***	0.009	0.229***	0.011	0.226***	0.015	0.168***	0.01	0.213***	0.016	0.026*	0.014
Park	−0.794***	0.065	−0.944***	0.088	−0.861***	0.124	−0.508***	0.082	−1.325***	0.136	−0.559***	0.114
Young male	4.676***	0.647	0.671	0.86	13.226***	1.233	0.522	0.725	11.037***	1.322	0.233	1.028
Higher education	2.536***	0.452	7.087***	0.617	−2.709**	0.841	3.09***	0.544	0.058	0.891	3.116***	0.765
Secondary road	0.025***	0.002	0.017***	0.003	0.025***	0.004	0.028***	0.002	0.038***	0.004	0.009**	0.003
Local road	0.012***	0.001	0.009***	0.002	0.011***	0.003	0.012***	0.002	0.007*	0.003	0.012***	0.002
Main road	0.076***	0.009	0.108***	0.012	0.074***	0.013	0.061***	0.009	0.069***	0.014	0.022	0.014

Table 2 (continued)

Dependent variables	Total crimes		Vandalism		Violence		Theft		Narcotics		Residential	
	Gamma Poisson		Gamma Poisson		Gamma Poisson		Gamma Poisson		Gamma Poisson		Gamma Poisson	
Public function building	0.052***	0.005	0.062***	0.007	0.03**	0.009	0.051***	0.006	0.061***	0.01	0.015*	0.008
Industrial building 1	0.053**	0.017	0.09***	0.024	0.013	0.028	0.065***	0.019	0.014	0.031	0.064*	0.026
Commercial building	−0.111	0.194	−0.036	0.268	0.25	0.345	−0.204	0.229	−0.243	0.386	0.009	0.329

ings largely align with previous studies on the relationship between crime rates and housing ownership structures (Kling et al., 2005; Schill, 1993). We acknowledge that some crimes occurring on nearby streets may be recorded at the building's address, which could slightly blur the distinction between inside and near.

The results confirm the disparities in how public and private companies affect the occurrence of crime. Public housing companies often operate within bureaucratic structures that can limit flexibility and are constrained by resource shortages, which may weaken their ability to respond effectively to crime and disorder. In contrast, some private firms, such as Private Company 2 in our study, appear to engage in more proactive security efforts and exercise stronger oversight, which may help reduce opportunities for certain types of crime. Condominium associations, while different from both public and private firms, rely on resident-driven governance, where owners themselves participate in decision-making and informal monitoring. This form of resident engagement can foster stronger guardianship and surveillance, contributing to variations in crime outcomes across ownership types. Public companies, particularly Public Company 1 and Public Company 2, exhibit the strongest associations with higher crime rates across most types of crime. Public Company 1 consistently demonstrates a significant positive impact, particularly in reducing vandalism and violence, where its coefficients are highest. Public Company 2 also displays strong positive effects, particularly for vandalism, although its influence is somewhat lower than that of Public Company 1 for other crime types. Public Company 3 has a smaller positive effect overall but is more strongly linked to narcotics-related crimes. Public Other Companies show weaker and less consistent effects, with their influence being insignificant for residential crime in certain instances. Moreover, private companies exhibit more varied patterns depending on the type of crime. Private Company 1 has a positive association with crime, particularly residential crime, where its effects are most pronounced. In contrast, Private Company 2 is consistently linked to lower crime levels, with its most significant negative effects observed in theft and narcotics-related crimes, after controlling for locational and other factors. Private Company 3 exhibits significant inconsistency across crime types, indicating a weak positive correlation for vandalism but a negative correlation for residential crimes.

When controlling for land use and socioeconomic factors, several patterns emerge. The proportion of young males is strongly linked to violent crimes, while educational attainment shows mixed effects: higher education correlates negatively with violent crime but positively with vandalism. This partly aligns with previous research (Boessen et al., 2023; Khalilikhah et al., 2016; Lewis, 1998), though the positive link to vandalism may reflect higher reporting levels in more educated areas due to greater social control and lower tolerance for crime (Allen, 2008; Goudriaan et al., 2006). Land use factors also matter. Bars, nightclubs, and restaurants are most strongly associated with vandalism but show only minor effects on residential burglaries, suggesting their role as both potential risky facilities (Madensen, 2007; Madensen & Eck, 2008) and sources of natural surveillance at night. Parks are generally linked to lower crime, particularly drug-related offenses, supporting prior findings that well-maintained parks reduce crime risk (Ogletree et al., 2022). This has implications for the housing market. Proximity to parks generally raises property values, but in high-crime areas it can have the opposite effect, as crime reduces the recreational and

aesthetic value of parks, a pattern confirmed for Stockholm by Iqbal and Ceccato (2015). Regarding the built environment, features like street layouts and clear public-private boundaries are associated with reduced crime, consistent with CPTED principles (Jeffrey, 1971). Main roads are mainly linked to vandalism, while local roads play a smaller (yet statistically significant) role. Higher residential density within 100 m appears slightly protective, while public functional facilities (e.g., administrative buildings, sports, and leisure facilities) have a significant but small positive effect across all crime categories. Similar findings were found for firearm violence across Sweden (Wilhelmsson, Ceccato, & Gerell, 2021). Industrial buildings have minor significant effects on all crime except violence and narcotics while commercial buildings show no significant relationships.

A limitation of the study comes from the use of the apartment count as an intensity measure in place of an offset variable. Using intensity accounts for exposure, but it is not considered a true offset. While this improves model stability, it may limit the models' ability to fully account for population-based exposure differences across space. Despite this limitation, we are confident that the main patterns observed, particularly the differences in crime levels associated with various housing ownership types, remain robust, namely that after accounting for relevant differences, the analysis reveals that public companies, particularly Public Company 1 and Public Company 2, are more closely associated with crime, specifically vandalism and violence.

In contrast, private companies display more varied results. Practices in Private Company 2 are recognised for their crime-reducing effects, particularly in reducing theft and narcotics offences, making it the most protective type against crime. Although these results do not permit direct testing of the ORCA model (Madensen, 2007), they support the idea that place management actions can be used to reduce crime. Da Costa & Ceccato (2015) found, for instance, that homeowners in Stockholm are more likely than renters to invest in physical security measures (e.g., better locks, alarms, reinforced doors), reflecting a more proactive approach to place management that helps lower their risk of victimisation. These active forms of place management can mitigate criminogenic pressures, even in socio-economically disadvantaged neighbourhoods. However, despite these assumptions, a lack of empirical evidence remains regarding which specific practices are employed, how consistently they are implemented, and under what conditions they are most effective in the Swedish context.

Conclusion

This study set out first to analyse the concentration of crime in residential buildings, with particular attention given to the influence of housing ownership on this phenomenon. Police-recorded crime data were geocoded at the building level using Geographic Information Systems (GIS) and integrated with socio-demographic and land use variables. These combined datasets were subsequently examined through Poisson regression models to assess the relationship between housing characteristics and crime concentration. Findings confirm that crime is geographically concentrated in a relatively small number of buildings, consistent with the "law of crime concen-

tration", which suggests that a significant portion of crime tends to occur in a small fraction of micro places (Weisburd, 2015). This reinforces the importance of examining residential buildings not just as background structures, but as active nodes in the criminology of place, where physical design, ownership, and management practices intersect to shape crime opportunities. Although few in number, these buildings account for a significant share of reported crimes. This pattern remains robust even when crimes are adjusted per apartment unit, suggesting that it is not merely a function of size or density, which supports the concept of "risky facilities" (Eck et al., 2007). Such micro-level regularities also suggest that targeted, place-based interventions may be more effective than broader, area-wide strategies.

Another relevant finding is the persistent association between public housing and higher levels of crime. The findings suggest that ownership structures, and by implication, management practices, are central to understanding crime concentrations at buildings. This supports a place management perspective, indicating that differences in ownership may be more consequential than neighbourhood-level tenure rates alone. When controlling for local and citywide land use and socioeconomic factors, housing ownership remains a significant predictor of variation in crime levels. Public housing, particularly that managed by large public companies, is more strongly associated with higher levels of crime, especially vandalism and violence. This contrasts with privately owned housing, where the relationship with crime is more variable. Some private companies, such as Private Company 2, are associated with lower crime rates, particularly in relation to theft and narcotics-related offences. While private actors appear to be more actively involved in managing their buildings, the specific nature of these practices remains unclear. Little is known about how company-level management strategies interact with broader policing efforts and area-based crime prevention initiatives, and whether these strategies remain stable over time. Thus, future research should explore how various housing providers, public and private, organise and deliver place management, and under what conditions these strategies are effective. It also remains to be examined the role of resident engagement and informal guardianship in crime prevention, which could provide insight into how the social dynamics within buildings influence crime levels beyond company-level practices. Physical design should affect social interactions and guardianship, but these aspects have not been fully addressed in this study. It is also possible that inner-city areas with mixed land use require distinct forms of property management compared to more homogenous residential areas on the urban periphery, where challenges and resources differ. Finally, a further question relates to whether successful management practices used in elite-managed or high-end residential buildings can be meaningfully transferred to public housing settings, and whether such replication is feasible, contextually appropriate, or even desirable across diverse parts of the city.

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Declarations

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