

# How frequent and visible criminal violence affects housing prices: evidence from Mexico City (2007–2011)

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## Abstract

**Purpose** – Between 2006 and 2012, Mexico implemented a “frontal war against organized crime”. This strategy increased criminal violence and triggered negative consequences across the country’s economic, political and social spheres. This study aims to analyse how the magnitude and visibility of criminal violence impact the housing market of Mexico City.

**Design/methodology/approach** – The authors used different violent proxies to measure the effect of the magnitude and visibility of violence in housing prices. The structure of the data set is an unbalanced panel with no conditions of strict exogeneity. To address endogeneity, the authors calculate the first differences to estimate an Arellano–Bond estimator and use the lags of the dependent variable to instrumentalise the endogenous variable.

**Findings** – Results suggest that the magnitude of violence negatively impacts housing prices. Similarly, housing prices are negatively affected the closer the property is to visible violence, measured through narcomessages placed next to the bodies of executed victims. Lastly, housing prices are not always affected when a violent event occurs nearby, specifically, when neighbours or potential buyers consider this event as sporadic violence.

**Originality/value** – There are only a few studies of violence in housing prices using data from developing countries, and most of these studies are conducted with aggregated data at the municipality or state level. The authors are using geocoded information, both violence events and housing prices, to estimate more disaggregated effects. Moreover, the authors used different proxies to measure different characteristics of violence (magnitude and visibility) to estimate the heterogeneous effects of violence on housing prices.

**Keywords** Mexico, Housing prices, Visibility, Magnitude, Criminal violence, Narcomessages

**Paper type** Research paper

## List of abbreviations

BACRIM = Database of criminal presence in México;  
CIDE = Centre for research and teaching in economics (Spanish acronym);  
PPD = Drug policy programme (Spanish acronym);  
ENVIPE = National victimisation and public security perception survey (Spanish acronym);  
INEGI = National Institute of Statistic and Geography (Spanish acronym); and  
2SLS = Two-stage least squares.

## Introduction

To analyse Mexican social reality, we need to understand the context of violence. Since 2006, violence in Mexico has increased exponentially due to structural changes in the narco-trafficking business and in other illegal activities conducted by organised crime



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groups (Magaloni *et al.*, 2013). In response, the government has militarised public security with the objective of reducing violence and obtaining control of territories that have been occupied by criminal groups. However, the Mexican government's "war against organized crime" has translated to more homicides, gruesome atrocities, torture, forced disappearances and massacres, among others. As a point of tragic reference, according with the [Human Right Watch \(2021\)](#), more than 90,000 persons were missing between 2006 and 2021.

Since the beginning of the "war against organized crime", violence has increased in every state, especially those located in the western and northern regions of the country, where drug production and trafficking are concentrated. This violence is a consequence of confrontations between criminal groups and between alleged criminals with security forces, often characterised by brutal and gruesome executions.

The increasing violence has also been accompanied by the proliferation of criminal groups and a diversification of illegal activities, including kidnapping, robberies and extortion (Enciso, 2017). Mexico City, in particular, has seen the expansion of criminal activities produce an environment of fear and insecurity, and the city has been denominated the "city of fear" (Pansters and Castillo, 2007). According to the BACRIM-2020, a data set gathered by the drug policy programme about presence of organised crime in Mexico (Atuesta *et al.*, 2022), by 2020, 51 criminal groups were present in Mexico City conducting activities related to extortion, narcotrafficking, petty dealing and robberies, among others.

Interestingly, authorities have maintained that the main criminal organisations did not have activities in Mexico City. Instead, they argued that the perceived insecurity was a consequence of the presence of small gangs and groups that committed illegal activities at a lower scale (González, 2020). However, the existence of petty drug dealing alarmed the society and the government, mainly because the existence of local drug markets used to be accompanied by the commission of different crimes and, consequently, an increase in violence (Pansters and Castillo, 2007). As a result, "the line that separates violence from the perception of violence has become more difficult to identify" (Pansters and Castillo, 2007, p. 580).

The commercialisation of illegal drugs has expanded criminality in the city, affecting both the private and social spheres of its inhabitants. This increase in violence raises the question of what the intangible effects of criminal violence are and how insecurity has changed the behaviour of the urban and social dynamics in the city. To answer these questions, this article analyses the effects of violence on one of the main analogues for the urban and social structure: the housing market. To do so, this article answers the following query: what was the effect of violence on the housing prices in Mexico City during the war against organised crime, between 2007 and 2011? Specifically, what characteristics this violence must have to impact housing prices?

To answer this question, we explore the link between violent events and security perception to understand why some violent events are more prompt to change individuals' behaviour and, consequently, impact neighbourhood changes, specifically, housing prices. Based on previous literature (Wong *et al.*, 2019), we hypothesise that not all violent events affect housing prices as the population is not always aware of the commitment of this violence, and its security perception remains almost unchanged. By contrast, when events are more frequent (magnitude) or more visible (visibility), individuals are more aware of what is happening in their neighbourhood, and this internalisation of violence affects their perception and behaviour, also affecting negatively housing prices.

To empirically test these hypotheses, this work uses two main data sets: the first is a data set gathered by Softec (a private company focused on analysing the real estate market) from 2006 to 2011. This data set compiles geocoded information of housing prices and

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characteristics of new homes built in Mexico City. The second is the CIDE-PPD database (Atuesta *et al.*, 2019), gathered between December 2006 to November 2011, which catalogues the violent events related to organised crime – specifically, executions committed by alleged criminals and confrontations between criminals and security forces.

To test if more frequent and more visible violent events have greater effects on housing prices in Mexico City, we use three different proxies of violent events:

- (1) the distance of the dwelling to the closest execution (regardless of its characteristics);
- (2) the distance of the dwelling to the closet execution with a narcomessage left next to the executed body (visible violence); and
- (3) the number of executions between the dwelling and the closest narcomessage (the magnitude of violence).

Disaggregating the effect between an execution and an execution with a narcomessage left beside the body is important. As Atuesta (2017) argues, narcomessages are used by organised crime to publicise or make their acts more visible, or to reassert their power. These acts are also intended to threaten or to send specific messages in a manner not publicly available via formal information outlets to the broader population, other groups or the government (Atuesta, 2017).

The magnitude of violence matters because a single execution is not always known about or published in the press, meaning that potential buyers or neighbours may be unaware of the violence in the area. However, if the number of executions increase, violence becomes more evident (if citizens know about this violence by being spectators, victims or for spreading rumours) and neighbours or potential homebuyers might change their location choices depending on the insecurity of the neighbourhood (Wilcox *et al.*, 2003). Specifically in the case of Mexico, municipalities located in states with high levels of drug-related violence, such as Guadalupe Distrito Bravos, Ciudad Mier and Praxedis G. Guerrero, have suffered from urban flight becoming “ghost towns” where properties are abandoned, and the population had fled looking for safer places (López, 2018).

The contributions of this paper are several. Firstly, this is one of the few analyses of violence on housing prices conducted in a developing country, as most studies have been done in developed countries. Secondly, the use of geocoded information, both of violence and housing prices, provides an empirical method for analysing disaggregated effects. Lastly, we acknowledge that criminal violence cannot only be understood as homicide rates. Executions and the visibility mechanisms used by criminals have a significantly negative effect on the mental health of individuals, and on the social and urban cohesion of cities.

The rest of the paper is organised as follows. Section 2 describes the theoretical framework used to explain the causal mechanisms of our hypotheses. Section 3 presents a description of the Mexican context and summarises the literature that has explored the social and economic costs of the war against organised crime in Mexico, emphasising on the effects of violence on housing prices. The data sets used to empirically test the hypotheses are described in Section 5, and the empirical strategy is explained in Section 6. Section 7 analyses the results, and Section 8 concludes and provides policy recommendations for this analysis.

### **Theoretical framework**

The impact of violent events on housing prices is often linked to changes in security perceptions. To uncover the causal mechanisms between violent events and housing prices,

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it is important to investigate how different types of violent events affect individual security perceptions and subsequently alter housing prices.

This section first explores how criminal violence influences fear of crime and identifies which characteristics of violence have the strongest impact on individuals' perceptions of their neighbourhoods. Next, we examine existing literature that studies how violence affects housing prices.

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### *Crime and fear of crime*

Violent events do not only affect the direct victims; they often cause fear and depression in the general population (Flores Martínez and Atuesta, 2018). However, not all violent events affect individuals in the same way. The type of violence and the characteristics of the neighbourhood and its inhabitants play a significant role in shaping perceptions of security (Elo *et al.*, 2009).

One common effect of violence on individuals who experience it indirectly (i.e. not directly involved in the violent event) is fear of becoming a victim (Fe and Sanfelice, 2022). Violence exposure often leads to a heightened sense of risk, which can translate into fear and anxiety and cause individuals to change their behaviour (Wilcox *et al.*, 2003). Fear of crime can have a significant impact on individuals' behaviour, sometimes more so than the actual crime itself (Fe and Sanfelice, 2022; Janke *et al.*, 2016).

Although security perception and fear of crime are typically related to the level of violence in a particular area (Janke *et al.*, 2016), they may not always co-occur. For example, research shows that security perceptions can remain high even if crime rates decrease (Ambrey *et al.*, 2014). Some individuals may also choose to buy properties in high crime neighbourhoods if other housing characteristics outweigh the negative effects of the violence (Skogan, 1986).

The gap between security perception and crime depends on many factors, including the role played by social media, the knowledge and information of the crime and place where the crime occurred (Ambrey *et al.*, 2014; Fe and Sanfelice, 2022; Surette, 2015; Skogan, 1986). Other factors such as the neighbourhood characteristics, the number of crimes happening in the same area and the neighbours' cohesion also influence how individuals interiorise violence and change their behaviour according to the levels of violence faced in their setting.

We argue that the security perception is not always affected when a violent event occurs nearby. Maybe because individuals living in the neighbourhood (or potential buyers) are not always aware of the commitment of a sporadic violent event, so it could pass unnoticed. So, what would be the characteristics that a violent event must have to impact individual behaviours? Here, we develop two causal mechanisms for exploring the relationships between criminal violence and fear of violence: magnitude and visibility.

Magnitude (sometimes called frequency) and visibility have been explained previously in the literature as outputs of criminal behaviour. Specifically, Durán-Martínez (2015) argues that the structure of the illegal market (monopolistic vs competitive) affects the frequency of violence, while visibility is triggered when criminals do not have governmental support or protection. However, the effects of magnitude and visibility on security perception and fear of crime have not yet been studied.

### *Magnitude*

Magnitude refers to the frequency of violent events in a particular area. When a place is frequently exposed to violent incidents or events with multiple victims, it is perceived as highly dangerous. However, using homicide rates as a proxy for measuring violence is problematic as this data is usually available at an aggregated level such as municipality,

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state or national level. As a result, individuals tend to feel secure if homicides do not occur in their neighbourhood, even if their municipality is experiencing high homicide rates. But, what happens when criminal violence increases in local spaces?

Criminal violence is mobile and responds to different dynamics. For example, different criminal groups could be competing to control a neighbourhood's territory, which can result in sporadic violence to signal power to other groups. However, if other groups are not deterred, this sporadic violence could become more frequent, leading to a turf war between groups that is known and noticed by the neighbourhood residents (Trejo and Ley, 2018).

The impact of criminal violence on perception and housing prices depends on how frequent the violence is. If the neighbourhood only experiences sporadic violent events, neighbours or potential buyers may not notice these events, leading to minimal or no effect on housing prices. However, if violent events become more frequent, it is almost impossible that they would go unnoticed, resulting in deterioration of the security perception and affecting potential buyers' willingness to pay.

Several violent events occurring in a neighbourhood serve as a red flag to potential buyers, signalling the presence of criminal groups and insecurity. Incorporating the magnitude factor into the analysis is crucial, as "the concentration effect, which is not present in other studies, tends to be much greater than the distance effect" (Caudill *et al.*, 2015).

The magnitude of violence increases the exposure of individuals to crimes, their risk and their vulnerability. Crimes occurring in public spaces affect individual behaviour more than crimes occurring in private places, causing the deterioration of the urban setting and urban flight (Wilcox *et al.*, 2003; Fe and Sanfelice, 2022). Frequent violent events in a local area also create an impact on individual fear due to the sound of shootings or physical damages to properties, which cause a negative reputation of the neighbourhood and increase the fear of crime exposure. A study in Stockholm, Sweden, found that housing prices are affected by these circumstances days after a shooting takes place (Wilhelmsson *et al.*, 2022).

### *Visibility*

Visibility, or the performance of violence (Surette, 2015), plays a crucial role in shaping urban areas. Society and territory are in constant interaction and, in this dynamic, the perception of security is a key element in understanding the configuration of the public space (Fraile, 2007). In the Mexican case, the performance of the criminal groups – the visible violence – turns out to be a catalyst for this perception (Atuesta, 2017). According to Lantz (2016), criminal groups recognise the importance of their reputation in influencing how they choose to exercise acts of violence. Hence, they seek to convey their message of social control to the public through various means, including leaving threatening messages next to executed bodies (known in Mexico as *narcomessages*) (Lantz, 2016).

Criminal groups can decide which violence they want to make public and which one they prefer to hide. These decisions shape not only the political terrain where these groups move (Molin Friis, 2015) but also the perceptions the population has in terms of insecurity and violence. This visible violence could be censored, published or used by political leaders to justify security policies (Molin Friis, 2015). Regardless of what politicians or the public media do with this violence, as soon as criminals decide to make their violence visible, these events stop being something that happens farther away, to other people, to become vivid experiences observed in their own neighbourhoods. Not only is social media making visible violence more pervasive (Surette, 2015), but local news broadcasting, neighbourhood blogs and police presence in the area also contribute to the increased visibility of violence (Fe and Sanfelice, 2022).

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Once society realises that a violent event can happen nearby, or once criminal groups use visibility to have a wider impact on the population, anxiety and fear psychologically affect society. The insecurity perception is triggered, creating “panic rumors” that spread quickly (Oseguera, 2018). Narcomessages are one of the main means by which criminal groups make visible the violence they commit or can commit. These messages are distinguished by their originality, their emotional intensity and their evocative capacity, making it possible to configure urban spaces as undefined places (Oseguera, 2018). Contrary to the performance of violence through social media, the visibility of violence through the use of narcomessages, locates violent events in specific places, changing the norms established for daily life (Turner, 1982; Surette, 2015), permeating the collective image about the places where these events occur and, therefore, reducing the desire of individuals to be close to them.

Rumours of high-visibility crimes spread faster and create greater fear in the public (Skogan, 1986). Conversations or secondary information about serious crimes, regardless of the risk of direct victimisation, exacerbate the perception of insecurity in the locality and influence neighbour’s behaviour (Skogan, 1986). According to Oseguera (2018), “panic rumours” remind people that a violent event could occur nearby, making it difficult to shake off the fear of criminal activity in the area.

#### *Impact of crime on housing prices*

After establishing the relationship between crime and fear of crime, as well as the mechanisms that cause these relationships, this paper examines the impact of crime on housing prices. Due to the lack of accurate data on citizens’ concerns about personal safety in local areas, several scholars use crime recorded data as a proxy for fear of crime (Fe and Sanfelice, 2022; Janke *et al.*, 2016). The presence of crime in an area not only affects the decision to buy a property but also the decision to change residences. High levels of criminality make people move to safer areas, negatively affecting the local economic development of the area (Fe and Sanfelice, 2022).

Several scholars have documented the relationship between housing prices and crime (Ceccato and Wilhelmsson, 2011; Buonanno *et al.*, 2012; Iqbal and Ceccato, 2015; Agudelo *et al.*, 2017; Gaviria *et al.*, 2010; Delgado and Wences, 2018; Ceccato and Wilhelmsson, 2020; De Graaff and Zietz, 2020; De la Paz *et al.*, 2021; McIlhatton *et al.*, 2016; Wilhelmsson *et al.*, 2022; Wong *et al.*, 2019). The presence of crime in an area not only affects the decision to buy a property, but also the decision to change residences. Some have argued that the feelings of fear and anxiety generated by the presence of crime are determinants of how satisfied individuals are in a specific neighbourhood (Ceccato and Wilhelmsson, 2010). When criminality rates increase, homeowners and renters “vote with their feet”, moving to a safer, or at least less violent, location (Ozdenerol *et al.*, 2015; Fe and Sanfelice, 2022; Wilcox *et al.*, 2003).

The question here is why violence affects property values and what would need to be the characteristics of this violence to affect housing prices. The literature focused on analysing the impact of crime on housing prices assumes that there is a change in individuals’ behaviour when they are exposed or close to an insecure environment. Thaler (1979), for instance, argues that buying a property is a complex decision, and the price the individual is willing to pay depends on the dwelling characteristics, the neighbourhood where the property is located and its relationship with the rest of the city. Moreover, Gibbons (2004) posits that the spatial concentration of crime contributes to the decision individuals take of buying, or not buying, a property in a specific location. In that sense, in neighbourhoods with high levels of criminality, fear and the indirect costs associated with property crime could discourage buyers from purchasing a property and therefore, negatively affect the local economic development of the area (Fe and Sanfelice, 2022).

Violent events represent a disorder in the environment, which increases the fear of crime and leads to destabilisation of the neighbourhood (Skogan, 2015). The frequency of these disorders is associated with the residential area decline. According to Steenbeek and Hipp (2011), a high level of disorder in a neighbourhood causes urban flight, increases residential instability and reduces the residents' compromise to improve neighbouring conditions and security.

The literature has also documented the housing market implications of the reduction of social cohesion and residential compromise. Neighbourhoods with high levels of violence experience lower levels of social cohesion (Hipp and Steenbeek, 2016), which negatively affects the housing market. McCord *et al.* (2013) find that the social segregation caused by the building of "peace walls" in Belfast, negatively impacts housing prices. High levels of instability and low levels of residential satisfaction reduce private investment and property values (Hipp, 2009).

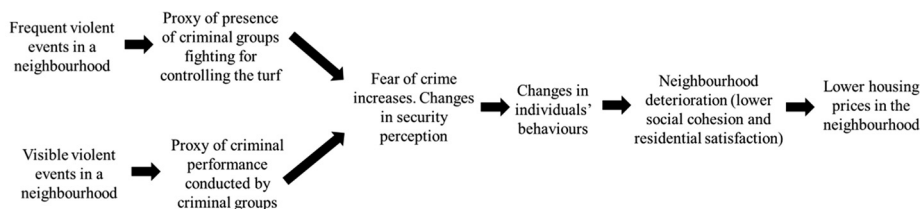
Previous scholars have found evidence that the housing demand tends to decrease in places where criminality rates are high. According to Gibbons (2004), the price gradient of dwellings with high and low criminality rates differs. For this reason, several authors have used quantitative methods to estimate the impact of crime on housing prices. Ceccato and Wilhelmsson (2011) and Ceccato and Wilhelmsson (2020) use hedonic prices to estimate the effect of crime and crime hotspots, respectively, on housing prices in Stockholm, Sweden; Pope (2008) uses the home address of former offenders to estimate the impact of crime on property values; Buonanno *et al.* (2013) and Iqbal and Ceccato (2015) use quantile regressions to estimate heterogeneous effects of crime on housing prices; Agudelo *et al.* (2017) estimate a geographically weighted regression with data from Medellin, Colombia, to analyse how the location decision of individuals changes when considering properties located in insecure and problematic neighbourhoods; Gaviria *et al.* (2010) use a hedonic price model to estimate the willingness of Bogota's residents to pay higher prices to avoid crime; and Delgado and Wences (2018) using data from in Acapulco, Mexico, calculate how housing prices increase the farther away properties are from the most dangerous neighbourhood in the city.

### Hypotheses

Figure 1 shows the theoretical arguments explained in this section to understand the relationship between violent events and housing prices.

Following the arguments explained in this section, we hypothesise that:

- H1. Housing prices are reduced when the magnitude of criminal violence increases. However, sporadic violent events do not necessarily affect housing prices.
- H2. When criminal groups decide to make violence visible, through the use of narcomessages, security perception is affected and the neighbourhood is labelled as a dangerous place, negatively affecting housing prices. Therefore, the closer a property is to a place where a narcomessage was left next to an executed body, the lower is the price of this property.



Source: Author's own work

**Figure 1.** Causal mechanisms to explain the relationship between frequent and visible violent events with housing prices

## Social and economic costs of the war against organised crime in Mexico

Mexico has experienced a significant surge in criminal violence since the beginning of the presidency of Felipe Calderon in 2006. The president declared military operations in various Mexican states shortly after his inauguration. As of 2020, the military was involved in public security activities in almost all regions of Mexico (Human Right Watch, 2022). The frontal attack on criminal groups led to the fragmentation of organised crime, resulting in an increase in violence to levels never seen before. More than 80 criminal groups were identified as conducting illegal activities in 2011, compared to only five in 2007 (Atuesta and Pérez-Dávila, 2018). The homicide rate increased from eight homicides per 100,000 population in 2006 to 24 per 100,000 population in 2011, representing an increase of over 200% (Zúñiga, 2012).

Mexico is one of the most dangerous countries in Latin America (Instituto para la Economía y la Paz, 2019). Moreover, due to the brutal and gruesome techniques used by criminals, the Open Society Foundations (2016) catalogued crimes in Mexico as “undeniable atrocities”. The magnitude of violence and, accordingly, the perception of insecurity, in Mexico is greater when compared to other countries in which the relationship between crime and housing prices has been studied. Therefore, we could reasonably expect a negative impact of violence on Mexican housing prices, either measured by its magnitude or its visibility.

The increase of violence in Mexico has brought about a range of social and economic costs. Existing research suggests that violence leads to migration (Atuesta and Paredes, 2015), negatively affects birth rates (Torche and Villarreal, 2014), educational outcomes (Orraca, 2015) and the mental health of both journalists (Feinstein, 2012; Flores *et al.*, 2014) and the general public (Flores Martínez and Atuesta, 2018).

Criminal violence also affects individual and societal behaviours. Flores Martínez and Atuesta (2018) found that violent crime has a negative impact on the mental health of the Mexican population, including those who have not directly suffered from violence. The authors propose various explanations for the effects of violent crime on people’s behaviour, such as fear and distrust of both criminal groups and government security forces.

The perception of insecurity is translated into a society that is fearful of being exposed to violent situations. Flores Martínez and Atuesta (2018) suggest that criminal violence affects communities and society by increasing fear, reducing the willingness of individuals to live in properties located nearby and limiting mobility and the use of public spaces (Whitley and Prince, 2005), as demonstrated by the national survey on victimisation and public security perception (ENVIPE by its Spanish acronym). The ENVIPE, which measures people’s perception of security, found that 50.6% of Mexico City’s population considered their neighbourhood to be insecure, while 23.8% felt most insecure in their homes (INEGI, 2019).

The economic costs of violence are less studied in the literature, although they are evident in Mexicans’ daily lives. During Calderon’s administration (2006–2012), when homicides skyrocketed, economic growth was at its lowest level since the prior four administrations (Magaloni *et al.*, 2013). According to Saborowski (2018), criminal activity accounts for 2.5% of GDP, whereas the Institute for Economics and Peace (Instituto para la Economía y la Paz, 2019) estimates the economic cost of violence, mainly homicides, to be 24% of GDP. The effect is not uniform among regions; regional location, culture, the presence of organised crime groups and the normalisation of violence account for regional differences.

Economic costs are measured differently in the scholarly literature. For example, Nuñez *et al.* (2017) analyse the influence of violence and other local factors on regional wage and housing rent discrepancies. They contend that residents residing in states with greater



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criminal violence perceive that the economic opportunities from engaging in illegal activities outweigh the negative effects of crime. Magaloni *et al.* (2013) identified a negative influence of violence on economic activity, using energy consumption as an economic activity index at the local level. Ríos (2011) estimated the economic losses to society attributable to drug trafficking to be approximately US\$4.3m per year since 2006.

The real estate market is impacted by the commission of violent crimes, including homicides and executions, leading people to be less willing to live in insecure neighbourhoods. This trend is noticeable when assessing the factors influencing the housing location decisions of families (Méndez and Isunza Vizuet, 2010). About “Property buying intentions of Mexicans – 2019” (eBay, 2019), 73% of respondents indicated that neighbourhood insecurity was a key factor while choosing where to reside. Therefore, neighbourhood insecurity acts as a negative amenity for housing location options.

Mexico City presents a pertinent case study to study this relationship for several reasons. Firstly, violence has been on an exponential rise since 2006, and the number of homicides and other violent crimes continues to increase (Vélez *et al.*, 2016). Additionally, violence is ingrained in the social fabric and permeates different contexts, making it a pervasive and all-encompassing influence on both public and private lives of citizens (Vite, 2015).

### Data description and empirical strategy

For estimating the impact of criminal violence on housing prices in Mexico City, we use two types of information. Firstly, we use a private database of housing prices and characteristics gathered by Softec [1] (one of the main real estate consulting firms in Mexico and the only one gathering information directly from developers about housing prices and characteristics, including the exact location of housing projects). Secondly, we use the CIDE-PPD Database that registers violent events of the “war on drugs” in Mexico from December 2006 to November 2011. In what follows, we describe the two databases and the variables used for the empirical strategy.

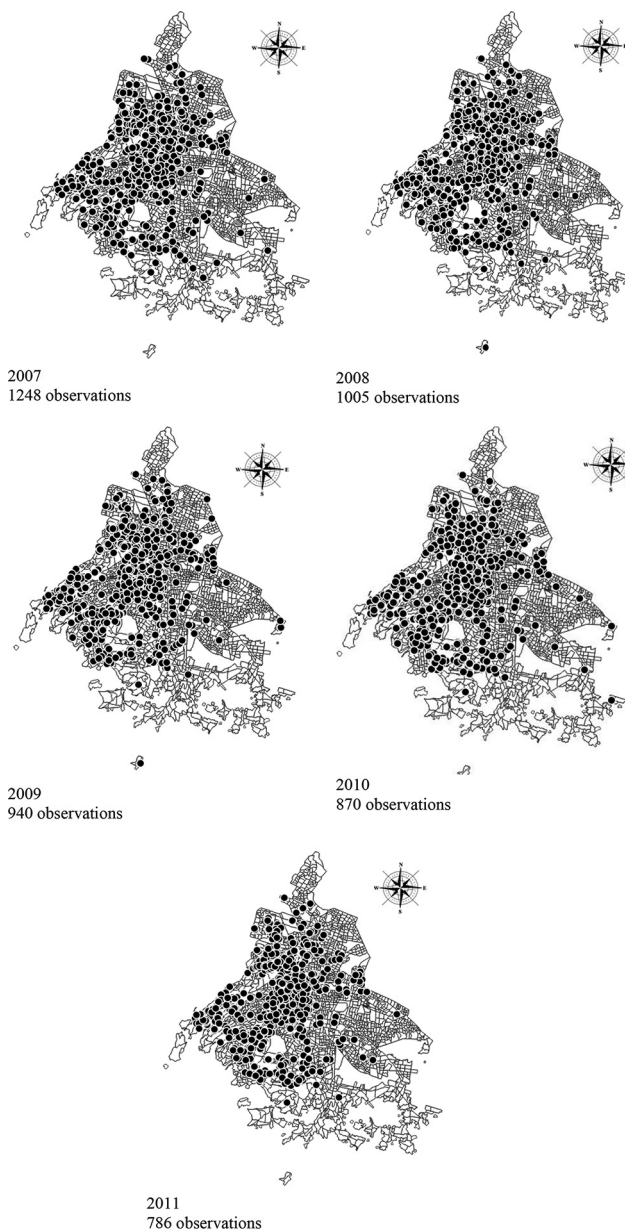
#### *Housing data*

The Softec database has information on new housing constructions in Mexico City. The information is compiled at the housing project level (most dwellings in Mexico are built in closed-gated communities or housing projects) and includes the characteristics of the representative property [2]. The information is gathered until the last property of the housing project is sold, so the number of years a housing project enters into the panel depends on the years it takes to sell all properties of the housing project. Some housing projects are completely sold within a year; others take four or five years. In other words, the information on each housing project is available from the year the project began its sales until the last property in the project was sold.

Although the characteristics of the representative property can vary, this paper assumes that the price of the representative property offers clear information regarding the behaviour of the real estate market in that specific location. Figure 2 shows the quantity and the geographic dispersion of housing projects compiled by Softec between 2007 and 2011.

#### *Database of violent events*

The CIDE-PPD Database is public, and it registers more than 36,000 violent events related to organised crime in Mexico from December 2006 to November 2011. More specifically, the database contains information regarding executions committed by criminal groups, confrontations between criminal groups and between criminal groups and security forces and aggressions of criminal groups to the civilian population or authorities. The database



**Figure 2.**  
Amount and  
geographic  
dispersion of housing  
projects gathered by  
the Softec database in  
Mexico City from  
2007 to 2011

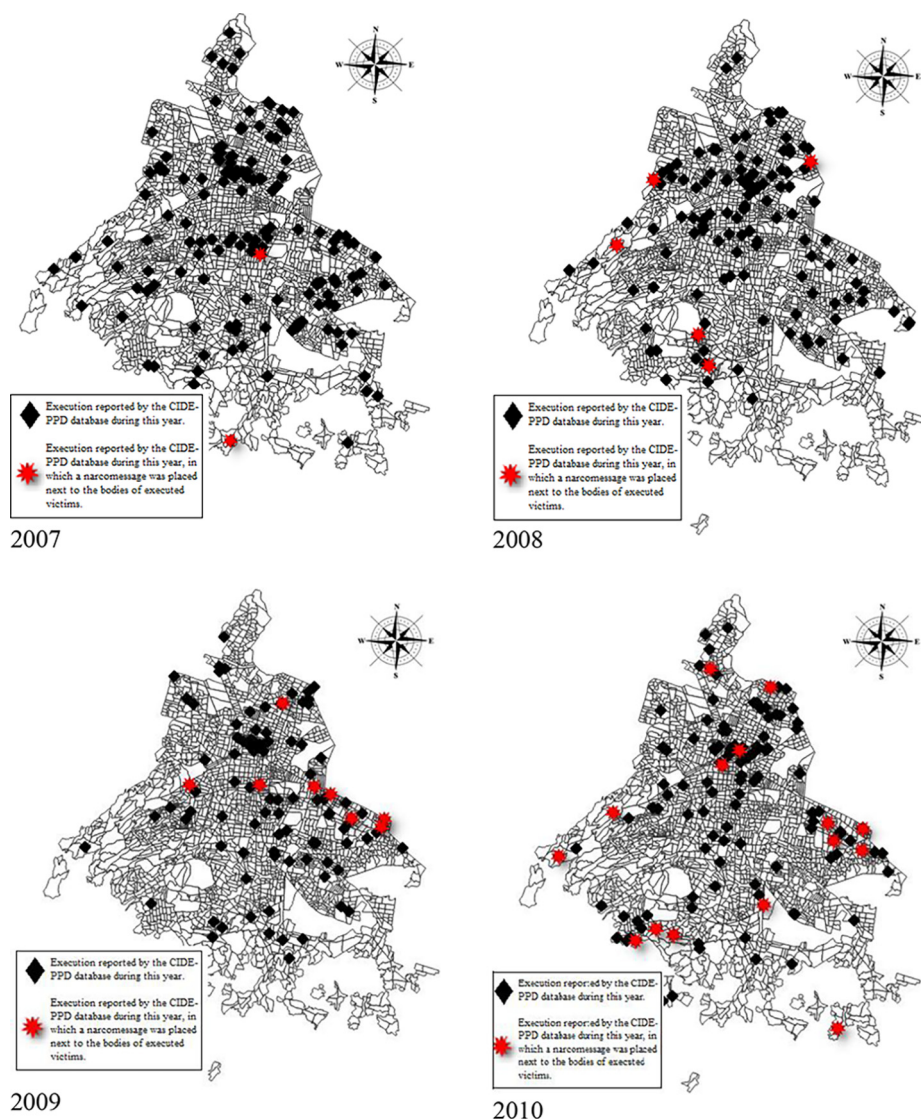
**Source:** Author's own work

was received anonymously, and its information was validated by a multidisciplinary group comprised of researchers of the drug policy programme and CentroGeo (Atuesta *et al.*, 2019).

The category of executions gathers homicides on which the perpetrator and/or the victim were members of criminal groups. An event in the database could have more than one

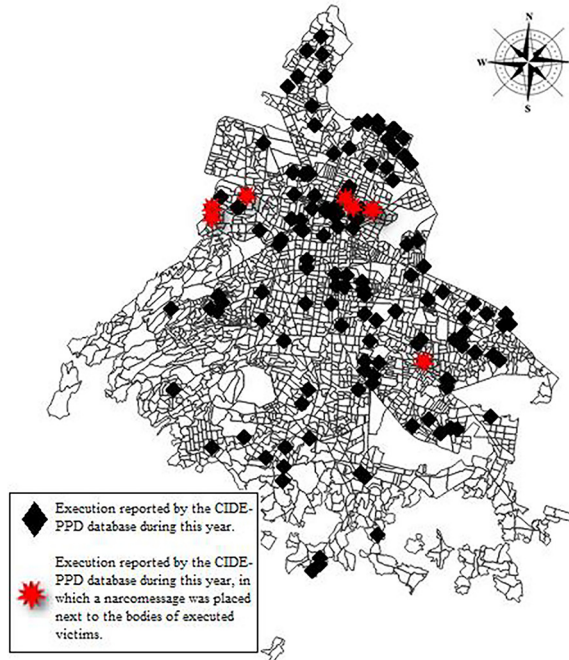
homicide, as an execution could have had several victims. The description of the execution is also included in the database, such as whether a narcomessage was left next to the executed bodies and how the victim was murdered (Atuesta *et al.*, 2019).

For this article, we consider only those executions that were reported in Mexico City. Figure 3 shows the number and the geographical dispersion of executions per year in the city, as well as those executions that were left with a narcomessage.



**Figure 3.** Number and geographical dispersion of executions versus executions left with narcomessages

(continued)



2011

Source: Author's own work

Figure 3.

*Dependent variable: housing value of the representative property (in logs)*

The dependent variable of the empirical strategy is the natural logarithm of the housing value of the representative property (in Mexican pesos) of project  $i$  in time  $t$ . Table 1 shows the behaviour of the housing values of representative properties for each year with provided information. As noted in the previous section, this information corresponds to the housing value reported during the last trimester of each year.

*Criminal violence-related variables*

The first variable used to measure criminal violence is the distance between each housing project and the nearest execution (with one or more victims). The second variable is the

**Table 1.**  
Average price of the representative property of housing projects reported by Softec during 2007–2011

Year	No. of housing projects	Average price (MXN)	Average price (in USD) [3]	Standard deviation (MXN)	Minimum (MXN)	Maximum (MXN)
2007	1,248	1,489,422	74,959.12	1,324,316	167,589	15,400,000
2008	1,005	1,519,180	76,456.77	1,277,408	224,467.7	12,200,000
2009	940	1,606,833	80,868.14	1,397,933	159,951.1	11,700,000
2010	870	1,642,346	82,655.43	1,466,041	192,870.4	11,400,000
2011	786	1,739,862	87,563.18	1,728,751	169,674.7	15,400,000

Source: Authors' own work

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distance between the housing project and the nearest execution with a narcomessage. The hypothesis behind this latter variable is that the criminal performance of leaving a message serves as a reminder to the population that violent events can happen close to their property, cowering the public into submission or reminding them of the power dynamic between criminal groups (Oseguera, 2018). Therefore, we expect an execution with a narcomessage to have a greater impact than an execution without such a message.

The values of these two variables are expressed in meters, on a scale of 1:100. In other words, their coefficients are interpreted as the impact on housing values of being a 100 m farther away from where an execution (or an execution with a narcomessage) was committed.

Lastly, we also include a third variable as proxy of the *magnitude* of criminal violence: the number of executions between the housing project and the execution with narcomessage. This variable is important for two reasons: firstly, as observed in Figure 2, the number of executions with narcomessages reported in Mexico City is scarce; as such, the distance between the housing projects and the executions with narcomessages could be too big. Secondly, this variable reflects the *magnitude* of violence and measures the impact of *multiple violent events*, instead of focusing on the impact of just one event that could, or could not, be reported by the press and either acknowledged or unacknowledged by neighbours and potential buyers.

#### *Control variables*

As mentioned in the previous section, the existing literature attributes changes in housing prices to different variables, including characteristics of properties and neighbourhood characteristics. Here, we describe which variables are included in the empirical strategy to estimate housing values in Mexico City.

*Attributes of the property and the housing project ( $w_{ij}$ ).* Variables included in this group were gathered by Softec. According to the available data, we consider the following characteristics of the representative property: number of bathrooms (Caudill *et al.*, 2015; Nuñez *et al.*, 2017; Atuesta *et al.*, 2018), number of bedrooms (McCord *et al.*, 2013; Iqbal and Ceccato, 2015; Nuñez *et al.*, 2017; Atuesta *et al.*, 2018), size of the property (in square meters) (McCord *et al.*, 2013; Iqbal and Ceccato, 2015; Nuñez *et al.*, 2017; Atuesta *et al.*, 2018), whether the housing project has a pool (Atuesta *et al.*, 2018) and whether the housing project has private surveillance (Dimeji and Omodadepo, 2020). We also include variables regarding the type of property (duplex, apartment, loft, townhouse, flat or penthouse) (McCord *et al.*, 2013; Atuesta *et al.*, 2018). Regarding characteristics related to the location of the housing project, we consider four variables: distance from the project to the closest metro station, distance to the closest Bus Rapid Transit (BRT) System station (Atuesta *et al.*, 2018), distance to the Central Business District (CBD) (McIlhatton, 2016; McCord *et al.*, 2013; Atuesta *et al.*, 2018) and access to different employment subcentres (Atuesta *et al.*, 2018).

*Socioeconomic characteristics of the neighbourhood ( $z_{it}$ ).* We consider seven different variables in this section, obtained from the Housing and Population Censuses of 2005 and 2010 (INEGI): average education level, population, population rate without social security, rate of properties with inadequate floors, rate of properties without sewerage, rate of properties without water services and rate of properties without amenities (radio, television, fridge, washing machine, automobile, computer, telephone, cell phone and internet).

#### *Empirical strategy*

To estimate the impact of criminal violence on housing prices in Mexico City, three models are specified, all of them using as a dependent variable the natural logarithm of the price of

the representative property in each housing development during 2007–2011. Three different sets of independent variables are included:

- (1) variables related to criminal violence;
- (2) variables related to the property and housing project attributes; and
- (3) socioeconomic characteristics of the neighbourhood.

The structure of the data set is an unbalanced panel as each housing project enters the data set the years it takes to be completely sold (some projects are sold within a year, and some others take longer to sell). However, we could not find a theoretical argument to use a fixed effect or a random effect model as empirical strategy because there are no conditions that meet the assumption of strict exogeneity, either of the error term or the omitted variable.

Moreover, the housing prices of year  $t$  are affected by the housing prices of year  $t - 1$ , which makes endogenous the lagged variable as it is correlated with the error term of  $t - 1$ . To correct for this endogeneity, we modify the model in two ways: firstly, we transform the variables used in the estimated equation (using first differences) to drop the omitted variable that is fixed over time. Secondly, to correct for the endogeneity of the lagged dependent variable, we use the previous lags of the dependent variable as instrumental variables. [Wilcox \*et al.\* \(2003\)](#) explain the importance of using changes in crime rates instead of absolute levels of crime, both from an empirical and a theoretical perspective. Empirically, because changes allow us to compare crime rates from different settings; theoretically because residents of a historically violent neighbourhood already have considered the level of crime in their previous decisions or future expectations, so changes in their location choices would only be observed when the neighbourhood experiences changes in its crime levels.

In estimating the model in two steps, and instrumenting the endogenous variable, we assure exogeneity of all independent variables included in the empirical strategy. The mathematical specification of these assumptions, as well as the model estimated, are shown in the following equations:

$$LnP_{i,t} = \gamma LnP_{i,t-1} + X_{it}\beta + W_{it}\beta + Z_{it}\beta + c_i + u_{it} \quad (1)$$

where  $LnP_{i,t}$  is the logarithm of price of the representative property of the housing project  $i$  in year  $t$ ;  $LnP_{i,t-1}$  is the lagged dependent variable;  $X_{it}$  are the three proxies of criminal violence described in the previous section;  $W_{it}$  includes all variables related to the characteristics of the property and the housing project;  $Z_{it}$  includes all sociodemographic characteristics of the neighbourhood where the housing project is located;  $c_i$  is the omitted variable, which is constant through time, and includes attributes of the representative property, the neighbourhood and the housing project that explain the housing price and do not change over time (e.g. the reputation of the construction firm that is responsible of the housing project, the history and culture of the neighbourhood where the housing project is located or the quality of the materials used for building the representative property). Lastly,  $u_{it}$  is the error term.

To estimate unbiased and consistent estimators, assumptions about the exogeneity of the error and the omitted variable, given all independent variables in all periods, must hold, as shown in [equation \(2\)](#):

$$E[u_{it} | x_{it}, x_{it-1}, \dots, x_{i1}, c_i] = 0 \quad t = 1, 2, \dots, T \quad (2)$$

If these assumptions hold, we can conclude that the independent variables are sequentially exogenous conditional to the omitted variable ([Wooldridge, 2010](#)). However, the assumptions

are too strong, and even more so when the independent variables include the lagged dependent variable. To make these assumptions hold, we conduct a linear transformation (first differences) of the equation to be estimated, to remove the omitted variable  $c_i$  from the regression and to use instrumental variables to control for the endogeneity caused by the correlation between the lagged dependent variable and some error terms. The transformation then is expressed by the following equations:

$$\Delta \ln P_{it} = \Delta \ln P_{it-1} + \Delta x_{it} \beta + \Delta u_{it}, \quad (3)$$

$$E \left[ x'_{is} u_{it} \right] = 0, \quad s \neq t \quad (4)$$

$$E \left[ x'_{is} \Delta u_{it} \right] = 0, \quad s \neq t \quad (5)$$

This model is estimated using a pooled 2SLS, using lagged dependent variables as instrumental variables to control for the endogeneity explained in the previous paragraph. It is important to consider that once the first differences model is estimated, variables that are constant through time are also dropped from the equation. These include the accessibility of the housing project to different employment subcentres, the distance to the CBD and the distance to the closest metro station.

### Analysis of the results

The results of the empirical strategy are shown in [Table 2](#). Column A shows the results of the empirical model in which only variables related to criminal violence are included (distance from the housing project to the nearest execution, distance to the nearest execution with a narcomessage and the number of executions between the housing project to the nearest execution with narcomessage). Column B shows the results of the model that adds housing characteristics and attributes of the housing project. Lastly, Column C includes socioeconomic characteristics of the neighbourhood where the housing project is located. The three models include the lagged dependent variable on the right-hand side of the equation and use the log of the housing value (from the representative property) as the dependent variable. The three models are estimated using a pooled 2SLS of first differences using as instrumental variable, the second lagged dependent variable.

The results suggest that individuals indeed consider criminal violence to be a negative amenity in their housing location decisions, especially when criminal groups make this violence *more visible or attributable* by leaving a narcomessage next to the executed body (or bodies). The closer the housing project is to an execution with a narcomessage, the lower the housing value of the representative property. Specifically, if the distance to the execution with a narcomessage increases from one year to the next, the housing value increases by 0.028%. Thus, the housing project farthest away from any of these events enjoys the greatest appreciation in the housing prices of that specific project.

Surprisingly, the distance from the housing project to the nearest execution is not significant in explaining housing prices. This result may be explained by the fact that, on the one hand, an isolated execution committed near their potential home is not reason enough for buyers to reject the location of the property. This situation changes, however, when a narcomessage is left next to the executed body: violence become more visible, and if

	Column A Crime-related variables	Column B Crime variables and housing and project characteristics	Column C Crime variables and housing, project and neighbourhood characteristics
Lagged of log of housing price	0.114 (0.164)	0.107 (0.164)	0.126 (0.136)
Distance to the nearest execution with a narcomessage	0.000283** (0.000127)	0.000267** (0.000126)	0.000286** (0.000127)
Distance to the nearest execution	-0.000215 (0.000334)	-0.000199 (0.000337)	-0.000435 (0.000354)
Number of executions between the housing project and the nearest execution with narcomessage	-0.000455 (0.000314)	-0.000392 (0.000312)	-0.000787** (0.000335)
Number of bedrooms		0.0833** (0.0341)	0.0755** (0.0339)
Number of bathrooms		-0.00426 (0.0368)	-0.000371 (0.0350)
Whether the housing project has surveillance		-1.14e-05 (1.53e-05)	-1.45e-05 (1.54e-05)
Distance to the closest BRT station		0.00225*** (0.000686)	0.00239*** (0.000682)
Property size (m <sup>2</sup> )		-0.0132 (0.0199)	-0.0111 (0.0193)
Type of property: horizontal		-0.0165 (0.0693)	-0.00551 (0.0688)
Type of property: condo		0.0320 (0.120)	0.0329 (0.119)
Type of property: loft		0.221 (0.157)	0.217 (0.156)
Type of property: townhouse		-0.00327 (0.139)	-0.00518 (0.137)
Whether the housing project has a pool		0.0431 (0.0481)	0.0427 (0.0439)
Whether the housing project has green spaces		-0.00396 (0.0234)	-0.00776 (0.0231)
Average education level in the neighbourhood			0.308*** (0.101)
Neighbourhood population			1.07e-06 (9.30e-07)
Population rate without social security			0.0226** (0.0100)
Rate of properties with inadequate floors			0.0376*** (0.0107)
Rate of properties without water services			-0.201*** (0.0605)
Rate of properties without assets			0.0155 (0.229)
Rate of properties without sewerage			0.185* (0.112)
Constant	0.0103 (0.00707)	0.0107 (0.00706)	0.0151** (0.00721)
Number of observations	918	918	918

**Table 2.** Results of the three models estimated. All three models are estimated by a pooled 2SLS. The dependent variable is the log of price of the representative property in each housing project

**Notes:** Standard errors in parenthesis. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . The models include time fixed effects and are estimated using a pooled 2SLS of first differences, as specified in [equation \(3\)](#). The endogenous variable is the lagged housing price, and the instrument is the second lag

**Source:** Authors' own work



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the message is signed and/or directed, it is possible to attribute violence to a specific criminal group, which increases fear (Flores Martínez and Atesta, 2018).

The exact location of the execution, or even the execution itself, is not always reported by the press, so potential buyers are not always aware of isolated violent events happening closer to their prospective home. However, if several executions happen nearby, the insecurity perception of the neighbourhood changes; as neighbours become aware of different violent events happening close by, potential buyers could change their housing location decisions based on this perception of the insecurity of the neighbourhood. In other words, what matters is not only the violence reported in the neighbourhood, but the *magnitude* (number of events) and *visibility* (whether a narcomessage was found next to the execution) of this violence. In this sense, a positive change in the number of executions closer to the housing project from one year to the next is reflected in a reduction of 0.078% on housing values. In other words, the greater the violence reported in the neighbourhood, the greater the reduction in housing prices of projects located in that neighbourhood.

The control variables have a constant, and expected behaviour. As predicted, the attributes of the dwelling and the housing project impact the housing values. For instance, the number of bedrooms and the size of the property positively affect housing prices. Location variables and other attributes of the housing project, although they have the expected sign, are not significant factors in explaining changes in housing values.

Lastly, the socioeconomic attributes of the neighbourhood where the housing project is located reflect the preferences of Mexico City society regarding housing choices. Firstly, individuals are sorted based on their preferences (as they “vote with their feet”) and neighbourhoods with a higher socioeconomic level tend to offer more expensive housing alternatives. This sorting is observed when analysing the coefficient of the average education level in the neighbourhood and its effect on housing values: the greater the education level in the neighbourhood, the more housing values appreciate. Secondly, the informality of neighbourhood residents is not considered to be a negative attribute of housing values. Neighbourhoods with a greater proportion of informality (measured by those residents without social security) have greater housing values. This result is explained because informality in Mexico is not necessarily associated with the socioeconomic level of individuals but with hiring practices that are used in all economic activities (Temkin and Cruz, 2019).

Lastly, more segregated neighbourhoods, measured by characteristics of their dwellings, tend to offer lower housing prices, making segregation a negative amenity when analysing housing values. For instance, the negative relationship between the rate of properties without water and the housing values is an indicator of how new buyers observed characteristics of neighbouring properties when making housing location decisions. However, other negative amenities of the neighbouring dwellings (such as the rate of properties with inadequate floors or the rate of properties without sewerage) have a positive relationship with housing values, suggesting that the new housing projects (that already have these amenities) tend to offer a higher price even though the neighbourhood still exhibits precarious housing characteristics.

### Conclusions and policy implications

After more than a decade since the beginning of the “war on drugs”, its social and economic negative consequences are still being felt and are, in fact, growing. Far from achieving its objective (reduce levels of violence), this strategy is full of errors and inconvenient effects on social welfare. The problem is that the authorities continue its implementation and increase their action field, in terms of the militarisation of civilian activities and the creation of new

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militarised security forces. Criminals have responded in kind: violence is more gruesome than ever, and performative criminality has increased fear in the society at large and exacerbated uncertainty in terms of economic growth.

Studying the social and economic adverse effects of the “war on drugs” in Mexico has been common in recent literature. However, despite the existence of worthy analyses, many impacts of the “war” remain understudied. This article explored a field that has not been deeply investigated: the economic implications of the “war on drugs” on housing in Mexico. For doing so, we analyse the effect of this failed strategy on the behaviour of the real estate market. Specifically, we estimate the impact of criminal violence on housing prices of new housing projects built in Mexico City, between 2007 and 2011. The results of this analysis are clear: the proximity of criminal events has negative impacts on housing values.

The results of this analysis corroborate different narratives of violence that have engendered fear in the population. On the one hand, the executions conducted by criminal groups (with one or more victims) are considered a maximum expression of violence. On the other hand, narcomessages show society and the authorities that they (criminals) are fearless and are willing to cross the line (Vargas, 2018). Further, narcomessages serve to remind society that violent events could occur in neighbourhoods where people live, controlling the territory through violence and creating protection rackets (Oseguera, 2018).

These results have several policy implications. From a social perspective, these findings are evidence of an adverse effect of the war against organised crime. Fear of being a victim of violence, or even simply the threat of being a spectator, have created ruptures in society that are hard to heal. Individuals now have come to care only about their closest relatives and are always looking for a safer place to live, where violence is not observed; ergo, such violence is not their problem. As housing is considered to be a long-term investment, buyers are seeking isolated places (closed-gated communities), even if these places mean isolation from other amenities offered by urban society. As these communities are usually located in the urban spheres, looking for housing farther away from expressions of violence becomes as important as being closer to restaurants, parks or employment centres. When violence explodes close to these housing projects, homeowners feel that, not only is their family at risk, but also their home investment, as housing prices will likely depreciate.

From an urban perspective, a better understanding of which attributes are attractive for buyers when considering their location choices, and for housing project constructors and investors, is critical to have better urban planning based on evidence and focused on actual demands. If the equilibrium of the market also considers violence, the profit generated for the public and the private investment could be greater.

This paper has limitations that are noteworthy. Firstly, this analysis considers the impact of criminal violence on new housing projects. Developers are accountable for the sales’ strategy, and their interests to decrease or increase prices may differ from those encountered by homeowners looking to sell their property due to violence escalation. Nevertheless, the equilibrium price reflected in this study considers the rational decisions of both buyers and sellers, along with the conduct of other housing prices in the neighbourhood. This implies that the results of this paper can be viewed as an approximation of how housing prices act when violent incidents occur nearby. Secondly, this study only examines the initial period of the war on drugs in Mexico. After 2011, violence in the country continued to increase, criminal organisations became more diversified and the number of groups multiplied. However, due to data restrictions, a more current period could not be included in the analysis. Housing prices are accessible only until 2013, and the CIDE-PPD Database is available only until November 2011.

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Further research should focus on evaluating whether the effects of violence are constant through time and space. We chose to analyse the housing market of Mexico City, the biggest city in the country, and a city that offers multiple amenities such as employment opportunities and cultural and recreational alternatives. However, the characteristics of each city are different, as are the presence and expressions of criminal groups. By obtaining reliable data on housing markets and on the organised crime presence in different cities, this analysis could be expanded to have a better knowledge of the implications of organised crime in housing values and housing location decisions.

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## Notes

1. The Softec database contains information from 2002 to 2013. However, this paper's analysis is focused on the Calderón administration (2007–2011).
2. The information provided is the median property sold in the community.
3. We use the exchange rate as of 23 May 2022 (US\$1.00 = MX\$19.87).

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