Effects of Internal Forced Displacement on Crime: Evidence from Colombia

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Abstract: *Internal forced displacement, a consequence of territorial control strategies by armed groups, has resulted in profound socioeconomic challenges for receiving areas. Approximately eight million people have been affected in Colombia, where internal conflict and criminal networks have prevailed for over five decades. This paper explores the relationship between internal forced migration and crime rates in Colombian municipalities from 2003 to 2016, focusing on spatial dynamics. The study utilizes a spatial panel model and considers five crime categories: homicides, kidnapping, personal injuries, automobile theft, and residential burglary. The results reveal significant associations between forced displacement and certain types of crime, highlighting the importance of spatial analysis in understanding the interaction between migration and crime. The findings offer valuable insights for policymakers and researchers, facilitating informed policy interventions and community initiatives to address the repercussions of internal migration on crime dynamics.*

Keywords: *Internal forced displacement, crime, spatial panel, Colombia, Latin America, internal migration.*

JEL Classification: K42, O15, R23, R59.

Efectos del desplazamiento forzado interno sobre la delincuencia: evidencia de Colombia

Resumen: *El desplazamiento forzado interno, consecuencia de las estrategias de control territorial de los grupos armados, ha resultado en profundos desafíos socioeconómicos para las zonas receptoras. Aproximadamente ocho millones de personas se han visto afectadas en Colombia, donde el conflicto interno y las redes criminales han prevalecido durante más de cinco décadas. Este artículo explora la relación entre la migración interna forzada y las tasas de criminalidad en los municipios colombianos de 2003 a 2016, enfocándose en la dinámica espacial. El estudio utiliza un modelo de panel espacial y considera cinco categorías de delitos: homicidios, secuestros, lesiones personales, robo de automóviles y robo residencial. Los resultados revelan asociaciones significativas entre el desplazamiento forzado y ciertos tipos de delincuencia, destacando la importancia del análisis espacial para comprender la interacción entre migración y delincuencia. Los hallazgos ofrecen información valiosa para los formuladores de políticas y los investigadores, facilitando intervenciones políticas informadas e iniciativas comunitarias para abordar las repercusiones de la migración interna en la dinámica del crimen.*

Palabras clave: *desplazamiento interno forzado, criminalidad, panel espacial, Colombia, América Latina, migración interna.*

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Effets du déplacement forcé interne sur la criminalité: données probantes provenant de Colombie

Résumé: *Les déplacements forcés internes, conséquence des stratégies de contrôle territorial des groupes armés, ont entraîné de profonds défis socio-économiques pour les zones d'accueil. Environ huit millions de personnes ont été touchées en Colombie, où règnent des conflits internes et des réseaux criminels depuis plus de cinq décennies. Cet article explore la relation entre la migration forcée interne et les taux de criminalité dans les municipalités colombiennes de 2003 à 2016, en se concentrant sur la dynamique spatiale. L'étude utilise un modèle de panel spatial et considère cinq catégories de crimes : les homicides, les enlèvements, les blessures corporelles, le vol d'automobile et le cambriolage résidentiel. Les résultats révèlent des associations significatives entre les déplacements forcés et certains types de criminalité, soulignant l'importance de l'analyse spatiale pour comprendre l'interaction entre migration et criminalité. Les résultats offrent des informations précieuses aux décideurs politiques et aux chercheurs, facilitant des interventions politiques éclairées et des initiatives communautaires pour faire face aux répercussions de la migration interne sur la dynamique de la criminalité.*

Mots clés: *Déplacement forcé interne, criminalité, panel spatial, Colombie, Amérique latine, migration interne.*

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Effects of Internal Forced Displacement on Crime: Evidence from Colombia

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Introduction

Forced displacement, characterized as a rapid and unexpected form of migration, has emerged as a profound consequence of territorial control strategies and attacks on civilian populations by armed illegal and criminal groups (Roche-Villarreal, 2012). Colombia has been beset by internal conflict and criminal networks affecting a staggering eight million people over five decades (InSight Crime, 2021; Unidad para las Víctimas, n.d.). The appropriation of essential resources by insurgents and criminals in the pursuit of territorial supremacy has led to the deprivation of welfare and property rights for the affected civilian population, exposing them to increased risks of permanent injuries and fatalities (Ibáñez, 2009; Téllez, 2021).

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Host areas of forced migrants face socioeconomic challenges, including worsening labor market conditions, increased inequality, and deteriorating living standards, with limited access to public services and educational systems (Calderón-Mejía & Ibáñez, 2016; Ibáñez & Moya, 2010). The arrival of forced migrants also alters the dynamics of the local population and creates a more heterogeneous society, resembling the consequences observed in general migration scenarios (Ibáñez & Vélez, 2008). Furthermore, despite considerable government efforts to combat criminal activities, crime rates in the receiving areas have persisted and, in some cases, even increased, negatively affecting the population's welfare (Roche-Villarreal, 2012).

Mixed findings characterize empirical research on the migration-crime relationship. Reid et al. (2005) examine the effects of migration on crime rates in metropolitan areas and conclude that migration does not necessarily lead to increased crime rates. Similarly, Bianchi et al. (2012) find that migration primarily affects the incidence of robberies but does not impact other crime types. Kubrin et al. (2016) identify diverse effects of migration on violent crime rates across various neighborhoods. International migration studies exploring spatial heterogeneity effects in specific regions, such as those by Graif and Sampson (2009) and Arnio and Baumer (2012), have contributed to the literature by revealing inconsistent relationships between migrants and crime. These studies underscore the significance of incorporating spatial dynamics into the analysis of migration and crime interactions.

The main objective of this research paper is to delve into the relationship between internal forced migration and its potential impact on crime rates. To achieve this aim, we examine crime rates in various Colombian municipalities from 2003 to 2016. A crucial spatial component is integrated, recognizing the growing importance of spatial analysis in elucidating this relationship. Our work contributes to the existing body of knowledge by providing valuable insights for policymakers, researchers, and communities into the implications of internal migration on crime dynamics, thereby facilitating informed policy interventions and community initiatives.

This study's novelty lies in its comprehensive investigation of the relationship between internal forced migration and crime rates in Colombia.

By integrating spatial analysis, the study offers fresh insights into the complex interplay between migration patterns and criminal activities across various geographical locations. This innovative approach adds depth to the existing literature and contributes to a nuanced understanding of the factors influencing crime rates in the context of internal forced migration.

This article is organized as follows. In Section I, we conduct a literature review of the most relevant theories and empirical studies exploring the relationship between migration and crime. Section II presents the data and the empirical strategy for spatial panel data, and section III presents the results. Finally, we present the conclusions.

I. Literature Review

Theoretical approaches to explaining the crime-migration relationship are founded in sociological and criminological theory, of which the three main theories are the Social Disorganization Theory, Cultural Theory, and Strain Theory. The Social Disorganization Theory posits that lack of resources, inhabitants' diversity, and residential mobility are determinants of criminal acts. Due to these factors, communities cannot build strong relations, which increases social disorganization and ultimately leads to higher crime rates (Mears, 2001). Cultural Theory proposes that the causes of crime are related to cultural contradictions since immigrants face different behavior patterns in host areas; these contradictions exacerbate tensions among the population. Strain Theory argues that crime is derived from tensions generated by the pressures to succeed and structural barriers in the receiving areas. Therefore, tensions arise between immigrants and the local population since each group strives to improve living conditions (Thomas, 2011). These theories share a particular characteristic: population heterogeneity, which entails differences between migrants and local inhabitants and is one of the main determinants of crime.

Chiswick and Miller (2014) state that if crime can be observed and analyzed as an economic factor, it is clear how migration comes into play. One of the first determinants of internal migration studied is related to the difference in returns between rural and industrial activities. When

rural fertility exceeds urban fertility, agricultural labor will grow faster than industrial employment (Herrick, 1965). In principle, this was perceived as beneficial due to the scarce labor supply in large industrial centers. However, migration is increasingly acknowledged as the major contributing factor to the phenomenon of urban surplus labor and as a force that continues to exacerbate serious urban unemployment problems caused by growing economic and structural imbalances between urban and rural areas (Herrick, 1965).[1] As for crime and its economic effects, its increase is negatively related to the welfare of citizens –as evidenced by the reduction in security perception–, investment decisions, and the reduction of public investment in sectors that yield higher welfare benefits since resources are diverted to crime prevention investments.

In some specific cases, migration may be related to crime. When low-skilled migrants arrive in areas where job opportunities are scarce and their contact networks are typically reduced, their chances of finding employment are diminished. At the same time, the possibility of engaging in illegal activities is heightened. An important factor that increases participation in illegal activities is that these activities generate high income with little effort.[2] The government's effort to punish crime is a crucial factor in its reduction, as stated by Ehrlich (1973).

Despite the general belief that there is a link between migration and crime, empirical research exploring this relationship is sparse (Reid et al., 2005). Reid et al. (2005) examine the effects of migration on metropolitan crime rates. After controlling for a host of demographic and economic characteristics, they find that migration does not increase crime rates in the receiving areas and that some aspects of migration may even reduce crime in metropolitan areas. A similar approach was employed by Bianchi et al. (2012), who found that migration leads to an increase in the incidence of robberies but does not impact other types of crime. A critical aspect

[1] In this perspective, for the Colombian case, Calderon Mejía and Ibáñez (2016), find that internal migration substantially reduces wages for unskilled urban workers who compete for jobs with forced migrants.

[2] Psychological and social factors are also important determinants of criminal behavior (see Hirschi and Stark 1969).

of these studies is that they examine international migration, which means the opportunity cost of committing a crime is higher for immigrants. In a similar vein, Kubrin et al. (2016) observed a decrease in violent crime rates in neighborhoods in southern California that experience a large influx of immigrants from Northern Africa. However, a higher proportion of violent crimes are committed in areas with higher rates of Central American immigrants.

Various studies analyze both the positive and negative effects of the relationship between migration and crime. Bell and Machin (2013) find that a higher influx of migrants leads to increased crime rates. They provide evidence of higher seven categories of crime rates in areas of Wales where asylum seekers are located. Nunziata (2015) demonstrates a low positive correlation for three specifications regarding the relationship between migration and crime in European countries. In the same line of argumentation, Spenkush (2014) discovers that in the U.S., a 10% increase in the migrant population leads to a 1.2% rise in property crime rate, with no effect on violent crime rates. According to Wadsworth (2010), there was a reduction in homicide and robbery rates in the U.S. between 1990 and 2000, partially due to increased immigration. These results are similar to those of Ousey and Kubrin (2009) for 159 large U.S. cities from 1980 to 2000.

Internal migration can be the result of governmental policies. In such a scenario, a shift in population will occur that will interfere with the community's capacity to inhibit crimes. It will increase population heterogeneity and promote socioeconomic disadvantages (Treyger, 2013).

An essential attribute of internal migration is that it is predominantly associated with a movement of individuals from rural to urban areas (Meng & Zhang, 2013). Consistent with research on the relationship between international migration and crime, the findings regarding the relationship between internal migration and crime are also ambiguous. For the Canadian case, Andresen (2013) affirms that there is a lack of evidence regarding the effect of local migration on crime rates. Meng and Zhang (2013) concur with these assertions regarding rural-to-urban domestic migrations in China. On the contrary, Treyger (2013) demonstrates an increase in crime rates caused

by the government's relocation of domestic migrants. According to Schultz (1971), interregional migration in Colombia occurred prior to the internal conflict due to market forces that attracted rural labor to the cities from regions with relatively low returns to labor and an oversupply of labor.

Crime rates fluctuate in response to economic and demographic factors, as explained by traditional approaches. However, criminal activities exhibit spatial and temporal concentrations. Hence, an approach that includes the spatial dynamics of the variables is necessary for analyzing patterns and causes of crime rates (Almeida et al., 2003). The main theoretical perspectives are related to the Routine Activities and Crime Hot Spots approaches. The Routine Activities approach posits that the place determines favorable or unfavorable conditions for criminal acts through two forms: first, physical features influence the social control capacities of crime suppressors; second, criminal actions are not randomly distributed in space since crime is influenced by routine activities and the characteristics of each place, which means criminal actions have a spatial concentration in areas conducive to crime. The Crime Hot Spots approach associates the conditions of the population and some land uses with the spatial concentration of crime. Furthermore, physical conditions may serve as indicators of the social control that the community can exercise in the area (Anselin et al., 2000).

Consequently, some studies include spatial effects to explain the relationship between migration and crime. Arnio and Baumer (2012) provide evidence of spatial heterogeneity effects in Chicago neighborhoods between 2007 and 2009, although the concentration of immigrants does not significantly affect crime. Graif and Sampson (2009) suggest the same effect of spatial patterns and migrants on homicide rates across Chicago neighborhoods between 1990-2000. Using a spatial panel data model for Wales and England's migration-crime relationship between 2001 and 2011, Jaitman and Machin (2013) identify evidence supporting this linkage. Additionally, Cracolici and Uberti (2009) suggest that including spatial effects for analyzing crime rates in Italian provinces and the concentration of foreigners in previous periods are essential determinants of criminal activities in this region.

Due to the decades-long clash between government forces and anti-government insurgent groups, internal forced displacement has been the leading cause of internal migration in Colombia. The intensification of the internal armed conflict and the intention of illegal armed groups to expand territory control and asset appropriation, in conjunction with the country's institutional weakness, have induced the mobility of the population to safer areas in other municipalities (Ibáñez, 2009). Significant research has been conducted on the effects of displacement on poverty, inequality, and the labor market. Ibáñez and Vélez (2008) find that welfare losses caused by forced displacement in Colombia represent 37% of the net present value of rural lifetime aggregate consumption. They claim that a violent environment modifies the net benefits of migration.[3] Additionally, displaced persons are forced to confront a decreased labor income, dire conditions in host areas, and a severe disruption of risk-sharing mechanisms. The effects of government programs are transitory and forced migrants are unable to recover the income and welfare levels they had before displacement (Ibáñez & Moya, 2010).

Using a structural model of crime and inequality, Bourguignon et al. (2017) show that income distribution in Colombia influences aggregate crime and find that a significant number of criminals live in households with an eighty percent below-mean income per capita. Furthermore, inflows of forced migrants increase the proportion of low-skilled and informal workers, causing a reduction in informal wages (Calderón-Mejía & Ibáñez, 2016). Consequently, the welfare loss of forcibly displaced persons can determine engagement in illegal actions within this population and generate labor market problems; informal wage reduction and unequal distribution of income influence the criminal propensity of the entire population.

While internal forced displacement and its associated impacts have been widely examined, a variety of repercussions of the massive displacement that occurred in the nation have also been observed. These consequences include the breakdown of social connections, fragmentation of families, elevated

[3] The criminal and reception of forcibly displaced persons rates are obtained by multiplying each crime variable by a factor of 100,000/total municipality population; the probability of apprehension for each kind of crime is determined by dividing the number of captures by the number of crimes committed in the same category.

unemployment rates, unfavorable socio-economic conditions in numerous destination cities, and depletion of economic, financial, physical, human, and social resources throughout the country (Ibáñez & Moya, 2006; Ibáñez & Velásquez, 2009; Ibáñez & Vélez, 2008). However, due to inconclusive evidence, comprehensive research on its repercussions on crime rates in receiving areas still needs to be conducted. Previous studies, such as Roche-Villarreal's (2012) investigation into the effect of displacement on property-related crimes in municipalities, have not established a clear relationship (Reid et al., 2005). The present study is motivated by the persistent Colombian conflict, which has spanned over half a century and led to a staggering 7,849,014 documented cases of displacement, as reported by the Unidad para las Víctimas.

II. Empirical Strategy

Four data sources were used in this research. The annual reports of the Colombian National Police (Policía Nacional de Colombia, n.d.) provide the crime categories for the municipalities. Unidad para las Víctimas (2018) generates statistical data on internal forced displacement. The National Department of Statistics (DANE, n.d.) is the source of demographic data. Data from the Municipal Panel of CEDE of the Centro de Estudios para el Desarrollo Económico (CEDE) at the Universidad de Los Andes (Acevedo & Bornacelly, 2014) were also used.

Table 1 presents information on the central variables included in the analysis and the number of occurrences for each crime category. This research examines five types of crime: homicides, kidnapping, personal injuries, automobile theft, and residential burglary. These crime categories were selected because they are the most frequently reported and registered. The primary explanatory variable is the number of receptions of forced displacement populations in each municipality. Additionally, this research considers significant crime predictors and population heterogeneity determinants as control variables.

[4] The criminal and reception of forcibly displaced persons rates are obtained by multiplying each crime variable by a factor of 100,000/total municipality population; the probability of apprehension for each kind of crime is determined by dividing the number of captures by

Table 1. *Description of variables included in the analysis*

Variable	**Description**	**Source**
Homicide rates	Logarithm of the number of homicides per 100,000 inhabitants in each municipality	Policía Nacional Colombia
Kidnapping rate	Logarithm of the number of kidnappings per 100,000 inhabitants in each municipality	Policía Nacional Colombia
Personal injuries rate	Logarithm of the number of personal injuries per 100,000 inhabitants in each municipality	Policía Nacional Colombia
Residential burglary rate	Logarithm of the number of residential burglaries per 100,000 inhabitants in each municipality	Policía Nacional Colombia
Automobile theft rate	Logarithm of the number of automobile thefts per 100,000 inhabitants in each municipality	Policía Nacional Colombia
Reception FDP rate[4]	Logarithm of the number of receptions of forcibly displaced persons per 100,000 inhabitants in each municipality	Unidad para las Víctimas
Percentage Male 19-34	Percentage of male population between 15-34 years for each municipality	DANE
Log Population	Logarithm of the total population for each municipality	Panel CEDE
Probability of apprehension	Number of arrests divided by the number of crimes in each crime category and municipality	Policía Nacional Colombia

Source: Own elaboration.

The control variables were selected based on previous empirical studies on crime and data availability for Colombian municipalities. Other research considers population density an essential determinant of criminal acts because a larger population in an area provides more opportunities for offending and

the number of crimes committed in the same category.

less social control over criminals (Reid et al., 2005). Furthermore, males are more prone to commit criminal acts (Cheng et al., 2017). The empirical strategy incorporates the proportion of males among the total population to control for these effects. Additionally, the econometric model includes the apprehension rate for each crime since a higher probability of arrest reduces individual incentives to commit a crime (Ehrlich, 1973). Table 2 presents the descriptive statistics for the variables included in the analysis.

Table 2. *Descriptive statistics*[5]

Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Homicide rate	15 344	36.087	60.366	0	1 607.467
Kidnapping rate	15 344	20.480	8.874	0	255.427
Personal injuries rate	15 344	98.948	132.339	0	4 723.072
Residential burglary rate	15 344	23.035	44.962	0	1 087.326
Automobile theft	15 344	5.406	17.694	0	886.143
Reception of forcibly displaced persons rate	15 344	704.94	1 849.586	0	70 958.08
Total population	15 344	41 197.11	251 271.3	837	798 000,1
Percentage of males 15-34	15 344	32.496	2.946	20.743	68.436
Prob. of capture for homicide	15 344	43.016	92.910	0	2900
Prob. of capture for kidnapping	15 344	353.630	2452.473	0	118200
Prob. of capture for personal injuries	15 344	7.971	51 916	0	2300
Prob. of capture for residential burglary	15 344	18.898	82.436	0	3 100
Prob. of capture for Automobile theft	15 344	9.572	50.002	0	1 200

Source: Own elaboration.

Becker (1968) and Ehrlich (1973) provide the foundations for the base model in this paper. It assumes the number of criminal actions is monotonically related to the probability of arrest (p), the marginal cost of punishment (f), the marginal earning of illegal (w_c) and legal (w_l) activities,

[5] The descriptive statistics in Table 2 correspond to the information of the variables by levels.

the probability of unemployment (u) and a set of variables (π) that may affect the frequency of crimes.

$$q_i = \psi(p, f, w_c, w_l, u, \pi). \tag{1}$$

This approach assumes that all individuals are identical, a quality that permits the aggregation of individual functions. Therefore, the number of crimes in society is defined as an aggregate behavioral function,

$$Q = \Psi(P, F, Y_c, Y_l, U, \Pi), \tag{2}$$

where the variables denote the mean of the components of the individual behavioral function. Ehrlich (1973) proposes some behavioral implications for this model: An increase in the probability of arrest and in the marginal cost of punishment reduce the incentives to engage in illegal activities. Similarly, an increase in the probability of being unemployed and in the earnings obtained through illegal activities generate a rise in incentives for committing a crime.

Consequently, following the approaches of Becker (1968) and Ehrlich (1973), this paper presents the supply offenses function, where each kind of crime depends on the reception of forcibly displaced persons and the determinants of heterogeneity.

$$\left(\frac{Q}{N}\right)_i = A\, FDP_i X_i W e^{(\mu_i + \tau_t + \varepsilon_{it})}. \tag{3}$$

In equation (3), the component $\left(\frac{Q}{N}\right)_i$ represents the number of specific crimes in area i, where N is a population scale factor, A is a constant, FDP_i is the number of forcibly displaced persons received in region i, X_i is a portmanteau of heterogeneity variables of population in i and the probability of apprehension for the same type of crime in the area, W are the spatial effects, and u_i summarizes the effects of the physic, income and other nonquantifiable variables in the same area. From the linearization of equation (3), the econometric specification for the panel model is:

$$logC_{it} = \alpha + \beta'_i logFDP_{it} + \beta_i X_{it} + W + \mu_i + \tau_t + \varepsilon_{it}, \tag{4}$$

where i denotes municipalities and t denotes time. C_{it} is the crime rate per 100.000 inhabitants in region i and year t, FDP_{it} is the forcibly displaced persons reception rate per 100.000 inhabitants, X_{it} is a portmanteau of heterogeneity variables and the probability of apprehension for the same type of crime in the area, μ_i are municipality fixed effects, τ_t are time fixed effects, and ε_{it} is the error term.

This extension of the Becker-Ehrlich model allows the inclusion of socioeconomic, geographic, and demographic variables (Cracolici & Uberti, 2009); it is commonly used to analyze the relationship between all types of migration and crime. This model allows us to consider the reception of forcibly displaced persons and the spatial allocation of the variables. The Spatial General Nested (SGN) model is deemed the most appropriate for our research as it enables the incorporation of spatial determinants of crime allocation, forcibly displaced persons, and population heterogeneity variables. Additionally, it includes the spatial error term containing the omitted spatial variables that are correlated with crime. Equations (5) and (6) present the SGN model as applied in our work:

$$logC_{it} = \alpha + \delta W logC_{it} + \beta'_i logFD_{it} + \beta_i X_{it} + WZ_{it}\theta + u_{i,t} \quad (5)$$

$$u_{it} = \lambda W u_{it} \ + \mu_i + \tau_t + \varepsilon_{it}, \quad (6)$$

where i denotes municipalities, j represents the contiguous municipalities, and t denotes time. C_{it} is the crime rate per 100.000 inhabitants in region i and year t, FDP_{it} is the forcibly displaced persons reception rate per 100.000 inhabitants, X_{it} is the logarithm of population, the percentage of males between 19-34 years of age and the probability of apprehension, Z_{jt} denotes the explanatory variables in the neighbor municipalities, μ_i are municipality fixed effects, τ_t are time fixed effects, ε_{it} is the error term, and u_{jt} is the spatial error term.

Before estimating the dynamics of spatial patterns, the Explanatory Spatial Data Analysis (ESDA) is applied as a descriptive step for identifying the presence of spatial effects in the analysis area (Ye & Wu, 2011). In Colombia, criminal gangs, drug cartels, and illegal armed groups that operate across geographical areas are essential determinants of crime. The change in dynamics of these criminal associations in conjunction with governmental

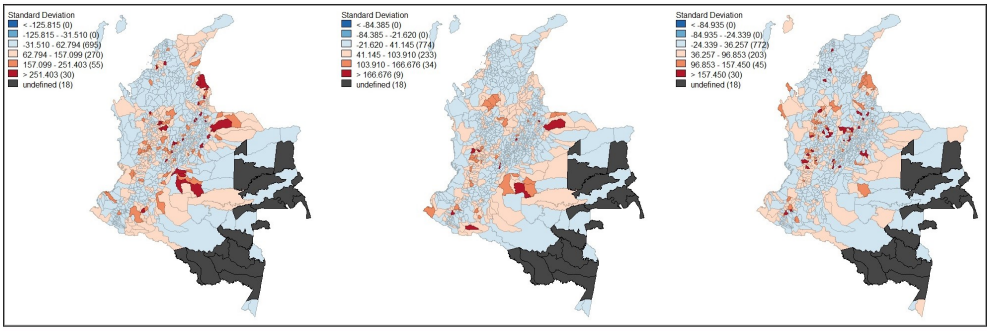
actions lead to a temporal and spatial fluctuation in crime rates. Therefore, our study provides an ESDA of the five categories of crime rates; however, due to space limitations, we only present the analysis for the first, seventh, and thirteenth years of the period analyzed (2003, 2009, and 2016). This procedure consists of sampling the selected period to detect any changes in the spatial dynamics of the variables and to verify the inclusion of these effects in the empirical model.

The figures depict the spatial dynamics of the five crime categories. The homicide rate is illustrated in Figure 1, the kidnapping rate in Figure 2, the personal injuries rate in Figure 3, the automobile theft rate in Figure 4, and the residential burglary rate in Figure 5. Additionally, Figure 6 depicts the spatial dynamics of internal forced displacement rates. Specifically, municipalities with high homicide rates are concentrated in the following departments:[6] Andean region, Cesar and Guajira (Caribbean region); Valle del Cauca and Choco (Pacific region); Arauca, Meta and Casanare (Orinoquia region); Putumayo and Caqueta (Amazonas region). The spatial dynamics changed for the 6th and 13th years since the number of municipalities with homicide rates above the mean decreased, particularly in the Pacific region. Kidnapping rates exhibit a similar spatial distribution but a smaller number of municipalities above the mean as compared to homicide rates. As in the case of homicides, kidnapping rates experienced a significant reduction in the years 2009 and 2016. For this category, the municipalities of Arauca, Casanare, and Norte de Santander (North-East), and Nari no, Putumayo, and Cauca (South-West) exhibit high rates.

Personal injury rates showed a similar distribution in 2003, with the highest rates occurring in municipalities located in the eastern, central, and western parts of Colombia. In 2009, an upward trend in the number of municipalities with high rates was observed, especially in the eastern and northern areas. In 2016, municipalities with rates above the mean were concentrated in the Andean, northeastern, and southwestern regions. Residential burglary rates reveal a similar geographic distribution for the three years of analysis; this rate increases with each passing year and presents

[6] Departments are political units equivalent to states or provinces.

Figure 1. *Standard deviation map of homicide rate*

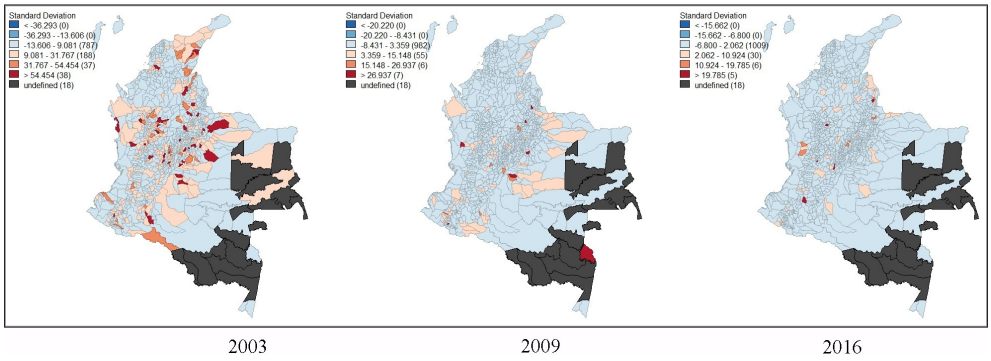


Source: Own elaboration with data from Policia Nacional de Colombia, Panel CEDE and Unidad para las Víctimas.

an increase number of municipalities with higher rates in 2016, particularly in the Orinoquia and Andean regions. The municipalities with the highest Automobile theft rates exhibit a constant spatial distribution and are located in central, northeastern, and southwestern areas. Reception rates of forcibly displaced persons in 2003 were concentrated in bordering areas of the Colombian territory, especially in Choco, Antioquia, Putumayo, Valle del Cauca, Guajira, Cesar, and Magdalena. The number of municipalities with a rate of forcibly displaced persons below the mean increased in 2009, and this trend was even more pronounced in 2016. Municipalities situated along the Pacific Coast have exhibited higher rates over the past year.

Spatial panel models offer technical advantages over traditional approaches, such as less collinearity, increased degrees of freedom, and the ability to incorporate numerous effects. The procedure for proper model identification consists of identifying the adequate model without spatial effects and choosing from the Pooled, Fixed Effects Panel, and Random Effects Panel models. The second phase involves estimating the general model of the spatial Durbin model (SDM) and testing whether it is more appropriate than the spatial lag model (SAR), spatial error model (SEM), spatial lag of X (SLX), spatial Durbin error model (SDEM), general nesting spatial model (GNS), or spatial autocorrelation model (SAC) (Torres-Preciado et al., 2017).

Figure 2. *Standard deviation map of kidnapping rate*



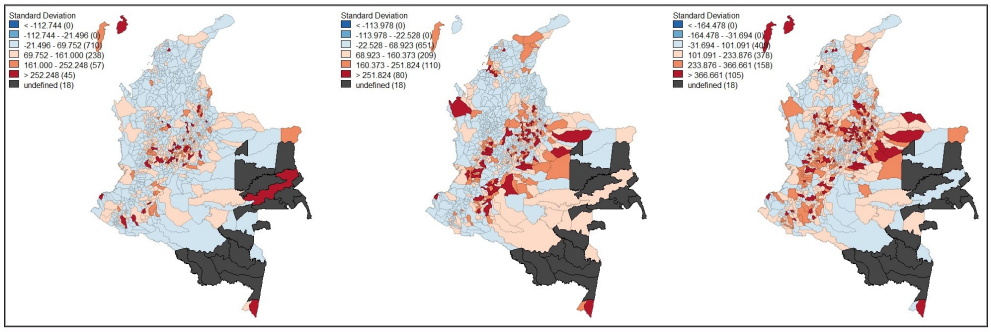
Source: Own elaboration with data from Policia Nacional de Colombia, Panel CEDE and Unidad para las Víctimas.

Table 3. *Moran test for spatial dependence*

variable	Test	2003	2009	2016
Homicide Rates	χ^2	99.44	64.08	30.58
	Prob. $> \chi^2$	0.000	0.000	0.000
Kidnapping Rate	χ^2	21.87	11.36	2.4
	Prob. $> \chi^2$	0.000	0.000	0.121
Personal Injuries Rate	χ^2	61.95	97.11	80.07
	Prob. $> \chi^2$	0.000	0.000	0.000
Residential Burglary Rate	χ^2	221.32	194.79	62.24
	Prob. $> \chi^2$	0.000	0.000	0.000
Automobile Theft Rate	χ^2	132.39	139.14	226.14
	Prob. $> \chi^2$	0.000	0.000	0.000

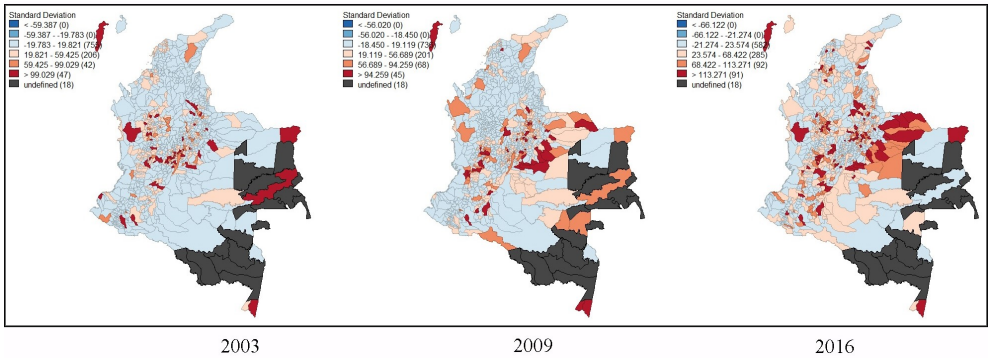
Source: Own elaboration

Figure 3. *Standard deviation map of personal injuries rate*



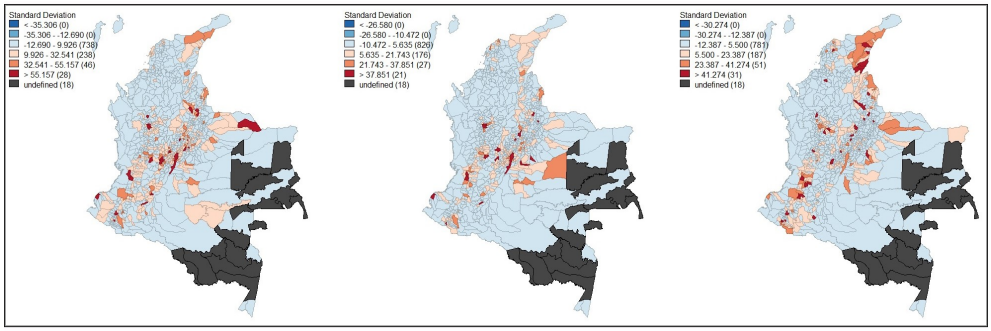
Source: Own elaboration with data from Policia Nacional de Colombia, Panel CEDE and Unidad para las Víctimas.

Figure 4. *Standard deviation map of residential burglary rate*



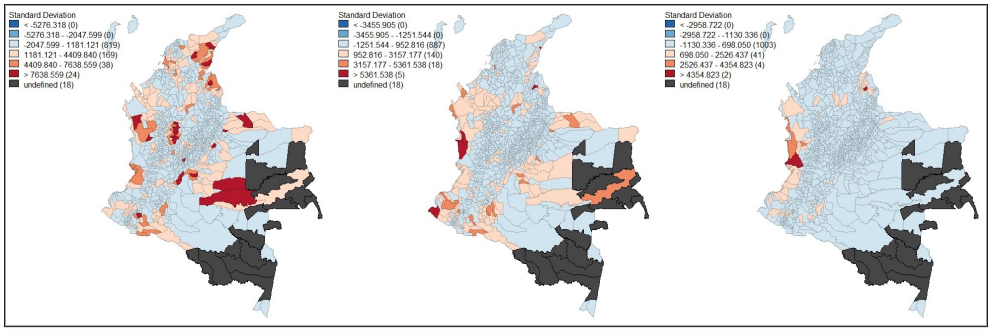
Source: Own elaboration with data from Policia Nacional de Colombia, Panel CEDE and Unidad para las Víctimas.

Figure 5. *Standard deviation map of automobile theft rat*



Source: Own elaboration with data from Policia Nacional de Colombia, Panel CEDE and Unidad para las Víctimas.

Figure 6. *Standard deviation map of reception of FDP rate*



Source: Own elaboration with data from Policia Nacional de Colombia, Panel CEDE and Unidad para las Víctimas.

III. Estimations Results

In line with the procedure suggested by Elhorst (2014), this paper initially estimates pooled, fixed effect, and random effect panel models for each type of crime category. Table 4 provides information for the fixed effects panel regression. The estimations use a two-period lag of the probability of apprehension due to the problem of endogeneity and counter-intuitive results

derived from using this variable without lag, consistent with the findings of Roche-Villareal (2012), which indicate a positive relationship between crime and the probability of apprehension. Tables A1 and A2 of the Appendix present the estimation results for our panel using this variable without lag and with one period lag to show the robustness of using the instrument of the probability of apprehension with a two-period lag in our analysis.

Traditional econometric theory posits that fixed effects is the most appropriate estimation method because it accounts for the heterogeneity of each municipality. Furthermore, considering the similarity between the N of the sample and the total number of municipalities, fixed effects is ostensibly the correct estimation method. Regardless, in the fixed effect model, as seen in Table 4, the negative sign for certain crimes in the percentage of males aged 19-34 years is disputed by the theory that a more significant proportion of males with a predisposition to commit crimes is found this age group. Additionally, the lagged probability of apprehension shows a negative relationship with crime, suggesting a time delay between police efficiency and its effect on crime levels.

Table 4. *Fixed effect estimations*

Variable	Homicide rate model	Kidnapping rate model	Personal injuries rate model	Residential Burglary model	Automobile theft rate
Reception FDP rate	0.020*	0.010	-0.055***	-0.013	-0.008
Population	0.966	-3.437***	-0.328	1.695*	1.875**
Percentage Male 19-34	-0.233***	-0.401***	0.456***	0.2088***	0.030
Probability of apprehension (-2)	-0.001**	-0.00003**	-0.0009**	-0.001	-0.0016**
Constant	-1.218	38.309***	-8.684	-24.815***	-24.432***
Observations	13152	13152	13152	13152	13152

Significance: $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$
Source: Own elaboration.

In view of the above, this paper goes further and corrects estimation problems by employing spatial models since migration has a significant spatial component, as suggested by Cracolici and Uberti (2009). Consequently, under this methodological approach, the spatial model selection criteria consist of comparing AIC statistics. Our results of the Spatial General Nested Model (SGN) model yield the lowest values, confirming the empirical relevance of using this spatial model (see Tables A3-A8 of the Appendix for SAR, SEM, SLX, SAC, SDM, and SDEM estimations). The estimation result is displayed in Table 5. Additionally, Table 6 presents the decomposition of the direct, indirect, and total effects of the SGN for the models.

The coefficients in section 1 of Table 5 correspond to the effect of the variables on the same type of crime within the same municipality; consequently, section 2 of Table 5 presents the spatial effects of the variables in the nearest municipalities. The significance of most of the coefficients associated with the spatial effects of the variables confirms the relevance of spatial effects in the analysis of crime and displacement. Furthermore, economic theory posits that this spatial coefficient presents the correct sign: a percentage of males between 19 and 34 causes an increase in crime, and a probability of apprehension is a deterrent to crime (Ehrlich, 1973). According to Anselin et al. (2000), criminals may commit illegal actions in transit areas near their residences; this supports the significance in most spatial coefficients but less so in local coefficients.

Additionally, the spatial effects of forcibly displaced persons yield a positive sign for homicide rates and a negative sign for personal injuries and residential burglary. These findings explain that forcibly displaced persons, in some cases, increase social control for certain crimes while simultaneously increasing the occurrence of others (Bucheli et al.,2019). Similar effects of immigrants' concentration on crime rates were observed in Los Angeles neighborhoods (Macdonald et al., 2013) and neighborhoods in England (Bell & Machin, 2013).

Consequently, the results of spatial effects on the reception of forcibly displaced persons suggest that only personal injury cases have direct and significant effects; that is, a 1% increase in the number of forcibly displaced

Table 5. *SGN model estimations*

Variable	Homicide rate model	Kidnapping rate model	Personal injuries rate model	Residential burglary rate model	Automobile theft rate model
Reception FDP rate	0.009	-0.009	-0.013	.02403*	-0.005
Population	-1.501	0.379	-3.497***	-2.620**	-1.507
Percentage Male 19-34	-0.213***	0.076	-0.065	-0.159**	-0.030
Probability of apprehension (-2)	-0.001***	-0.00003**	0.000	0.000	-0.0014*
Reception FDP rate	0.059***	0.020	-0.040**	-0.0601***	-0.003
Dependent variable	4.724***	-3.097***	3.531***	3.487**	4.600***
Spatial error term	0.038	-.411***	0.266***	0.236***	0.007
Population	0.002***	0.000	-0.001	-0.001	0.000
Percentage Male 19-34	.319***	.475***	.688***	0.718***	0.494***
Probability of apprehension (-2)	-0.253***	-0.425***	-0.583***	-0.648***	-0.392***
Constant	3.928***	3.168***	3.228***	4.287***	3.755***
Statistics					
AIC	67576.001	62919.690	64402.695	71542.683	67013.236
Observations	13152	13152	13152	13152	13152

Significance: $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$
Source: Own elaboration.

persons causes a nearly 2% decline in personal injury cases in the same municipality of reception. Furthermore, the indirect effect of the reception of forcibly displaced persons implies the existence of significant spatial spillovers. It suggests that a 1% increase in neighboring municipalities has a positive

impact of approximately 8.7% on homicide rates and a negative impact of nearly 14.8% on residential burglary and 14.2% on personal injuries.

Conclusions

This paper presents arguments for the relationship between forced displacement and crime rates in the receiving area. Economic theory suggests that individuals with adverse socioeconomic conditions are prone to committing crimes. Indeed, all types of forced migration alter the conditions of municipalities and affect crime rates due to the lack of opportunities and resources in every location. As individuals accustomed to a particular lifestyle arrive in the reception areas, they start to understand that they can no longer support themselves. The prospect of a new location may scare forced migrants, who have also lost their possessions and need fast incomes. Sadly, the easiest way to attain these is through illegal methods; therefore, displacement increases crime.

The findings suggest the presence of a correlation among three of the crime types examined. The estimation results for homicide, personal injuries, and residential burglary rates indicate a significant relationship with the allocation of forcibly displaced persons in densely populated areas. In the case of homicide rates, a positive relationship between the reception of forcibly displaced persons in nearby areas and an increase in local homicides can be observed. These patterns suggest the mobility of criminals to nearby places to commit these types of crimes. The effect of the reception of forcibly displaced persons on the rate of personal injuries presents a contrary sign in the results; this indicates an increase in social control in adjacent areas due to the reception of displaced persons, thereby reducing the incidence of personal injuries among the population in local areas. As for residential burglary, an increase in forced migrants in nearby places contributes to reducing this type of crime. Conversely, automobile theft and kidnapping rates are unrelated to the reception of forcibly displaced persons in main and adjacent areas. Furthermore, the results exhibit problems of endogeneity when the contemporary probability of apprehension is used. Using this variable with a

lag of two periods is the optimal solution since the results are consistent with the economic theory of crime.

Moreover, the evidence found in this study is consistent with previous studies conducted for developing countries such as South Africa and Brazil. In the case of South Africa, evidence supports a positive and significant effect of internal migration on serious crimes, including homicides (Kollamparambil, 2019). These effects are similar to those observed in Brazil, where a 10% increase in internal migrants generated a 9.4% increase in the homicide rate in a Brazilian microregions during the period from 2005 to 2010 (Egger, 2022).

Our estimations indicate that each crime category has distinct determinants and dynamics; this confirms the differences in the spatial distribution of crime and the reception of forcibly displaced persons across the Colombian territory. Due to these differences, the consolidation of a composite crime index is unsuitable. Consequently, the spatial allocation of the population heterogeneity variables is relevant for explaining crime levels; this demonstrates that previous estimates present bias error since they do not consider the spatial patterns of the variables.

In light of these expected results, the government's effort should be directed to generate opportunities for this vulnerable population who are victims of both internal conflict in their regions of origin and the limited job opportunities in the regions where they settle. It is then necessary to encourage these families to train their members according to the demands of the productive sector and to promote labor-intensive and ideally qualified activities, which will generate higher economic returns for these households. Therefore, social and economic programs to alleviate the adverse conditions of the vulnerable population must be implemented through plans that impact the local population of the municipalities and neighboring areas.

Appendix

Table A1. *Fixed effect without lag of probability of apprehension*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.046***	0.027***	-0.054***	-0.013	0.00004
Population	2.335***	-3.979***	-0.051	2.645***	0.415
Percentage Male 19-34	-0.300***	-0.610***	0.328***	0.1434***	-0.081**
Probability of apprehension	0.009***	0.0003***	0.001***	0.006***	0.0129***
Constant	-12.520**	50.437***	-7.260	-31.934***	-6.831
Observations	15344	15344	15344	15344	15344

Significance: * $p < .1$; **$p < .05$; *** $p < .01$
Source: Own elaboration.

Table A2. *Fixed effect with lag of probability of apprehension*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.029***	0.014	-.054***	-0.014	-0.003
Population	1.721***	-3.713***	-0.167	1.967**	1.134*
Percentage Male 19-34	-0.269***	-0.520***	0.387***	0.156***	-0.019
Probability of apprehension (-1)	-0.001***	0.000	-0.001***	-0.002***	-0.0012*
Constant	-7.238	44.947864***	-8.021	-25.746***	-15.727***
Observations	15344	15344	15344	15344	15344

Significance: * $p < .1$; **$p < .05$; *** $p < .01$
Source: Own elaboration.

Table A3. *SAR Models estimation*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.018*	0.006	-.041***	-0.002	-0.007
Population	0.763	-2.862***	-0.807	0.874	1.381*
Percentage Male 19-34	-0.215***	-0.330***	0.303***	0.128***	0.025
Probability of apprehension (-2)	-0.0011**	-0.00003**	-0.0006*	-0.0008	-0.001**
Spatial					
Dependent variable	0.102***	0.158***	.337***	.332***	.191***
Constant	3.987***	3.298***	3.495***	4.705***	3.889***
Statistics					
AIC	67600.092	63051.669	64655.179	71813.779	67051.579
Observations	13152	13152	13152	13152	13152

Significance: *$p < .1$; **$p < .05$; ***$p < .01$
Source: Own elaboration.

Table A4. *SLX Models estimation*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.014	-0.003	-0.033***	0.004	-0.004
Population	-1.061	-0.168	-3.244***	-1.573	-0.601
Percentage Male 19-34	-0.223***	-0.002	0.019	-0.115	-0.021
Probability of apprehension (-2)	-0.001***	-0.00003**	-0.00006	-0.0007	-0.001**
Spatial					
Reception FDP rate	0.074***	0.027	-0.114***	-0.109***	-0.008
Population	5.363***	-4.969***	3.611***	5.398***	5.871***
Percentage Male 19-34	-0.030	-0.613***	0.595***	0.385***	-0.007
Probability of apprehension (-2)	0.002**	-0.00001	-0.002***	-0.002	-0.001
Constant	3.993***	3.304***	3.605***	4.873***	3.927***
Statistics					
AIC	67620.626	63051.607	65152.215	72421.595	67219.647
Observations	13152	13152	13152	13152	13152

Significance: *$p < .1$; **$p < .05$; *** $p < .01$
Source: Own elaboration.

Table A5. *SEM Models estimation*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.017	0.006	-0.036***	0.003	-0.007
Population	0.582	-2.983***	-1.105	0.628	1.182
Percentage Male 19-34	-0.227***	-0.341***	0.304***	0.108*	0.0323
Probability of apprehension (-2)	-0.001***	-.00003**	-0.0005	-0.0007	-0.001**
Spatial					
Spatial error term	0.102***	0.148***	0.336***	0.332***	0.190***
Constant	3.987***	3.301***	3.501***	4.706***	3.889***
Statistics					
AIC	67600.47	63072.694	64691.959	71819.989	67053.566
Observations	13152	13152	13152	13152	13152

Significance: *$p < .1$; **$p < .05$; ***$p < .01$
Source: Own elaboration.

Table A6. *SAC Models estimation*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.019*	0.003	-0.031***	-0.002	-0.006
Population	1.004	-2.017***	-0.728	0.140	1.238**
Percentage Male 19-34	-0.179***	-0.234***	0.177***	0.074**	0.009
Probability of apprehension (-2)	-0.0009**	-0.00003**	-0.0005*	-0.0007	-0.001**
Spatial					
Dependent variable	0.325***	0.518***	0.703***	0.722***	0.497***
Spatial error term	-0.257***	-0.476***	-0.602***	-0.650***	-0.395***
Constant	3.930***	3.150***	3.219***	4.288***	3.755***
Statistics					
AIC	67596.491	62971.356	64440.093	71562.201	67019.308
Observations	13152	13152	13152	13152	13152

Significance: $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$
Source: Own elaboration.

Table A7. *SDM Models estimation*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.013	-0.004	-0.027***	0.010	-0.005
Population	-1.191	-0.137	-3.278***	-1.332	-0.716
Percentage Male 19-34	-0.222***	0.006	0.00004	-0.119*	-0.018
Probability of apprehension (-2)	-0.001***	-.00003**	-0.00001	-0.0006	-0.001**
Spatial					
Reception FDP rate	0.066***	0.022	-0.071***	-0.077***	-0.006
Dependent variable	5.060***	-4.225***	3.638***	3.446**	5.014***
Population	-0.005	-0.535***	0.415***	0.316***	-0.004
Percentage Male 19-34	0.002**	-0.000009	-0.001**	-0.001	-0.0005
Probability of apprehension (-2)	0.097***	0.136***	0.321***	0.326***	0.188***
Constant	3.983***	3.286***	3.486***	4.700***	3.887***
Statistics					
AIC	67580.286	62961.433	64577.127	71787.311	67019.308
Observations	13152	13152	13152	13152	13152

Significance: *$p < .1$; **$p < .05$; ***$p < .01$
Source: Own elaboration.

Table A8. *SDEM Models estimation*

Variable	Homicide rate	Kidnapping rate	Personal injuries rate	Residential burglary	Automobile theft rate
Reception FDP rate	0.015	-0.003	-0.033***	0.004	-0.005
Population	-1.065	-0.329	-2.945***	-0.799	-0.362
Percentage Male 19-34	-0.225***	-0.020	0.057	-0.075	-0.014
Probability of apprehension (-2)	-.001***	-.00003**	-0.0001	-0.0007	-0.001**
Spatial					
Reception FDP rate	0.068***	0.022	-0.081***	-0.076**	-0.009
Spatial error term	0.096***	0.132***	0.319***	0.326***	0.187***
Population	5.168***	-4.683***	3.570***	3.002	5.091***
Percentage Male 19-34	-0.025	-0.577***	0.528***	0.380***	-0.003
Probability of apprehension (-2)	0.002**	-0.00001	-0.002**	-0.001	-0.0007
Constant	3.983***	3.287***	3.489***	4.702***	3.887***
Statistics					
AIC	67581.701	62968.34	64594.445	71795.462	67047.534
Observations	13152	13152	13152	13152	13152

Significance: $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$
Source: Own elaboration.

Ethics Statement

This research article did not work with a person or groups of persons for the generation of data used in the methodology, therefore it did not require the endorsement of an Ethics Committee for its realization.

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