

## Article

# Spatial Externalities of Income Inequality on Security in Latin America

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**Abstract:** The aim of this research is to analyse the effect of income inequality on the homicide rate. The study is carried out in 18 Latin American countries for the period 2005–2018. The methodology used is the Generalized Least Squares (GLS) model and the data were obtained from World Development Indicators, the World Health Organization and the Inter-American Development Bank. Thus, the dependent variable is the homicide rate and the independent variable is income inequality. In addition, some control variables are included, such as: poverty, urban population rate, unemployment, schooling rate, spending on security and GDP per capita, which improve the consistency of the model. The results obtained through GLS model determine that inequality has a negative and significant effect on the homicide rate for high-income countries (HIC) and lower-middle-income countries (LMIC), whereas it is positive and significant for upper-middle-income countries (UMIC). On the other hand, the control variables show different results by group of countries. In the case of unemployment, it is not significant in any group of countries. Negative spatial dependence was found regarding spatial models such as: the spatial lag (SAR) and spatial error (SEM) method. In the spatial Durbin model (SDM), positive spatial dependence between the variables was corroborated. However, spatial auto-regressive moving average (SARMA) identified no spatial dependence. Under these results it is proposed: to improve productivity, education and improve the efficiency of security-oriented resources.

**Keywords:** inequality; homicides; Latin America; spatial models



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## 1. Introduction

The United Nations Office on Drugs and Crime (UNODC) defines homicide as the intentional death that one person causes on another and considers that homicides are the clearest reflection of the existing violence in a specific sector, country or region. According to the UNODC [1], in 2017, around 464,000 people were homicide victims in the world; 80% of the victims were men, and 20% were women, of which the vast majority were victims of their partner, ex-partner or male relatives. In addition, it points out that 95% of murderers are male.

Currently, in Latin America, the region with the highest number of homicides in the world, according to the UNODC [1], in 2017 the average homicide rate was 21.5% per 100,000 inhabitants. About 90.5% of homicide victims are men and 9.5% are women, and 50% of victims are between 15 and 30 years old, that is, the victims come from the group with the highest labour productivity. In order to achieve well-being, the costs of crime represent 3.5% of GDP. Therefore, security is Latin Americans' main concern.

With regard to inequality, it has increased worldwide in recent years. In 2016, 33% of global income was in the hands of 1% of the wealthiest countries and 50% only had

10% of the wealth [2]. According to the Economic Commission for Latin America and the Caribbean [3], Latin America is the most unequal region in the world, the Gini index dropped from 0.54 in 2002 to 0.47 in 2017; between 2002–2008 the average decrease in annual inequality was 1.3%; and between 2008–2014 the average was 0.8%, while between 2014–2017 the average reduction was 0.3%.

This research aims to determine the effect of income inequality on the homicide rate with a study carried out in 18 Latin American countries for the period 2005–2018. Two econometric stages are used to examine this relationship. The first through a Generalized Least Squares GLS model, which captures the determinants of homicides within each country. The second econometric stage captures spatial spillovers to explain the homicides of each country, using the spatial autoregression model (SAR), the spatial error model (SEM), the spatial auto-regressive moving average (SARMA) and spatial Durbin error (SDM). It seeks to respond to the hypothesis raised in which it is considered that an increase in income inequality leads to an increase in the homicide rate.

The results show that inequality tends to decrease in the period of analysis, while the homicide rate has increasing and decreasing periods. There is also a non-significant positive correlation between inequality and the homicide rate, which means that homicides apart from inequality depend on other variables. The GLS method confirms the aforementioned, in which inequality has a significant negative effect on the homicide rate for high-income countries (HIC) and lower-middle-income countries (LMIC), whereas the effect is positive and significant for upper-middle income (UMIC). According to the control variables, the relationship varies depending on the group of countries. Through spatial models such as: the SAR model, it was also determined that countries with low homicide rates are surrounded by countries with high homicide rates. With the SEM model, it was found that the homicide rate of a country depends negatively on the error of neighbouring countries, that is, the homicide rate is explained by variables external to the model. Furthermore, the SDM model shows that a country's homicide rate depends on the inequality in neighbouring countries. The contribution of the article is novel and contributes significantly to the state of the art on this problem in the region. The novelty of the study is that it takes into account the spatial effects that revolve around homicides, that is, it examines how homicides in a country are related to variables in neighboring countries.

The document consists of five sections. After the introduction, the second section presents the review of the previous literature. In the third section, the methodology is collected, the data is described and the econometric models used in the development of the research are discussed. The fourth section presents the discussion of the results found according to theory and empirical evidence. Finally, the last section discusses the conclusions and practical implications of the research.

## 2. Literature Review

There are some theories focused on the study of homicide, which include from an economic point of view the one developed by Becker [4]), who considers that criminals are individuals who reason and who adopt criminal behaviour for the expected benefit, which according to his perspective is greater than performing other legal activities. This theory is confirmed by Bourguignon [5], by arguing that violent crime arises from individual disadvantaged situations such as income inequality and poverty.

The empirical evidence linking income inequality and homicides is classified into three groups. In the first group, Coccia [6], Buonanno & Vargas [7] observe a significant positive relationship between inequality and homicides. Other studies, in addition to observing a positive relationship between these variables, also find it between unemployment and homicides [8]. In this regard, homicides are inversely related to GDP [9], but they are not significantly related to the educational level, urbanization, poverty and police activity [10].

There are relevant data worldwide that show that in 2012, one in every six homicide victims were children and adolescents from zero to 19 years old. In another study, in Lithuania in the period 2004–2016 it was found that 4.2% of homicide victims were children

and 73% men [11]. Similarly, in Latin America, homicide affects mainly boys rather than girls [12]. Furthermore, in this region, in 2015 the number of homicides was four times higher than the world average [13]. On the other hand, Nadanovsky and Cunha [14] determine that countries with lower income inequality have less poverty.

Similarly, in the United States, the 0.23% Gini coefficient predicts a 26% increase in crime [15]. On the other hand, Botello [16], in a study for Colombia, determines that an increase of one percentage point in the Gini coefficient results in a 4% increase in the homicide rate per 100,000 inhabitants. However, in Mexico, a one-point increase in the Gini coefficient leads to an increase of more than 36% in the number of homicides [17]. It is men aged between 20 and 49 who are the most likely to be homicide victims, with a rate of 40% per 100,000 inhabitants [18]. Meanwhile, in El Salvador it is men aged between 15 and 29 [19]. In addition, in 2016 it was identified that the homicide rate in El Salvador increased to 296 for the group of people aged 15–29 and to 205 for those aged 30–44 per 100,000 people [1]. In addition to this, Gregory [20] determines that men are nearly always the perpetrators of interpersonal violence.

In the second group we find Li, Wang and Zhang [21], who argue that inequality and homicides do not have a positive or negative relationship, but there are other variables that do influence homicides significantly. As for Bailey [22], he attributes poverty and cultural issues of violence to being predictors of high homicide rates, but not to disadvantaged situations. In addition, Briceño-León [23] states that institutionality has the greatest impact. And Menezes, Silveira Monteiro, Ratton [24] find that the positive effect of inequality on homicides is mitigated by spatial dependence, therefore, inequality cannot be attributed to being a determinant in the homicide rate. Other studies such as that of Brazil in the period 1980 and 2010 find that the increase to one million homicides is not only due to inequality, but also to issues such as: an increase of young men in the population, greater availability of firearms and an increase in drug use [25]. Racial heterogeneity [26] and a drop in social capital [27] also have a strong impact.

In the third group of studies, Crespo [28], Días [29], Chintrakarn and Herzer [30] determine that inequality and homicides are inversely related and are statistically significant. Therefore, it is identified that homicides occur due to factors other than inequality. Thus, Minkov & Beaver [31] argue that murder rates in the United States are predicted by parental absenteeism and adolescent fertility. They are also due to a high possession of firearms [32]. This country has had 6.9 times higher homicide rates compared to other high-income countries [33].

Among homicide victims, black people are more likely to be victims compared to white people and at a younger age [34]. This is confirmed by Temlett and Byard [35] in a study in Australia, where the indigenous homicide rate varied from 73.5% to 223.97% per 100,000 inhabitants, whereas the non-indigenous homicide rate varied from 8.16% to 12.6% per 100,000 inhabitants in the period 1969–2008. In addition, Valdivia and Castro [36] maintain that violence against women follows specific dynamics that are different from the dynamics of violence against men. In the US state of Colorado, 12.9% of 2279 homicides were caused by intimate partner violence of which most of the victims were women [37].

Unemployment also forces people to become criminals, but not inequality [38]. Tsushima (1996) states that poverty has a positive relationship with homicides and Vega [39] identifies that the decreases in homicides in Colombia in the period 2008 and 2011 are due to the peace agreement between the Colombian government and the FARC. On the other hand, in Mexico and Colombia, homicides increased after implementing anti-drug policies and their subsequent decrease [40,41]. Finally, it is concluded that corruption and homicides over time have adverse effects on the development of the economy, since productivity, investment, capital, economic growth and development decrease [42]. This is supported by Quiroz, Castillo, Ocenguera and Verela [43] by identifying a negative non-linear relationship between economic growth and insecurity measures such as: homicide, kidnapping and theft.

### 3. Data and Methodology

#### 3.1. Statistical Sources

This research used data that were extracted from the *World Development Indicators* (WDI) database of the World Bank [44], the World Health Organization (WHO) [45] and the Inter-American Development Bank (IADB) [46] in the period 2005–2018.

This research analyses the effect of income inequality on homicides. The dependent variable is the “homicide” rate per 100,000 inhabitants, obtained from the World Bank. In the case of Peru and Argentina for the year 2005–2010, the total number of homicides was obtained from the World Health Organization database. It was then divided by the total population of each year and country and multiplied by 100,000. Extrapolation was also applied in 2017 and 2018 for some countries that do not have data. Furthermore, the estimated models are carried out for all Latin American countries (global) and according to their income level. In other words, Latin American countries are classified according to their income level using the High-income Method of the World Bank [47], in high-income countries (HIC), upper-middle-income countries (UMIC) and countries lower middle income (LMIC).

The independent variable is “inequality” and the Gini index is used to measure it and a logarithm was applied. This index measures the income inequality found among a country’s citizens and takes the values of 0 and 1, where 0 represents maximum equality and 1 the highest inequality. At higher levels, control variables were incorporated: GDP per capita, urbanization rate, poverty, to which a logarithm was applied. Unemployment, spending on security, schooling and poverty were also included; variables supported by empirical evidence (Table 1). For GDP per capita and schooling, it is found that homicide rates decrease when growth improves, as well as the level of income and the average level of education [10]; urbanization is justified by finding a non-significant positive relationship with homicides [48]. On the other hand, McCall and Brauer [49] find that spending on social security reduces the number of homicides, in the case of unemployment, several authors find that it is the cause of crime [8,38] and poverty, Bailey [22], Tsushima [50] consider it the cause of homicides.

**Table 1.** Description of variables.

Type of Variable	Variable Name	Symbol	Unit of Measurement	Description	Source
Dependent	Log (Homicides)	Hm	Variable expressed as a rate per 100,000 inhabitants	It is the death of a person caused by another human being.	World Health Organization (WHO) [45]
Independent	Log (Inequality)	Gini	Variable expressed as an index, ranging from 0 to 100	This indicator measures the inequality present in a country, where 0 is total equality and 1 is total inequality, 1 can also be multiplied by 100.	World Bank [44]
Control	Log (GDP per capita)	GDPp	Constants prices 2010	The GDP per capita has the function of measuring the level of wealth or well-being of a population of a particular country at a particular time. It is the result of dividing the income by the total population.	World Bank [44]
Control	Log (Urbanization rate)	UP	Percentage of total population	The urban population is the group of people who live in large cities, which are areas where more than 2000 inhabitants live.	World Bank [44]

Table 1. Cont.

Type of Variable	Variable Name	Symbol	Unit of Measurement	Description	Source
Control	Unemployment rate	Une	Percentage of the working population	Unemployment is the situation in which a person, who has the age and ability to work but does not do so, since there is a labour market imbalance because the demand for work is greater than the supply.	World Bank [44]
Control	Security spending (% GDP)	SSg	Percentage of GDP	They are the resources that are allocated to fighting crime and maintaining order.	World Bank [44]
Control	Schooling index	Sch.	Schooling index	It is the proportion of members that are part of the population which is studied.	IADB [46]
Control	Log (Poverty % of population)	Pov.	Percentage of poor people	It is the lack of resources necessary for the support and development of people.	IADB [46]

In Figure 1, the correlation between homicides (percentage of homicides per 100,000 inhabitants) and income inequality (Gini index) is observed. The relationship shown in Figure 1 uses the variables homicides and income inequality before being transformed to logarithms, respectively.

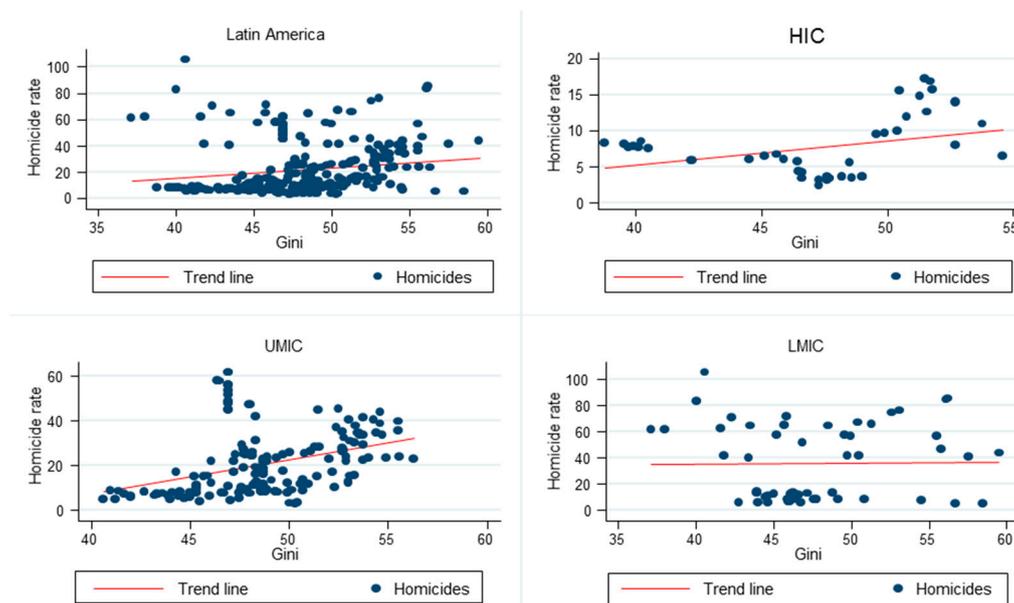


Figure 1. Relationship between homicide rate and income inequality. Source: Own elaboration with data from the World Bank [44] and WHO [45].

Figure 1 shows the correlation between income inequality and the homicide rate at global level and for the different groups of Latin American countries classified by their income level. In Latin American countries in general, there is a non-significant positive correlation between inequality and the homicide rate, that is, as inequality increases, the homicide rate also increases, but to a lesser extent. In the case of HIC, the relationship is positive and not very significant, so it is assumed that there are other more significant variables that influence the homicide rate. The correlation between inequality and the homicide rate is positive and significant for UMIC, that is, an increase in inequality generates an

increase in the homicide rate. However, in LMIC, there is no correlation between income inequality and the homicide rate. Therefore, homicides in these countries are produced by other variables.

Table 2 contains the descriptive statistics of the variables used to estimate the econometric models of the study that are described in Section 3.2. Table 2 collects the descriptive statistics of the variables used in the model, where the sample size is 18 countries (for the other two Latin American countries, there are no data to perform the analysis).

**Table 2.** Descriptive statistics of the variables.

Variable	Mean	Standard Deviation	Minimum	Maximum	Observations
Log (Homicide rate)	2.73	0.86	0.92	4.66	252
Log (Inequality)	3.87	0.09	3.61	4.09	252
Log (GDP per capita)	8.64	0.70	6.94	9.76	252
Log (Urbanization rate)	4.27	0.19	3.85	4.56	252
Unemployment rate	5.82	2.50	2.01	12.83	252
Security spending (% GDP)	1.22	0.88	0	3.86	252
Schooling index	0.64	0.09	0.39	0.82	252
Log (Poverty % of population)	3.38	0.55	1.55	4.20	252

### 3.2. Empirical Strategy

To examine the relationship between homicides and inequality, two econometric stages are used. The first is to use a GLS model to examine the relationship without considering the spatial spill that could exist between the territorial units (countries). In other words, the determinants of homicides within each country are examined. Then, the I Moran test is applied [51] with which the presence of spatial autocorrelation between the analysis variables is confirmed, a necessary condition to perform the spatial econometric analysis [52–55]. Consequently, homicides in one country are explained by variables from neighboring countries. Then, the SAR, SEM, SARMA and SDM models allow to capture the spatial dependence of the examined relationship.

In this sense, in the first econometric stage, from the different panel data methods, the generalized least squares (GLS) model was used, which allows to determine the relationship between inequality and the homicide rate. In addition, the Hausman test [56] was used to establish the effectiveness of applying a fixed-effects or random-effects model by group of countries. Taking into account that *chi2* is less than 0.05, a fixed effects model will be estimated. An assumption that must be used in the fixed effects model is that the time-invariant characteristics are unique to the individual and must not be correlated with other individuals; therefore, the entity’s error term and the constant must not be correlated with the others. To determine the relationship between the model variables, the following equation is proposed:

$$Hm_{it} = (\beta_0 + \alpha_0) + \lambda_1 Gini_{1it} + \varepsilon_{it} \tag{1}$$

In Equation (1),  $Hm_{it}$  is the dependent variable and represents the homicide rate of country  $i = 1, 2, 3, \dots, 18$  in period  $t = 2005, 2006, 2007, \dots, 2018$ , while  $B_0$  represents time,  $\alpha_0$  represents space,  $\lambda_1$  is the path of the independent variable (inequality) over time,  $Gini_{1it}$  is the inequality of country  $i$  in period  $t$  (independent variable) and  $\varepsilon_{it}$  is the error term. By including the control variables in the model we have the following equation:

$$Hm_{it} = (\beta_0 + \alpha_0) + \beta_1 Gini_{1it} + \beta_2 URB_{2it} + \beta_3 Une_{3it} + \beta_4 LGDP_{4it} + \beta_5 Edc_{5it} + \beta_6 SSS_{6it} + \beta_7 Pov_{7it} + e_{it} \tag{2}$$

In Equation (2),  $Hm_{it}$  represents the homicide percentage;  $Gini_{1it}$  represents income inequality. The control variables of the model are  $URB_{3it}$ , which represents the urban population rate;  $Une_{4it}$  represents the unemployment rate,  $LGDP_{5it}$  represents the GDP per capita,  $Edc_{6it}$  represents the education of each country,  $SSs_{7it}$  is security spending,  $Pov_{8it}$  is the poverty of each country and finally,  $e_{it}$  is the error term which is considered to follow a mean equal to zero and a constant variance.

Next in the second econometric stage, spatial autocorrelation was determined by Moran's I and the spatial models were applied that allow to determine the spatial dependence of the variables, which include: the SAR model that allows to verify how a country's homicide rate is affected by the homicide rate of neighbouring countries in Latin America, as expressed in the following formula:

$$Hm_{it} = \rho WHm_{it} + X_{it}\beta + \varepsilon_{it} \quad (3)$$

$X_{it}$ , represents a vector that contains all the explanatory variables indicated in Section 3.1. Through the SEM model, which is a technique that combines multiple regression and factorial analysis, the interrelation of spatial dependence was evaluated and the effects of the measurement error on structural coefficients were incorporated at the same time, as stated in the following equation:

$$Hm_{it} = X_{it}\beta + \lambda Wu_{it} + \varepsilon_{it} \quad (4)$$

The SARMA model is the combination of the SAR and SEM models. This model incorporates the spatial lag ( $\rho$ ) and the error term parameter ( $\lambda$ ). By using this model, the existence of other variables with spatial dependence is determined and which are not identified in the model. The approach of this model is as follows:

$$Hm_{it} = \rho WHm_{it} + X_{it}\beta + \lambda Wu_{it} + \varepsilon_{it} \quad (5)$$

The Durbin model includes lags for the independent variables ( $WX$ ) and for the inclusion of a spatially lagged endogenous variable ( $WHm$ ). It can be seen how a country's homicide rate is affected by the inequality present in other countries by using the DURBIN model. The model is presented as follows:

$$Hm_{it} = \rho WHm_{it} + X_{it}\beta + \lambda WX_{it}\beta + \varepsilon_{it} \quad (6)$$

Finally, the Lagrange multiplier (LM) and robust Lagrange multiplier tests are applied by means of LM spatial lag and LM spatial error, to determine if the effect of spatial lag or spatial error is significant and to identify the suitability of spatial models to explain the study relationship [57]. If one of the LM tests is significant and the other is not, the spatial effect model should be adopted [58]. In contrast, if the result of the two tests is not significant or jointly significant, the SDM model should be chosen [59,60].

#### 4. Discussion of Results

Table 3 shows the results obtained from the estimated regression between income inequality and the homicide rate per 100,000 inhabitants. It is observed that income inequality has a negative and statistically significant relationship with the homicide rate in Latin American countries at a global level, as well as in groups of countries classified by their income level HIC and LMIC. These results are related to those obtained by Crespo [28], who also found a negative relationship between inequality and the homicide rate in a study for Venezuela. However, the UMIC results are related to Becker's theory, which is confirmed by Bourguignon [5], who states that crime occurs due to the expected benefits. In addition, it is related to a study carried out in Brazil in the period 1980 and 2010, where an increase of one million homicides is related to an increase in inequality, but also finds other factors such as: an increase of young men in the population, greater access to firearms, greater drug use [25].

In Table 4, fixed effects by country were applied for each regression, while fixed effects by year were applied to some regressions in order to obtain an improved model fit. According to the results of the GLS model at global level, which includes control variables, in this regression, it is observed that at global level, inequality and the homicide rate have a significant negative relationship at 5% in the model. According to the results of the GLS model at the global level, including control variables, in this regression, it is observed that

at the global level, inequality and the homicide rate have a significant negative relationship at 5% in the model.

**Table 3.** Baseline regression of the GLS model, between inequality and the homicide rate.

	GLOBAL	HIC	UMIC	LMIC
Log (Gini)	−0.568 * (−2.40)	−1.757 *** (−5.69)	1.084 * (2.37)	−2.085 *** (−3.87)
Constant	4.156 *** (4.56)	8052 *** (6.75)	−1.403 (−0.78)	10.34 *** (4.81)
Fixed effects country	SI	SI	SI	SI
Fixed effects year	SI	SI	SI	SI
Observations	252	42	154	56

Note: The t-statistic in parentheses. \*  $p < 0.05$ , and \*\*\*  $p < 0.001$ .

**Table 4.** Baseline regression of the GLS model with control variables for Latin American countries globally (Global).

	M1 <sup>1</sup>	M2	M3	M4	M5	M6	M7
Log (Gini)	−0.568 * (−2.40)	−0.642 ** (−2.77)	−0.625 ** (−2.63)	−0.676 ** (−2.77)	−0.673 ** (−2.76)	−0.653 ** (−2.62)	−0.616 * (−2.46)
Log (Urbanization rate)		−2.879 *** (−3.67)	−3.024 *** (−3.50)	−3.292 *** (−3.74)	−3.373 *** (−3.78)	−1.837 (−1.65)	−1.673 (−1.51)
Log (GDP per capita)			0.022 (0.43)	0.061 (1.07)	0.068 (1.15)	−0.136 (−1.40)	−0.169 (−1.72)
Unemployment				0.014 (1.55)	0.013 (1.51)	0.016 (1.45)	0.017 (1.56)
Security spending					0.021 (0.43)	−0.066 (−1.10)	−0.063 (−1.05)
Schooling index						−0.197 (−0.25)	−0.286 (−0.37)
Log (Poverty)							−0.070 (−1.81)
Constant	4.156 *** (4.56)	17.32 *** (4.45)	17.71 *** (4.41)	18.64 *** (4.59)	18.91 *** (4.63)	13.92 ** (2.65)	13.62 ** (2.61)
Fixed effects country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	252	252	252	252	252	252	252

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ . <sup>1</sup> The heading of each column, M1, M2, . . . , M7, represent the estimated models as the control variables are included. This detail is maintained until the results of the Durbin model with the exception of the results of Moran’s I.

According to the results of the GLS global model including control variables, in this regression is observed that global inequality and homicide rate have a significant negative relation to 5% in the model. When the control variables such as: urban population, GDP per capita, unemployment, spending on security and the schooling rate are increased, the relationship between inequality and homicides is the same, but the level of significance changes to 1%. By increasing the control variables such as: urban population, GDP per capita, unemployment, spending on security and the schooling rate, the relationship between inequality and homicides remains, but the level of significance changes to 1%. In the increasing control variables such as: urban population, GDP per capita, unemployment, security spending and the rate of schooling, the relationship between inequality and homicide remains, but the level of meaningfulness changed to 1%. However, when the poverty variable is increased, the level of significance returns to 5%.

The urban population variable also has a statistically significant negative relationship at 0.01%, that is, as the urban population increases, the homicide rate decreases. The urban population variable also has a statistically significant negative relationship at 0.01%, that is, as the urban population increases, the homicide rate decreases. The variable urban population also statistically significant negative ratio 0.01%, ie to the increase of urban

population decreases homicides. This relationship and significance is maintained by adding the variables: GDP per capita, unemployment and spending on security. This relationship and significance is maintained by adding the variables: GDP per capita, unemployment and spending on security.

This relationship and significance is maintained at adding variables: GDP per capita, unemployment and security spending. However, when the schooling and poverty rate are included, the urban population variable maintains the negative relationship, but loses its significance in the model. However, with the inclusion of the schooling and poverty index, the urban population variable maintains the negative relationship, but loses its significance in the model. These results are contrasted with those found in the United States, where urbanization has a non-significant positive relationship with homicides [48]. In addition, Briceño-León [23] finds that institutionality is the greatest predictor of homicides.

The variables GDP per capita, spending on security, unemployment, schooling and poverty rate are not significant in the model. These results are similar to the theory of Cornish and Clarke [61], who argue that criminal behaviour is not always due to the economic perspective, but is rather due to a decision process. In addition, Bailey [22] considers poverty and cultural issues of violence as predictors of high homicide rates, but not disadvantaged situations.

In Table 5, to have an improved fit, fixed effects by countries are applied to the regression of the base model and fixed effects by years to the regression of the base model and to the model that includes the urban population variable. Regarding the results of the GLS model for the group of high-income countries, inequality and the homicide rate have a significant negative relationship of 0.1%. This relationship and significance remain the same when the control variables are included. It is possible that although there are high inequality rates in these countries, lower class people do not feel they are in a poverty situation, therefore, crimes are not related to inequality. Regarding spending on security, it shows the expected relationship and is correlated with a study carried out in the United States, which determines that a decrease in crime is justified by police presence [62].

**Table 5.** Baseline regression of the GLS model with a control variable for HIC.

	M1	M2	M3	M4	M5	M6	M7
Log (Gini)	−1.757 *** (−5.69)	−4.558 *** (−4.08)	−5.265 *** (−5.35)	−5.304 *** (−5.35)	−4.104 *** (−5.29)	−3.840 *** (−4.95)	−4.337 *** (−5.59)
Log (Urbanization rate)		−3.934 *** (5.66)	−3.956 *** (−6.43)	−3.592 *** (−3.82)	−0.843 (−0.96)	−1.052 (−1.24)	−1.669 * (−1.99)
Log (GDP per capita)			−0.447 ** (−2.68)	−0.541 ** (−2.70)	−0.350 * (−2.07)	−0.155 (−0.79)	0.181 (0.76)
Unemployment				−0.0249 (−0.62)	0.0239 (0.72)	0.0348 (1.08)	0.0522 (1.69)
Security spending					−0.547 *** (−4.25)	−0.485 *** (−3.76)	−0.415 *** (−3.47)
Schooling index						−2.413 (−1.78)	0.599 (0.33)
Log (Poverty)							0.442 * (2.32)
Constant	8.052 *** (6.75)	3697 *** (5.26)	43.77 *** (6.21)	43.35 *** (5.84)	25.27 *** (3.56)	24.92 *** (3.64)	22.83 *** (3.43)
Fixed effects country	Yes						
Fixed effects year	Yes						
Observations	42	42	42	42	42	42	42

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

GDP per capita is negatively related to the homicide rate even when unemployment and security spending are added, the former being insignificant in the model, while the latter contributes to the reduction of the homicide rate. These results are related to those of Dávila & Pardo [63] that determine that inequality and economic growth are negatively

related to the homicide rate. However, they find a positive relationship for unemployment, not corroborated in this study in which it is observed that it has no effect. On the other hand, in their study, poverty had no effect, but in this study the results show that it does and the expected results are achieved, which are that the higher the poverty, the higher the homicide rate. In Japan it is found that poverty is positively related to homicide, but this is lost with the inclusion of unemployment, the level of industrialization and the percentage of young men [50].

In another study, poverty and inequality are positively related to the homicide rate [21]. An increase in the urban population leads to a reduction in the homicide rate, since the economic activity in these countries is based on the secondary and tertiary sector that takes place in large cities, so an increase in the population in cities is favourable to a certain extent.

In Table 6, for a better fit of the model, fixed effects by countries are applied to the regression in which all the variables are included and the one that does not include poverty. Fixed effects by years are also applied to the base model, which includes the urban population and all the explanatory variables, and which does not include poverty. According to the results of the GLS model for UMIC including control variables, it is observed that inequality and the homicide rate have a positive and significant relationship of 5% in the model. It becomes insignificant when unemployment, spending on security, the schooling and poverty rate are added. These results are associated with those found in the municipalities of Mexico, where an increase of one point in the Gini coefficient in the period 2007–2010 generates an increase of more than 36% in the number of homicides [17].

**Table 6.** Baseline regression of the GLS model with control variables for UMIC.

	M1	M2	M3	M4	M5	M6	M7
Log (Gini)	1.084 * (2.37)	1.123 * (2.45)	0.836 * (2.04)	0.588 (1.44)	0.650 (1.54)	−0.296 (−0.98)	−0.183 (−0.61)
Log (Urbanization rate)		−0.169 (−0.50)	−0.245 (−0.62)	−0.670 (−1.42)	−0.854 (−1.76)	−2.527 * (−2.02)	−2.567 * (−2.10)
Log (GDP per capita)			−0.037 (−0.38)	0.019 (0.18)	0.059 (0.57)	−0.210 * (−2.03)	−0.268 * (−2.57)
Unemployment				0.023 (1.46)	0.021 (1.31)	0.009 (0.70)	0.011 (0.87)
Security spending					0.132 * (2.28)	−0.113 (−1.70)	−0.116 (−1.71)
Schooling index						0.915 (1.05)	0.780 (0.91)
Log (Poverty)							−0.089 * (−2.38)
Constant	−1.403 (−0.78)	−0.838 (−0.36)	0.955 (0.43)	3.140 (1.28)	3.201 (1.27)	15.60 ** (2.67)	16.22 ** (2.84)
Fixed effects country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	154	154	154	154	154	154	154

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ .

Spending on security also increases the homicide rate. An efficient use of resources aimed at security or a high violence rate is probably not being made. Therefore, an increase in the number of police officers does not contribute to reducing homicides. These results are related to a study carried out in Mexico for the period 2006–2012, where spending on security increased as well as the number of homicides [64]. In UMIC, poverty did not obtain the expected sign, since poverty is not deplorable in these countries and does not have a direct impact on homicides, but if extreme poverty is considered, the impact can be reversed. The results are similar to a study on South America [65].

In theory, the urban population increases homicides and the GDP per capita reduces them. In this study, it is observed that the two variables reduce them when we add the

schooling rate. The explanation may be that, according to the theory, schooling reduces homicides, and if we add the poverty variable, the level of significance remains the same, because, as previously mentioned, poverty does not affect the increase in the homicide rate in these countries. The results of GDP per capita are contrasted with a study in which homicides and the economic cycle have a causal relationship in the long term, but security policies do not [38].

Table 7 shows the results of the GLS model for lower-middle-income countries, including control variables, and for a better fit of the model we apply fixed effects by country and by year to the group that includes all the variables and the one that does not include poverty. The results show that inequality and the homicide rate are negatively related and statistically significant at 0.1%. When including the urban population, the relationship remains the same, but its significance varies by 1%, since most people live in minimal conditions in these countries. Therefore, they do not have the feeling of disadvantage, so there are other factors causing homicides. These results are related to the study by Dias [66], where inequality has the opposite relationship with homicides and poverty has no significant relationship, a point in which it differs with the results of this study. However, when the schooling rate is included, the relationship becomes positive, since, in these countries, access to education is limited and since they do not all have the resources to get education, those who benefit the most are upper-class families. According to Botello [16], an increase of one percentage point in the Gini predicts 4% on the homicide rate and 7% on the poverty rate.

**Table 7.** Baseline regression of the GLS model with control variables for LMIC.

	M1	M2	M3	M4	M5	M6	M7
Log (Gini)	−2.085 *** (−3.87)	−1.435 ** (−2.64)	−1.179 (−1.81)	−0.916 (−1.61)	−1.123 (−1.71)	1.413 * (2.19)	1.330 * (2.11)
Log (Urbanization rate)		5.053 ** (3.11)	−1.347 (−0.66)	5.471 ** (3.20)	−1.943 (−0.83)	3.483 ** (3.07)	3.403 ** (3.03)
Log (GDP per capita)			−0.215 (−0.81)	0.651 (1.94)	−0.156 (−0.58)	2.602 *** (13.92)	2.697 *** (14.79)
Unemployment				0.0180 (0.71)	0.0506 (1.62)	−0.0103 (−0.32)	−0.001 (−0.05)
Security spending					0.162 (0.78)	0.503*** (4.23)	0.272 (1.73)
Schooling index						−18.19 *** (−13.21)	−16.62 *** (−11.08)
Log (Poverty)							0.475 * (2.04)
Constant	10.34 *** (4.81)	−13.24 (−1.66)	13.90 (1.57)	−21.84 * (−2.37)	15.32 (1.54)	−26.24 *** (−4.56)	−28.82 *** (−5.03)
Fixed effects country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56	56	56	56	56	56	56

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

In these countries, the schooling rate contributes to reducing the homicide rate, since people with higher academic training have a greater chance of obtaining a well-paid job. In addition, they acquire other methods of solving problems, thereby reducing homicides. This relationship is maintained even when poverty is included. This result is the opposite of that of a study for 51 nations that claims that cognitive achievement does not predict the homicide rate, nor do income inequality, GDP or poverty. The factors that predict homicides are: abandonment of children by their parents and teenage pregnancy [31].

However, the urban population has a positive effect on homicides if unemployment and schooling are considered. This occurs due to an increase in the population in cities, which leads to increased unemployment, the creation of slum areas, where people live in miserable conditions and makes them engage in criminal activities in order to satisfy

their needs. These results are related to the theory of Wilson, Kelling and Skogan [67], in which they state that a disorganised and weak urban structure gives rise to the presence of gangs and activities related to vandalism. In addition, GDP per capita also has a positive effect when poverty and the schooling rate are considered, as does spending on security if schooling is considered.

Unemployment is not significant in the model for any group of countries. A study for Sweden finds that unemployment increases the risk of dying by suicide and some type of disease and not from causes related to homicides [68]. In the period 1940–1980 in the United States, unemployment also showed no significance in the homicide rate [69].

Next, to determine spatially the homicide factors in Latin America, Moran's I was calculated and the spatial models were estimated later: SAR, SEM, SARMA and SDM for the inequality model and the homicide rate, including the control variables: urban population, GDP per capita, unemployment, spending on security, schooling and poverty rate.

An I value close to 1 indicates positive spatial autocorrelation and a value close to  $-1$  indicates negative autocorrelation, but if the value is close to zero there is no spatial autocorrelation, that is, the values of the variables are independent of the location. Therefore, A value close to 1 indicates I positive spatial autocorrelation and a value close to  $-1$  indicates a negative autocorrelation, but if the value is close to zero there is spatial autocorrelation values of the variables are independent of the location, so, the spatial models should not be applied. Table 8 below shows the results of Moran's I.

**Table 8.** Results of Moran's I.

Variable	Moran's I	E(I)	SE(I)	Z(I)	<i>p</i> -Value
Log Homicides	0.516	$-0.058$	0.166	3.465	0.001

Table 8 shows the results of Moran's I for the homicide rate, which is the dependent variable, and inequality is the independent variable. The homicide rate has an  $I = 0.516$  and a *p*-value of 0.001 by which the existence of spatial autocorrelation is verified.

Table 9 shows the results of the spatial autoregressive model (SAR). When performing the regression between inequality and the homicide rate, a negative and statistically significant Rho is obtained at 1%, that is, a country's homicide rate depends negatively on the homicide rate of neighbouring countries by 0.28%. Therefore, for a better estimation of the model, control variables are included, such as: the urban population and the Rho. Their relationship is maintained, but their level of significance changes to 0.1%. Next, by including the variables: GDP per capita, unemployment, spending on security, schooling and poverty rate, progressively, negative Rho and statistically significant at 1%.

Meanwhile, the SAR model identifies that countries with low homicide rates border countries that have high homicide rates. Therefore, an increase in homicides in countries with high crime rates influences an increase in homicides in those countries with low crime rates. This probably happens because in a country where homicides are committed, the people who commit them (homicides) flee to neighbouring countries to escape the justice of their country. And it is in these countries of refuge where these homicides commit other murders. Therefore, a country is affected by the level of violence present in neighbouring countries.

It should be noted that the coefficients in none of the regressions performed in this model are statistically significant, that is, the residuals can be considered to be independent and to disappear with the application of the SAR model. These results are similar to those found in the departments of Bolivia by Rubin de Celis, Sanjinés and Aliaga [70], where the lagged variable has a negative rho and in the majority with a significance of 5%. Therefore, the departments with the highest criminal activity rate systematically infect the adjacent departments.

**Table 9.** Results of the SAR spatial model, of the relationship between inequality and the homicide rate, including the control variables.

	M1	M2	M3	M4	M5	M6	M7
Log (Gini)	0.065 (0.08)	−0.479 (−0.46)	−0.305 (−0.29)	−0.383 (−0.35)	−0.327 (−0.28)	−0.431 (−0.42)	−0.365 (−0.35)
Log (Urbanization rate)		−1.552 (−0.92)	−1.742 (−1.02)	−1.994 (−1.10)	−2.168 (−1.19)	−1.606 (−0.83)	−1.475 (−0.73)
Log (GDP per capita)			0.057 (0.41)	0.083 (0.57)	0.106 (0.66)	0.228 (1.16)	0.205 (1.01)
Unemployment				0.015 (0.62)	0.014 (0.57)	0.021 (0.96)	0.023 (1.03)
Security spending					0.070 (0.66)	0.000 (−0.00)	−0.002 (−0.02)
Schooling index						−2.180 (−0.88)	−2.279 (−0.91)
Log (Poverty)							−0.058 (−0.39)
Spatial rho	−0.277 ** (−2.84)	−0.309 *** (−3.34)	−0.331 ** (−2.81)	−0.331 ** (−2.82)	−0.336 ** (−2.81)	−0.341 ** (−2.83)	−0.337 ** (−2.81)
Variance sigma	0.062 *** (5.35)	0.061 *** (5.03)	0.061 *** (4.94)	0.061 *** (4.79)	0.060 *** (4.91)	0.059 *** (5.02)	0.059 *** (4.92)
Observations	252	252	252	252	252	252	252

Note: The t-statistic in parentheses. \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Table 10 shows the results of the spatial error model (SEM) for the homicide rate and inequality model. When performing the regression, a negative and statistically significant lambda is obtained at 1%. This means that a country’s homicide rate is 0.28% negatively dependent on the variables omitted in neighbouring countries. Next, the control variables are progressively included in the model for a better estimate and the negative relationship is maintained and its level of significance remains at 1%. Only when the poverty variable is included in the model does its level of significance become 5%. Menezes, Silveira-Neto, Monteiro, & Ratton [24] also obtain a negative lambda regarding the homicide rate. In other words, homicide rates of spatial units are negatively associated with lagged spatial homicide rates (neighbours’ homicide rates). Furthermore, a significant effect on crime is mitigated by the spatial dependence of crime among its neighbours. One possible reason is that the urbanization process creates islands of security inhabited by high-income people. They also argue that there are other variables that are not proposed in this model, such as: drug use, access to firearms, imprisonment rate, which can influence the reduction or increase in the homicide rate.

Table 11 shows the results of the model (SARMA) that relates inequality to the homicide rate. This model has a negative and statistically significant Rho at 5%, which indicates that there is a negative spatial dependence of 0.14% between the variables. The lambda is also negative and statistically significant at 1%, so it shows a negative spatial dependence of 0.14% with other variables omitted in the model.

**Table 10.** Results of the SEM spatial model, of the relationship between inequality and the homicide rate, including the control variables.

	M1	M2	M3	M4	M5	M6	M7
Log (Gini)	0.0575 (0.08)	−0.526 (−0.54)	−0.073 (−0.07)	−0.115 (−0.11)	−0.051 (−0.05)	−0.255 (−0.26)	−0.237 (−0.24)
Log (Urbanization rate)		−1.575 (−0.98)	−1.991 (−1.31)	−2.200 (−1.36)	−2.500 (−1.54)	−1.920 (−1.15)	−1.869 (−0.99)
Log (GDP per capita)			0.125 (0.95)	0.150 (1.02)	0.186 (1.11)	0.289 (1.51)	0.280 (1.27)
Unemployment				0.013 (0.61)	0.013 (0.63)	0.021 (1.09)	0.022 (1.10)
Security spending					0.097 (0.93)	0.022 (0.20)	0.022 (0.20)
Schooling index						−1.967 (−0.86)	−1.988 (−0.86)
Log (Poverty)							−0.015 (−0.09)
Spatial lambda	−0.277 ** (−2.82)	−0.331 ** (−3.04)	−0.430 ** (−2.81)	−0.428 ** (−2.66)	−0.461 ** (−2.71)	−0.456 ** (−2.86)	−0.448 * (−2.49)
Variance sigma <sub>2_e</sub>	0.062 *** (5.34)	0.061 *** (4.92)	0.059 *** (4.79)	0.059 *** (4.73)	0.059 *** (4.88)	0.058 *** (4.86)	0.058 *** (4.91)
Observations	252	252	252	252	252	252	252

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

**Table 11.** Results of the SARMA spatial model, of the relationship between inequality and the homicide rate, including the control variables.

	M1	M2	M3	M4	M5	M6	M7
Log (Gini)	0.058 (0.08)	−0.526 (−0.52)	−0.067 (−0.06)	−0.105 (−0.10)	−0.045 (−0.04)	−0.263 (−0.27)	−0.242 (−0.24)
Log (Urbanization rate)		−1.586 (−0.98)	−1.986 (−1.33)	−2.194 (−1.38)	−2.492 (−1.56)	−1.928 (−1.13)	−1.862 (−0.97)
Log (GDP per capita)			0.126 (0.95)	0.151 (1.01)	0.186 (1.12)	0.291 (1.51)	0.280 (1.24)
Unemployment				0.013 (0.62)	0.013 (0.63)	0.021 (1.07)	0.022 (1.08)
Security spending					0.096 (0.94)	0.022 (0.20)	0.022 (0.19)
Schooling index						−2.006 (−0.87)	−2.043 (−0.87)
Log (Poverty)							−0.020 (−0.11)
Spatial rho	−0.143 * (−2.50)	−0.079 (−0.42)	0.018 (0.09)	0.024 (0.11)	0.022 (0.13)	−0.042 (−0.25)	−0.053 (−0.28)
lambda	−0.143 ** (−3.24)	−0.256 (−1.13)	−0.447 (−1.64)	−0.451 (−1.48)	−0.482 (−1.82)	−0.418 (−1.75)	−0.399 (−1.32)
Variance sigma	0.068 *** (5.75)	0.066 *** (5.22)	0.064 *** (4.99)	0.064 *** (4.93)	0.063 *** (5.10)	0.062 *** (5.10)	0.064 *** (5.19)
Observations	252	252	252	252	252	252	252

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

By including control variables in the model such as the urban population, a negative Rho is obtained, but it is not statistically significant, that is, there is no spatial dependence between the variables and there is no spatial dependence with other variables omitted in the model. The results are contrasted with those found by Urrego, Gómez Velásquez and Valderrama [71], where a negative spatial dependence of 0.05% is found between income

inequality and the homicide rate, but a positive spatial dependence of 0.07 is found with variables that are not specified in the model.

Table 12 shows the results of the Durbin model for the model that relates inequality to the homicide rate. The Rho of this model is positive and statistically significant at 1%. Therefore, a country’s homicide rate is 0.40% dependent on the inequality of neighbouring countries. In addition, when including the urban population variable, a positive and significant Rho is acquired at 0.1%. Therefore, a country’s homicide rate is 1.97% dependent on the inequality and the current urban population of neighbouring countries. Subsequently, the GDP per capita variable is added and a positive and statistically significant Rho is determined at 1%, which indicates that a country’s homicide rate is 0.42% dependent on the inequality, urban population and GDP per capita of neighbouring countries. These results are in line with those found by Urrego et al. [71]. According to the Durbin model, they determine that a change in income from work in community *j* directly affects the level of crime in community *i*, while in others models first the crime level of *j* is affected and later the crime level of community *i* is affected.

**Table 12.** Results of the SDM spatial model, of the relationship between inequality and the homicide rate, including the control variables.

	M1	M2	M3	M4	M5	M6	M7
L. Whomicides	−1.997 *** (−8.93)	−9.031 *** (−40.66)	−2.594 *** (−11.76)	−2.218 *** (−10.00)	−1.296 *** (−5.41)	−1.685 *** (−7.06)	−1.699 *** (−7.26)
Log (Gini)	1.417 ** (3.24)	3.068 *** (6.97)	1.049 * (2.33)	0.756 (1.64)	−0.061 (−0.13)	0.783 (1.70)	1.026 * (2.24)
Log (Urbanization rate)		−5.630 *** (−6.54)	−1.914 * (−2.24)	−2.009 * (−2.17)	2.830 ** (2.88)	3.845 *** (3.85)	4.779 *** (4.83)
Log (GDP per capita)			−0.052 (−0.43)	−0.029 (−0.23)	−0.060 (−0.48)	−0.264 * (−2.12)	−0.293 * (−2.21)
Unemployment				0.026 (1.78)	0.040 ** (2.76)	−0.016 (−1.09)	−0.006 (−0.43)
Security spending					−0.712 *** (−9.28)	−0.172 * (−2.21)	−0.215 ** (−2.81)
Schooling index						11.42 *** (8.69)	11.26 *** (8.76)
Log (Poverty)							−0.373 *** (−5.20)
Spatial rho	0.402 ** (2.65)	1.971 *** (13.02)	0.421 ** (2.78)	0.374 * (2.46)	0.280 (1.85)	0.353 * (2.34)	0.260 (1.73)
Variance sigma	0.043 *** (11.52)	0.035 *** (9.49)	0.041 *** (11.43)	0.045 *** (11.47)	0.040 *** (11.61)	0.038 *** (11.49)	0.036 *** (11.58)
Observations	234	234	234	234	234	234	234

Note: The t-statistic in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Subsequently, with the inclusion of the unemployment variable, a statistically significant positive Rho of 5% is obtained. The same result is obtained if we add the schooling rate variable. Taking these results into account, it is determined that a country’s homicide rate depends on: income inequality, urban population, GDP per capita, unemployment, spending on security and the schooling rate. Finally, the poverty variable is added to the model and a non-significant positive Rho is obtained, that is, there is no spatial dependence between the variables. Regarding a study using the SDM method, it was found that the homicide rates of neighbours produce a positive effect on the growth of homicide rates for both men and women. The GDP per capita also has a significant positive effect on the growth of homicide rates, which means that the level of economic development of neighbouring municipalities contributes positively to the equalization of homicide growth rates [36].

Therefore, if a country focuses on reducing the homicide rate, for which it requires reducing inequality and other variables that influence homicides, not only in a particular

country, but also in neighbouring countries, then both the country where the homicide reduction policies are proposed, as well as the neighbouring countries will benefit from this.

Subsequently, a LM post estimation test is performed to determine the suitability of the spatial model. The results in Table 13 indicate that the two effects are significant, so the SDM model is the most suitable [72].

**Table 13.** LM residual test.

LM	Global	HIC	UMIC	LMIC
LM spatial lag	18.9374 *** (0.0000)	23.9834 *** (0.0000)	25.7943 *** (0.0000)	26.0845 *** (0.0000)
Robust LM spatial lag	8.1723 ** (0.004)	6.1289 * (0.016)	8.8832 ** (0.004)	3.9234 * (0.045)
LM spatial error	57.3192 *** (0.0000)	53.8475 *** (0.0000)	55.2536 *** (0.0000)	45.9283 *** (0.0000)
Robust LM spatial error	36.2850 *** (0.0000)	28.4345 *** (0.0000)	34.67 *** (0.0000)	39.3832 *** (0.0000)

Note:  $p$ -value in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

## 5. Conclusions and Recommendations

Homicides occur due to different factors, which depend on the structure of each country. In this study, countries were grouped by income level and control variables were added to identify the one that best specifies the problem. Thus, it was identified that inequality has a negative relationship with homicides in HIC and LMIC. The variables that predict homicides in HIC are: poverty, spending on security and GDP per capita, while inequality and the urban population showed unexpected results. In LMIC, the factors that predict homicides are: urban population and schooling and poverty, the variables with unexpected results are income inequality, GDP per capita when schooling is considered, and spending on security when schooling is considered.

In contrast, in upper-middle-income countries, which are the majority of the region, inequality is positively related to the homicide rate. But there are also unexpected results for the variables: spending on security, poverty, and urban population. While GDP per capita predicts the homicide rate when schooling and poverty are added, on the other hand, the schooling rate and unemployment are not significant. This confirms that Latin America is the most unequal region in the world, thus creating a situation of disadvantage and discomfort in people.

Through the application of spatial methods: SAR, SEM, SARMA and SDM, an analysis is contributed that uses a methodology different from the traditional one and that allows to identify how space influences homicides. Thus, the SAR model determines that the homicide rate of a country depends negatively on the homicide rate of its neighbouring countries. By using the SEM, it is found that the homicide rate of countries depends on other variables which are omitted in the neighbouring cantons. In addition, through the SDM method it is determined that a country's homicide rate depends on the inequality of neighbouring countries. As the SARMA is negative and statistically insignificant, it shows that there is no dependence between the variables. In this way, it contributes with important findings for Latin America, since there are no previous studies in which an integrated study of the countries of this region is carried out.

According to the findings, it is necessary to implement policies that reduce the homicide rate in HIC. It is also necessary to improve the targeting of social programmes aimed at the most vulnerable. GDP per capita must be increased through integrated production systems, and spending on security must be maintained and, if necessary, it must be increased. In UMIC, to reduce the homicide rate, policies must be established that regulate wages, make public investment aimed at basic services for the lower strata must be made, the productive matrix that ensures sustainable growth must be improved, as well as the efficiency of resources allocated to security. Finally, in order to reduce homicides in LMIC, the increase in the urban population must be controlled through the provision of basic

services to the rural sector, in addition to assessing a fair price for rural products, higher than the production cost. Education should be improved through incentives for both teachers and students.

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