

# **VIOLENCE AND GROWTH IN LATIN AMERICA**

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## **VIOLENCE AND GROWTH IN LATIN AMERICA**

### **Summary:**

This paper analyses the repercussions of the high level of criminal violence in Latin America on the economy of the countries of the region. The theoretical reflections are accompanied by an empirical study using panel data made up of sixteen countries and covering the period 1979-2001. The use of different estimation techniques -which allow the consideration of the presence of time-invariant country-specific effects and the correction of the joint endogeneity of the variables- shows that violence has had a significant negative effect on investment and economic growth.

**Key words:** violence, crime, growth, Latin America

**JEL Classification:** O40, O54, K14

## 1. INTRODUCTION

During the last two decades of the twentieth century, the countries of Latin America and the Caribbean grew at an average annual rate of just 0.6 per cent<sup>1</sup>. This figure is far from the world-wide average of 1.3 per cent. The differences are even more remarkable when compared with the values from more dynamic regions like East Asia and the Pacific or South Asia, which were 6.3 and 3.3 per cent, respectively.

For several decades, Latin America has been considered a region with huge potential for development but, inexplicably, it has not taken off. To analyze the reasons for this situation is a complex task. The causes suggested for this delay are numerous and well known to the specialists. Firstly, the stocks of physical capital, human capital and technology are scarce because of the chronic deficit in investment in these productive factors. Secondly, there is an evident inequality in the distribution of income. Thirdly, there is a systematic dependence of the foreign sector on a series of commodities. Finally, there are important institutional problems among which corruption, political instability, the obsolescence of the tax systems, regulatory inefficiency and the strong presence of an informal economy can be highlighted.

The elements indicated are, unfortunately, characteristic of the countries of the region and are obligatory references in research that analyses Latin American economies. Nevertheless, it should be pointed out that the economic literature has paid less attention to another characteristic inherent to the region: the high level of criminal violence. For instance, Latin America has a homicide rate that is almost three times the world average.

Most existing research on the phenomenon of violence in the area adopts a criminological, sociological or political perspective. The papers that relate violence to the economy are insufficient and mainly focus on trying to explain how structural elements of an economic nature –like, for example, poverty, inequality or unemployment - contribute to raising crime levels. It is unusual to find papers that deal with the inverse perspective, that is, that analyze the implications that violence has on the economic activity and growth of the region. Furthermore, the existing research usually adopts a local approach.<sup>2</sup>

The present paper tries to contribute to alleviating this deficit of theoretical and, above all, empirical studies on the effects of criminal violence on the economy and growth of Latin America. The paper is made up of five sections, including this introduction. The following section contains a reflection on the concept of violence and justifies the choice of the homicide rate as the reference indicator. On the basis of this indicator, it is shown that Latin America is characterized by a situation of endemic violence that constitutes a differential feature with respect to other regions. In the third section, the repercussions of this violence on economic activity are analyzed, repercussions that eventually affect the growth of the countries of the region. In the fourth section, an empirical analysis of panel data for a sample of sixteen Latin American countries during the period 1979-2001 is presented. The results show that violence has a significant negative effect on investment and economic growth. The main conclusions are collected in the final section.

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<sup>1</sup> Source: World Bank.

<sup>2</sup> The paper of Londoño and Guerrero (1999) is an exception. Most of the papers focus on the case of Colombia, where, for sadly well-known circumstances, a notable line of research has been produced on the economic consequences of violence. We can cite, for example, the papers of Rubio (1995 and 1997), Parra (1998) and Bejarano (2003).

## **2. On the concept of violence and how to measure it. An analysis of Latin American reality.**

The concept of violence is heterogeneous and broad. For instance, the World Health Organization defines violence as “the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation”. Krug *et al.* (2002, p. 5).

This definition, which will be adopted in this paper, covers a broad range of outcomes. Furthermore, it takes in a wide spectrum of victims and perpetrators and, thus, of types of violent acts, although self-directed violence, war, state-sponsored violence and other collective violence are specifically excluded from the definition<sup>3</sup>.

So, it will be difficult to find precise indicators of violence, because these indicators will not be able to reflect all the elements and nuances contained in the concept. Those habitually used register crimes like homicide, robbery, kidnapping or rape. Of these, the most frequently used to make international comparisons is the homicide rate. The reason for this is that the definition of other crimes varies according to the legal systems involved and the definition of homicide is more homogenous, so there is a greater precision in the measurement of the latter. Furthermore, in some countries, victims may not always report certain minor crimes to the police, especially if they consider this body to be inefficient or corrupt. Thus, the data based on the measurement of these crimes may be underestimated<sup>4</sup>. Lastly, it should be mentioned that there is a high correlation between homicides and other violent crimes, so the

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<sup>3</sup> See Waters *et al.* (2004, p. 3).

<sup>4</sup> See Salama (2003, p. 182).

homicide rate allows us to reflect the general tendencies of other crimes that are more difficult to measure.<sup>5</sup> These are, in short, the reasons why this indicator is going to be used to analyze the situation of the Latin American countries.

The statistics leave no room for doubt: Latin America has the highest violent crime rates in the world. Of the 520,000 homicides committed world-wide in 2000, 140,000 were in this region. The homicide rate, 27.5 per one hundred thousand inhabitants, is triple the world average of that year, 8.8<sup>6</sup>.

Even taking into account the importance of gender violence in these countries, the death rates are much higher among the male population, 51 homicides per one hundred thousand inhabitants. Moreover, the phenomenon is especially prevalent among the young. The homicide rate among the male population of between 15 and 29 years old is 89.7 per one hundred thousand inhabitants.

In view of these figures, it is not surprising that homicide is the fifth leading cause of death in the region. Furthermore, interpersonal violence is the third cause of loss of *disability-adjusted life years (DALYs)*<sup>7</sup>. This concept includes not only the years lost through premature death, but also those in which the person has been affected by disability or illness.

**Insert Table 1 here. Homicide rates in Latin America, 1979-2001.**

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<sup>5</sup> See Fajnzylber *et al.* (2000, pp. 239-40). The authors find that homicides are highly correlated with robbery and victimization rates across countries.

<sup>6</sup> See Krug *et al.* (2002, Table A.3)

<sup>7</sup> *Ibid.* Table A.6

Table 1 presents the data on homicides in sixteen Latin-American countries for the years between 1979 and 2001. Both the countries and the period coincide with those that will be used in the empirical analysis in Section 5. The average homicide rate during these years was 27.8 per one hundred thousand inhabitants. Five countries in the sample show higher than average rates: Colombia -which, with 119.6 homicides heads this macabre ranking-, El Salvador, Guatemala, Brazil and Mexico. Furthermore, although Ecuador and Venezuela are below the average, they show indices of violence much higher than the world-wide average.

With respect to the evolution of the indicator during the period of analysis, the slope of the regression line estimated using OLS reveals that only four countries show a downward crime trend: Guatemala, which has the biggest decrease, Mexico, Paraguay and El Salvador<sup>8</sup>. Thus, most countries suffered a worsening of their situation, which was particularly significant in Colombia and Brazil and important in Peru, Ecuador, Venezuela and Panama.

To sum up, the data allow us to characterize the region as violent. Even so, although the situation is habitually described as one of generalized insecurity, the violence affects the countries of the region in diverse ways. For example, even though some of them have crime rates that are among the highest in the world, in others the homicide rate coincides with or is lower than the world-wide average. The same disparity can be observed in the evolution of the data during the period analyzed.

The situation of insecurity revealed by the statistics will have important consequences on the Latin American economies, as will be seen in the next section.

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<sup>8</sup> It is encouraging that this downward trend has occurred in three of the five countries with the highest indices of violence, even though crime rates rose greatly in the other two.

### **3. The effects of violence on economic activity**

High levels of violence, a characteristic of the continent, are a disturbing human drama and have far-reaching consequences in the social, institutional and political fields. Violence will also have very significant economic effects, although these have not been so deeply studied. For instance, according to calculations carried out by Londoño and Guerrero (1999, p. 22), violence in Latin America represents a net cost of around 12.1 per cent of the regional GDP, that is, 145,000 millions dollars per annum.

Violence can be considered to affect the normal growth of economic activity in four ways, summarized in Figure 1.

1. Firstly, it conditions the accumulation of productive factors, negatively affecting the accumulation of physical capital, human capital and social capital.
2. It also implies an increase in production costs because of expenditure on private security, insurance premiums, extortion payments and systems of passive protection.
3. Furthermore, it damages the social infrastructure, which could lead to a deterioration of juridical security and, consequently, to an increase in transaction costs.
4. Lastly, it affects the possibilities of conserving the earnings generated by the productive activity.

In the following pages, and on the basis of the above-mentioned effects, we are going to carry out a more detailed analysis of the relationship between violence and economic activity.

**Insert Figure 1 here. The effects of violence on economic activity.**

## **3.1 Violence and the accumulation of productive factors**

### **3.1.1 Physical capital**

One first effect of violence on the stock of physical capital is the destruction of physical infrastructure -such as roads, public facilities, and major installations- through acts of vandalism<sup>9</sup>. To these direct effects, we must add the fact that violence has a negative impact on stability and generates fear and uncertainty. Stability is a determining aspect in the process of capital investment, because it is strongly linked to the provision of legal and institutional security, elements that make it possible for investment, both domestic and foreign, to find a propitious climate.

The analysis of aggregate data corroborates the negative impact of violence on investment in the region. Londoño and Guerrero (1999, p. 23), using different data sources referring to a group of six countries, estimate that urban violence has lowered investment and productivity levels by as much as 1.8 per cent of the GDP. This negative effect varies greatly between countries, from 0.2 per cent for El Salvador, 0.6 for Peru, 1.3 for Mexico, 2.0 for Colombia, 2.2 for Brazil and up to 2.4 for Venezuela<sup>10</sup>.

In the case of Colombia, Parra (1998) presents additional evidence of the negative relation between crime and investment, in an analysis of the period 1950-1996. The author finds that, if the homicide rate were reduced by 75 per cent, to reach levels similar to the other countries of the region, non-residential private investment, as a percentage of the GDP, could be raised by nearly 50 per cent<sup>11</sup>. This effect would have positive consequences on the growth of the country. So, a reduction of 10 per cent in the

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<sup>9</sup> See Ayres (1998, p. 7).

<sup>10</sup> *Ibid.* p. 26

homicide rate would allow a 1.24 per cent increase in the annual rate of growth of the economy<sup>12</sup>. These estimates agree with the results of Rubio (1995, p.101), who found that the high increase in the number of homicides in Colombia in the 70s and 80s meant a 2 per cent annual decrease in the country's growth rate.

### **3.1.2 Human capital**

Violence leads to direct losses in human capital due, on the one hand, to premature death<sup>13</sup> and, on the other, to the time the victims lose in recovering physically and psychologically. Both concepts are included in the term *disability-adjusted life years (DALYs)* lost<sup>14</sup>.

Moreover, the fear generated by crime will eventually affect productivity when employees decide to work fewer hours or are not willing to work at dangerous times of the day or in dangerous neighborhoods<sup>15</sup>.

For the same reasons, violence discourages school attendance, especially in girls and evening class students<sup>16</sup>. Furthermore, children who suffer aggressions, or who are witnesses to them, are more likely to have disciplinary problems and to drop out<sup>17</sup>.

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<sup>11</sup> *Ibid.* p. 10

<sup>12</sup> *Ibid.* p. 18

<sup>13</sup> As well as the direct deaths, we should point out that, indirectly, violence can also lead to higher morbidity and mortality due to the increase in the number of suicides, higher alcohol and drug consumption and as an element propitiating the development of mental health disorders. See Moser and McIlwaine (2006, p. 91).

<sup>14</sup> Buvinic *et al.* (1999, p.17) offer figures from diverse sources on *DALYs* lost in the region. For instance, in 1995 in El Salvador, 178,000 *DALYs* were lost through violent deaths; in Peru the figure was 60,792; in Río de Janeiro 63,136; in Mexico City 57,673; and in Caracas –where disabilities were not included in the calculation- 56,032. Trujillo and Badel (1998, p. 23) calculate that the value of life-years lost through premature death in Colombia between 1991 and 1996 was 4.24 per cent of the GDP. In 1996 alone, they represented 1.06 per cent of the country's income.

<sup>15</sup> See IADB (2003, p.2).

<sup>16</sup> See Ayres, (1998, p. 7) and Buvinic *et al.* (1999, p. 8).

<sup>17</sup> See Morrison and Orlando (1999).

Another effect of violence on human capital is that it causes a fall in investment in this type of capital because it leads to the imitation and development of criminal instead of educational abilities<sup>18</sup>. Dropping out of the educational system and the proliferation of teenage gangs may be due, among other reasons, to the inadequacy of the education that the young receive with respect to their needs. The result is that they perceive a very low return on the investment in education compared to the high returns from criminal activities<sup>19</sup>. This effect is even more dramatic in the case of activities related to drug dealing, which can bring very high earnings in a very short time. Rubio (1997, p. 11) points out that “it would be naive to think that the decisions of Colombian youths to invest in human capital have been immune to the example of the most successful Colombian careers of the last two decades. It is revealing that, [...] out of a range of professions, the young consider that the one with the greatest chance of success is that of the drug dealer<sup>20</sup>”. In this way, criminal behavior patterns lead to a loss of human capital by causing a diversion of skills towards harmful activities. If a significant part of the talent of a society is dedicated to carrying out tasks that exclusively imply a transfer of income, this will have negative repercussions on entrepreneurial activity and technical progress<sup>21</sup>.

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<sup>18</sup> See Buvinic *et al.* (1999, p. 8) and Fajnzylber *et al.* (2000, p. 258).

<sup>19</sup> See Arriagada and Godoy (2000 p. 124).

<sup>20</sup> To the question “which of these professionals leads a better life?” 27% of young Colombians answered “drug dealer”, 14% big businessman, 18% politician, 11% doctor, 8% priest, 6% lawyer, 5% engineer, 3% smuggler, 2% farmer and 1% university professor and small businessman. See Cuéllar (1997), *cit.* in Rubio (1997, p. 11). The perception of the success of the drug dealer compared to that of other “professionals” is greater in the poorer levels than in the richer. Even so, the proselytism of the drug dealer is not only addressed to the marginalised youths. Gómez and Frizt (2005, p. 373) deal with the phenomenon of the so-called Mexican *narcojuniors*, young children of well-off families from Tijuana who were recruited by the cartel of this city in Baja California to work as hit-men and smuggle drugs into the USA.

<sup>21</sup> See Bejarano (2003, p. 47).

One final phenomenon with a great repercussion on human capital stock that should be analyzed is that of population migration motivated by situations of insecurity. It is estimated that the total number of people forced to change their residence in Colombia for this reason is around a million<sup>22</sup>. In the case of international migrations, those affected are often individuals who belong to higher educational and economic strata, thus increasing their effect on economic activity. Arraigada and Godoy (2000, p. 121) show that kidnapping for economic gain, which fundamentally affects the well off, has led whole families to abandon their countries. In Guatemala, at least five important families (totaling some 40 people), victims of kidnappings or extortion, recently left the country because of the State's inability to protect them.

### ***3.1.3 Social capital***

In communities with high levels of violence, social capital can be affected because of the loss of trust between the members of the community. Moreover, participation in community events will fall because of the fear of traveling in dangerous neighborhoods. Nevertheless, it should also be borne in mind that these effects might be offset by the positive consequences derived from the appearance of community crime-fighting groups<sup>23</sup>.

## ***3.2 Violence and production costs.***

The measures taken by firms to prevent crime result in an increase in production costs. They include, among others, expenditure on private security, the payment of insurance premiums, extortion payments and systems of passive protection. They will lead to a rise in the prices paid by consumers and will eventually affect the aggregate

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<sup>22</sup> See Rubio (1997, pp. 3-4).

demand. As well as protecting their businesses, the entrepreneurs will also have to worry about their personal protection, which will cause the corresponding inefficiency. A good example of this is in Colombia where some entrepreneurs have to manage their businesses, located in the more violent zones, from a distance, making their task so much more difficult<sup>24</sup>.

### **3.3 Violence and social infrastructure**

Crime and violence destroy the social infrastructure and, thus, have a negative effect on productivity. The lack of social infrastructure encourages predatory behavior, diverting capital and labor towards unproductive activities, either by engaging in crime-related activities or by protecting human and physical assets<sup>25</sup>. In economies characterized by the illegal redistribution of resources, individuals present unproductive behavior based on rent-seeking. This type of behavior is eventually damaging to economic growth<sup>26</sup>.

Furthermore, violence can erode a key element of the social infrastructure: juridical security. The predictability of judicial sentences can be affected if the judges are extorted or bribed, both of which are habitual practices in scenarios with high levels of violence. Moreover, an excessive number of crimes could saturate the judicial system, as occurs in many countries of the region, especially when the material and human resources available are very limited. Sergio Morales, *Procurador de Derechos Humanos (Defender of Human Rights)* in Guatemala, recently highlighted that, for the

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<sup>23</sup> See Lederman *et al.* (2002, p. 511).

<sup>24</sup> See Trujillo y Badel (1998, p. 21).

<sup>25</sup> See Cárdenas (2001, p. 14).

<sup>26</sup> See Murphy *et al.* (1993).

240,000 crimes committed in the country, only 60 people end up serving prison sentences<sup>27</sup>.

These phenomena may be accompanied by a generalized sensation of impunity that, in the end, affects the honoring of contractual obligations. If the crime rate is very high, the citizens may feel unprotected and begin to question the legitimacy of the government and, thus, of the whole institutional apparatus that guarantees juridical security. As a consequence, it will be more costly to guarantee the honoring of contracts and so there will be an increase in the transaction costs of goods and services.

### **3.4 Violence and the conservation of earnings**

In the long run, violence can affect the possibilities of conserving the earnings generated by the productive activity by diverting a considerable part of them to their protection. In extreme situations, characterized by high levels of violence, entrepreneurs may be discouraged from undertaking new business projects.

Faced with the costs involved in trying to protect themselves, people may attempt to increase their welfare by deciding to live in poverty. Egalitarianism will thus become a strategy towards achieving peaceful relations with their neighbors. For instance, to avoid being the target of violent acts, people could decide to live without the goods that propitiate this type of acts. Poverty would thus become the price of peace<sup>28</sup>. Therefore, in societies immersed in violence, investment, although desirable, may not be a rational act<sup>29</sup>.

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<sup>27</sup> From the TV programme *En Portada - Guatemala: las heridas abiertas*, produced by the Spanish Television News Services (Servicios Informativos de Televisión Española). Broadcast 22 September 2006 by Channel 2 of Spanish Television.

<sup>28</sup> See Bates (2001, p. 46).

<sup>29</sup> *Ibid.* p. 48.

Even if the entrepreneur manages to save his earnings from criminal practices, a situation of violence would mean that he would have to spend a higher proportion of his earnings on paying taxes. As a direct consequence of violence, society will have to face higher social expenditure on services used in the treatment and prevention of violence<sup>30</sup>. This includes expenditure on the police, judicial and prison systems, expenditure on medical treatments, housing and social services. Although all governments have to face these types of expenditure, in the Latin American case these budgetary items represent quantities that are proportionally much higher. Londoño and Guerrero (1999, pp.21-22) estimate that the cost of medical attention resulting from violence are as much as 0.2 per cent of the GDP of the region. Public safety expenditure, including prevention campaign costs, would be about 1.1 per cent of the GDP. The expenditure on justice is 0.5 per cent. The cost of all this, will have to be financed by more taxes and, thus, the net earnings obtained will be lower.

If this expenditure increase is not accompanied by a rise in taxation, it will have to be financed by crowding out resources from other budgetary items, which would be an opportunity cost and would lead to a negative effect on the quantity and quality of the public services finally provided.

Economic growth is the final manifestation of the economic activity carried out in a country. As has been seen, violence has negative repercussions on factor accumulation, leads to an increase in production and transaction costs and reduces the net earnings obtained; therefore, violence will eventually have a negative effect on growth. To obtain empirical evidence for this effect becomes a priority. This will be the objective of the following section.

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<sup>30</sup> Buvinic *et al.* (1999, p. 8).

#### **4. Violence and growth in Latin America: empirical evidence.**

Two effects are going to be analyzed: the direct effect of violence on growth and the indirect effect produced through investment. To be able to confirm and quantify them, we will first have to select an econometric model that can be the basis of this study and that contains the main factors of growth in the countries of the area, trying not to omit relevant variables. This is always a complex task and will be conditioned by the availability of data. Furthermore, it will be necessary to take into account two considerations that will limit the number of explanatory variables to be employed. On the one hand, the possible problems of multicollinearity between variables should be avoided. On the other, it will be necessary to consider the restrictions that the degrees of freedom impose, especially when using complex estimation techniques which require higher quantities of information.

On the basis of this, a standard growth model has been chosen, similar to that used in most empirical work and that will take into account several of the main explanatory factors contained in the growth literature. The growth model central to this paper will be:

$$(1) \text{GROWTH}_{it} = \beta_i + \beta_1 \text{INVESTMENT}_{it} + \beta_2 \text{HUMAN CAPITAL}_{it} + \beta_3 \text{PRICE LEVEL OF INVESTMENT}_{it} + \beta_4 \text{TRADE}_{it} + \beta_5 \text{VIOLENCE}_{it} + u_{it}$$

Where  $i$  represents each country,  $t$  each time period and  $u_{it}$  is the error term.

The growth of the per capita income is made to depend on investment as a percentage of the GDP, human capital -measured through the rate of secondary

education-, the price level of investment<sup>31</sup> -which is a proxy for market distortions that affect the cost of investment-, and trade openness -as the sum of imports and exports with respect to the GDP -. As well as all these factors that are usual in growth models, we add a variable that contains the effect of violence and crime in the region: the number of homicides per one hundred thousand inhabitants. The convenience of using this as an approximation to the phenomenon of violence has already been justified in Section 3.

The sample used for this study is composed of sixteen countries, chosen in function of their population size and the availability of information. They are: Argentina, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. The period analyzed is that between 1979 and 2001. The data set, therefore, consists of an unbalanced panel with an important number of observations, which allows us to use complex econometric panel data analysis techniques.

The data used to estimate the model come from the *World Development Indicators Database* (World Bank), with two exceptions: the variable *PRICE LEVEL OF INVESTMENT* has been taken from the *Penn World Table (version 6.1)*<sup>32</sup> and the variable *VIOLENCE* has been elaborated on the basis of data from the World Health

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<sup>31</sup> This variable frequently appears in the growth literature and measures the cost of the investment in each country with respect to the United States. It is a proxy for market distortions that affect the cost of investment, such as tariffs, government regulations, corruption, and the cost of foreign exchange. Thus, it is expected that the variable will have a negative effect on growth. See Forbes (2000, technical note 7).

<sup>32</sup> Heston, A., Summer, B. and Aten, B. (2002). Penn World Table Version 6.1, Center for International Comparisons at the University of Pennsylvania (CICUP). Available from <http://pwt.econ.upenn.edu/>

Organization<sup>33</sup>. The final data set, with definitions, sources, number of observations, means, ranges and standard deviations of the variables is reported in Annex 1.

The standard methods of panel estimation are fixed effects or random effects. In our case, the model proposed will consider that there is an intercept term fixed for each country. Thus, we have conditional inference with respect to the countries of the sample.

The unconditional inference that is associated with the estimation of random effects is discarded by the Breusch and Pagan Lagrangian multiplier test for random effects<sup>34</sup>. The value of the statistic for the equation proposed, which has a  $\chi^2$  distribution with one degree of freedom, is equal to 0.66, which is far below the critical values of this distribution at any reasonable level of significance. Thus, the panel will be resolved considering the existence of fixed effects, which is consistent with the no stochasticity of the sample of countries employed.

Before explaining the estimation methods used, it is worth calling attention to the so-called problem of joint endogeneity, habitual in growth models like the one proposed<sup>35</sup>. The origin of this is that the explanatory variables used are, on the one hand, the cause of economic growth but, on the other hand, the growth of income will, in turn, affect these variables. Take, for example, the case of violence. Its effects on economic activity are very varied, as we have seen, and they will have consequences for growth. But, also, violence is a complex phenomenon that has its origin in many diverse causes, among them those of a socio-economic nature. So, as Fajnzylber *et al.* (2000)

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<sup>33</sup> World Health Organisation: Health statistics and health information systems - Mortality Database. Available from <http://www.who.int/healthinfo/statistics/mortdata/en/index.html>

<sup>34</sup> See Breusch and Pagan (1980).

<sup>35</sup> See Temple (1998) y Durlauf *et al.* (2005).

prove empirically, the growth rate of the economy could be a determinant of the crime rate<sup>36</sup>. This dual causality, which, in principal, can affect all the explanatory variables of the model, would lead to obtaining inefficient estimators, if it is not detected and adequate estimation techniques adopted.

The exogeneity of the variables was tested by means of the Hausman Test<sup>37</sup>. The results, presented at the foot of the estimations, show the presence of joint endogeneity in the case of two explanatory variables: *INVESTMENT* and *TRADE*. Therefore, it was decided to instrument them through their corresponding lags. These instruments have to be correlated with the original variables but uncorrelated with the regression residuals. The validity of the instruments chosen was tested using the Sargan Test and the result is at the foot of each estimation<sup>38</sup>.

Taking into account all the factors pointed out, two estimation methods are going to be used: the Three-Stage Least Squares (3SLS) method and the Generalised Method of Moments (GMM). Both of them permit the estimation through fixed effects and the use of instruments with which to solve the detected problem of joint endogeneity. Below, a brief explanation of the basic foundations of each method and an analysis of the results obtained through their application is offered.

3SLS is a system method that estimates all of the coefficients of the model and, then, forms weights and re-estimates the model using the estimated weighting matrix<sup>39</sup>. The method estimates all the identified structural equations together as a set, instead of

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<sup>36</sup> The authors find that, for a sample of 45 countries and in the period 1970–1994, a one percentage point increase in the GDP growth rate is associated with a 2.4 percent decline in the homicide rate and a 13.7 percent decline in the robbery rate. See Fajnzylber *et al.* (2000, p. 247)

<sup>37</sup> For an analysis of the test, see Hausman (1976).

<sup>38</sup> The test has been performed following the methodology proposed by Seddighi *et al.* (2000 pp. 155-6).

estimating the structural parameters of each equation separately. It is based on the Two-Stage Least Squares estimator, but is asymptotically more efficient. As its name indicates, this method has three stages. In the first stage, we regress the right-hand side endogenous variables on all exogenous variables and get the fitted values. In the second stage, we regress the endogenous variables on the fitted values and the exogenous variables. In the third stage, Feasible Generalized Least Squares are applied to get the estimators<sup>40</sup>.

Table 2 shows the results of the proposed model applying 3SLS.

**Insert Table 2 here**

Investment and human capital had a positive effect on growth, while violence, the price level of investment and trade had a negative one. Therefore, most of the coefficients estimated in Table 2 agree with those traditionally reported in the literature and are highly significant<sup>41</sup>.

From the analysis of the results, it is clear that violence has had a negative influence on the growth rate of the region. If the homicide rate in Latin America could be reduced to levels similar to the world average –that is, from 27.8 to 8.8 homicides per one hundred thousand inhabitants- there would be an annual 0.9 per cent increase in the growth of the region's income.

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<sup>39</sup> In this case, the system is formed by the equation for each of the countries. The method uses all the information contained in the system to carry out the estimations.

<sup>40</sup> The exact methodology used by the econometric software employed is explained in *EViews 5 User's Guide*, Quantitative Micro Software, LLC, 2004, pp.681 and 700.

<sup>41</sup> With respect to the negative sign of the coefficient of the variable *TRADE*, see Rodrik and Rodriguez (2000), Yanikkaya (2003) and Freeman (2004).

With respect to the GMM, I will focus on a technique developed by Arellano and Bond for the resolution of dynamic panel data models<sup>42</sup>. This technique controls for a country's unobservable, time-invariant characteristics, or fixed effects, focusing on changes in the variables within each country over time. The method proposes including the endogenous variable –lagged two periods or more- as a regressor. Moreover, with the aim of controlling the potential endogeneity of the explanatory variables, the lags of these variables will be included as instruments.

The GMM estimator obtained will be consistent if the error term is not serially correlated and the instruments chosen are valid. The first question is verified by a test of second-order serial correlation. First-order serial correlation is expected, but second-order serial correlation of the differenced residuals indicates that the original error term is serially correlated and the instruments are misspecified. The Sargan test tests the null hypothesis of the overall validity of the instruments. Failure to reject this null hypothesis gives support to the model. Once these aspects have been checked, regressions in levels and differences -each properly instrumented- are estimated jointly in a system.

The methodology described has important advantages in studying economic growth, because, as Bond et al. (2001, p. 3) pointed out, first, estimates will not be biased by any omitted variables that vary little over time (unobserved country-specific or fixed effects); second, the use of instrumental variables allows parameters to be estimated consistently when we have joint endogeneity; and, finally, the use of instruments potentially allows consistent estimation even in the presence of measurement error.

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<sup>42</sup> See Arellano and Bond (1991).

The results based on Arellano and Bond's estimator are reported in Table 3.

**Insert Table 3 here**

Using GMM -which employs a methodology that has evident differences with respect to the 3SLS and means an 11 observation reduction - the variables *PRICE LEVEL OF INVESTMENT* and *TRADE* are no longer significant and there is a change in the sign of the variable *human capital*<sup>43</sup>. The effect of the variable *INVESTMENT* on the dependent variable becomes greater. Violence continues to have a significant negative effect on growth, although the value of the coefficient of the variable is reduced. Under this estimation method, we find that a decrease in the homicide rate of the region to a level similar to the world average would have the net result of an annual income increase of 0.1 per cent.

Finally, one last estimation will allow us to check empirically the effect that violence has on investment and, thus, on growth. This will be done by proposing a model made up of a system of two equations. In this system, violence will have a dual effect on growth: direct and indirect, the latter through the variable investment. The first of the two equations will be a growth equation similar to that proposed previously. The second will have investment as the dependent variable and the real interest rate, human capital and violence as the independent variables. Thus, the model will be:

$$(2) \text{GROWTH}_{it} = \beta_i + \beta_1 \text{INVESTMENT}_{it} + \beta_2 \text{HUMAN CAPITAL}_{it} + \beta_3 \text{PRICE LEVEL OF INVESTMENT}_{it} + \beta_4 \text{TRADE}_{it} + \beta_5 \text{VIOLENCE}_{it} + u_{it}$$

$$\text{INVESTMENT}_{it} = \gamma_i + \gamma_1 \text{REAL INTEREST RATE}_{it} + \gamma_2 \text{HUMAN CAPITAL}_{it} + \gamma_3 \text{VIOLENCE}_{it} + \varepsilon_{it}$$

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<sup>43</sup> With respect to the change of sign, see Pritchett (2001).

Where  $i$  represents each country,  $t$  each time period, and  $u_{it}$  and  $\varepsilon_{it}$  are the error terms.

The procedure used for the estimation of the system will be the 3SLS, which, as has been indicated, permits us to work with systems of equations, an option that is not feasible with the procedure of Arellano and Bond. The estimations are shown in Table 4.

#### **Insert Table 4 here**

The results obtained are, in the case of the first equation, similar to those of the estimation carried out previously using the same procedure. Investment and human capital had a positive effect on growth while violence, the price level of investment and trade had negative effects. With respect to the equation that explains investment, the relationships between the variables are those that were foreseen *a priori*: human capital had a positive effect and the real interest rate and violence had negative effects. All the variables were highly significant.

Thus, the empirical evidence allows us to confirm, once again, the theoretical effects pointed out: violence has a significant negative effect on investment and on growth. A reduction in the homicide rate to levels similar to the rest of the world would lead to an annual increase in investment of 1 per cent, as a proportion of the GDP. This would, in turn, lead to an increase of 0.16 per cent in the growth rate. If both the direct and the indirect -exerted through investment- effects of violence on growth are considered, the increase in the annual growth of income, if the homicide rate were the same as the world average, would be 1.1 per cent.

To conclude the empirical analysis, it must be borne in mind that these results could be biased by the high homicide rates in some of the countries in the sample. For

example, in Colombia, the homicide rate is four times the regional average. Therefore, to check whether the effects of violence on investment and growth can be considered robust, a new estimation was carried out, eliminating Colombia from the original sample. The estimation was based on the system proposed and resolved through the 3SLS. Although the values of the coefficients varied very slightly, all the variables of the system maintained their signs and significance. The variable *VIOLENCE* conserved its negative and highly significant relation with growth, its coefficient taking a value of -0.057. The same occurred with the relation between violence and investment, which was negative and highly significant, with a coefficient of -0.053.

If El Salvador -the country with the second highest homicide rate, three times the regional average- is excluded from the sample, the results of the estimation are similar for all the variables of the system. The coefficients of the variable *VIOLENCE* are, in this case -0.048 for the growth equation and -0.049 for the investment equation. The high significance is maintained.

Thus, from the results obtained from the estimations carried out, it can be concluded that violence has had, in the period analyzed, an important negative and significant effect on the growth of Latin America, both directly and through investment.

## **5. Conclusions**

The phenomenon of violence is one of the biggest concerns of the citizens of Latin America. This worry is justified, taking into account that the region has crime rates that are well above those of other regions of the world. The situation is a real human drama for the hundreds of thousands of families that are affected each year by different manifestations of the phenomenon. To the social consequences must be added the repercussions on the economic activity of the countries of the zone. Violence

conditions the accumulation of productive factors, negatively affecting physical capital, human capital and social capital. Furthermore, it leads to an increase in the production costs, damages the social infrastructure and deteriorates juridical security, increasing transaction costs. Finally, it conditions the conservation of the earnings generated by the productive activity.

All these factors eventually affect growth negatively, as has been shown in the empirical research with panel data carried out in the paper. The panel was resolved using two methods: the Three-Stage Least Squares method and the Generalized Method of Moments developed by Arellano and Bond (1991). Both control for the presence of time-invariant country-specific effects and correct the presence of joint endogeneity of the variables. The results suggest that violence has had an important negative and significant effect on growth in Latin America, both directly and through investment.

The violence differential quantified using the homicide rate, between this region and the rest of the world means a drop of 0.1 per cent in the annual growth rate of the GDP of Latin America, according to the results offered by the method of Arellano and Bond. The drop is of 0.9 per cent when estimated through the Three-Stage Least Squares method. The latter procedure, applied to the resolution of a system of equations that have growth and investment as the endogenous variables, reveals that the differential in the homicide rate leads to a 1 per cent annual decrease in investment as a proportion of the GDP. If the direct effect of violence on growth is considered together with the indirect effect -exercised through investment-, we find that the increase in the annual growth of income, if the homicide rate were equal to the world average, would be 1.1 per cent.

The conclusions that can be drawn from these figures are evident. Violence prevention policies will have significant economic effects. An effective reduction of

violence could contribute substantially to the economic growth of the region. Some of the measures to be adopted would be carried out through educational programmes; controlling the consumption of alcohol and drugs and the possession of weapons; strengthening institutional systems dedicated to the fight against crime, especially the police and the judicial system; fighting against impunity and fomenting transparency; reforming the punishment system; and fighting against poverty, exclusion and social inequality. Lastly, given the importance of the phenomenon, it is necessary to foster research to analyze the risk factors, prevention policies and the social and economic cost of violence.

## Annex 1. Definitions, sources and statistics of the variables used

<i>VARIABLE</i>	<i>DEFINITION</i>	<i>SOURCE</i>	<i>OBSERV.</i>	<i>MEANS</i>	<i>MIN.</i>	<i>MAX.</i>	<i>STAND. DEV.</i>
GROWTH IN PER CAPITA INCOME	GDP per capita growth (annual %). Annual percentage growth rate of GDP per capita based on constant local currency.	World Development Indicators (World Bank)	384	2.53	-26.48	14.82	4.82
INVESTMENT	Gross capital formation as a share of gross domestic product.	World Development Indicators (World Bank)	383	20.45	-5.74	43.30	5.17
SCHOOL	School enrolment in secondary education (% gross).	World Development Indicators (World Bank)	204	54.88	18.59	107.53	18.37
VIOLENCE	Homicide rate per one hundred thousand inhabitants.	Authors' own elaboration based on data from the World Health Organization: Health statistics and health information systems - Mortality Database	301	26.73	1.36	213.50	33.45
PRICE LEVEL OF INVESTMENT	PPP of investment / exchange rate relative to the United States.	Penn World Tables v. 6.1.	352	68.81	31.75	423.28	25.49
TRADE	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Development Indicators (World Bank)	383	48.98	11.55	126.47	20.73
REAL INTEREST RATE	Lending interest rate adjusted for inflation as measured by the GDP deflator.	World Development Indicators (World Bank)	269	15.06	-97.62	789.80	52.03

## Tables and Figures

**Table 1. Homicide rates in Latin America. 1979-2001.**

	Average homicide rate per 100.000 inhabitants between 1979 and 2001	Homicide rate in the country/ average homicide rate (in %)	Slope of the regression line of the homicide rate between 1979 and 2001 estimated using OLS
Argentina	9.7	35%	0.13
Brazil	37.0	133%	1.52
Chile	6.5	23%	0.09
Colombia	119.6	431%	4.09
Costa Rica	9.9	36%	0.14
Dominican Republic	5.5	20%	0.12
Ecuador	21.8	78%	0.86
El Salvador	79.8	288%	-0.01
Guatemala	56.8	205%	-3.92
Mexico	33.4	120%	-0.49
Nicaragua	5.6	20%	0.08
Panama	11.1	40%	0.69
Paraguay	11.1	40%	-0.05
Peru	3.1	11%	1.00
Uruguay	8.0	29%	0.33
Venezuela	25.2	91%	0.79
Media	27.8	100%	0.07

Source: Author's own elaboration on the basis of data from the WHO *Health statistics and health information systems - Mortality Database*

**Table 2. Estimation carried out using 3SLS**  
**Dependent variable: Growth in per capita income**

	Coefficient	t-Statistic	Signif.
INVESTMENT	0.144	3.047	**
SCHOOL	0.047	2.219	**
VIOLENCE	-0.047	-4.144	**
PRICE LEVEL OF INVESTMENT	-0.117	-7.313	**
TRADE	-0.051	-2.940	**

- (\*\*) (\*) denotes that coefficients are significantly different from zero at the 5 percent (10 percent) level.
- Number of countries: 16. Period: 1979-2001. Total system (unbalanced) observations 162. Fixed effects.
- Instrumented variables: *INVESTMENT* and *TRADE*. The two variables present a value of the t-Statistic of 14.9 and -2.3, respectively, when performing the Hausman test. Thus, the presence of joint endogeneity cannot be rejected at the 5 percent significance level. The other variables present values of the t-Statistic which allow us to reject the presence of joint endogeneity for this level of significance.

- The instruments used were the lags of the variables. The Sargan test for the validity of the instruments reflects a P-Value, through a  $\chi^2$  distribution, equal to 0.99, which allows us to accept the null hypothesis and the validity of the instruments.

**Table 3. GMM Arellano-Bond dynamic panel-data estimation.**  
**Dependent variable: Growth in per capita income**

	Coefficient	t-Statistic	Signif.
LAGGED DEPENDENT VARIABLE	-0.0068	-0.12	
INVESTMENT	0.3482	3.84	**
SCHOOL	-0.0133	-2.43	**
VIOLENCE	-0.0050	-2.23	**
PRICE LEVEL OF INVESTMENT	-0.0063	-0.78	
TRADE	-0.0083	-0.22	
CONSTANT	1.1825	1.9	*

Arellano-Bond test of 1st Order Serial Correlation  $z = -2.45$   $Pr > z = 0.0142$

Arellano-Bond test of 2nd Order Serial Correlation  $z = -1.48$   $Pr > z = 0.1393$

- (\*\*) (\*) denotes that coefficients are significantly different from zero at the 5 percent (10 percent) level.
- Number of countries: 16. Period: 1979-2001. Total system (unbalanced) observations 151. Fixed effects.
- Instrumented variables: *INVESTMENT* and *TRADE*. The two variables present a value of the t-Statistic of 14.9 and -2.3, respectively, when performing the Hausman test. Thus, the presence of joint endogeneity (cannot be rejected) at the 5 percent significance level. The other variables present values of the t-Statistic which allow us to reject the presence of joint endogeneity for this level of significance.
- The instruments used were the lags of the variables. The Sargan test for the validity of the instruments reflects a P-Value, through a  $\chi^2$  distribution, equal to 0.99, which allows us to accept the null hypothesis and the validity of the instruments.
- With respect to the autocorrelation of the residuals, according to the P-Value, we can reject second order autocorrelation of the residuals in the first-differenced model. This implies the absence of first order autocorrelation of the residuals in the model written in levels. The test fails to reject the null hypothesis of no second-order serial correlation and, consequently, the original error term is serially uncorrelated and the moment conditions are well specified.

**Table 4. Estimation carried out using 3SLS.**  
**Dependent variable: Growth in per capita income.**

Equation 1. Dependent variable: GROWTH IN PER CAPITA INCOME.	Coefficient	t-Statistic	Signif.
INVESTMENT	0.158	4.897	**
SCHOOL	0.042	3.491	**
VIOLENCE	-0.041	-5.681	**
PRICE LEVEL OF INVESTMENT	-0.110	-10.031	**
TRADE	-0.043	-3.693	**

Equation 2. Dependent variable: INVESTMENT	Coefficient	t-Statistic	Signif.
REAL INTEREST RATE	-0.039	-4.893	**
SCHOOL	0.144	6.899	**
VIOLENCE	-0.054	-4.521	**

- (\*\*) (\*) denotes that coefficients are significantly different from zero at the 5 percent (10 percent) level.
- Number of countries: 16. Period: 1979-2001. Total system (unbalanced) observations 297. Fixed effects.
- Instrumented variables: *INVESTMENT* and *TRADE*. The two variables present a value of the t-Statistic of 7.75 and -4.52, respectively, when performing the Hausman test. Thus, the presence of joint endogeneity cannot be rejected at the 5 percent significance level. The other variables present values of the t-Statistic which allow us to reject the presence of joint endogeneity for this level of significance.

- The instruments used were the lags of the variables. The Sargan test for the validity of the instruments reflects a P-Value, through a  $\chi^2$  distribution, equal to 0.99, which allows us to accept the null hypothesis and the validity of the instruments.

**Figure 1. The effects of violence on economic activity.**

1. It conditions the accumulation of productive factors:
  - a. physical capital
  - b. human capital
  - c. social capital.
2. It implies an increase of production costs.
3. It negative affects the social infrastructure) and raises transaction costs.
4. It limits the possibilities of the conservation of the earnings generated by the productive activity.

Source: Author's own elaboration

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