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Transnational study on the link between the possession of a firearm and the rate of homicides by firearms

■ ABSTRACT

Background The aim of this article is to examine the link between the rate of homicides by firearms, the possession of a firearm and the severity of legislation with regard to firearms. The construction of our research as well as the different variables selected are based on elements taken from reference works on the subject of mortality by a firearm referred to in scientific literature. *Method* The statistical design of the study has an ecological approach based on a number of countries (N=52), not including the USA. It integrates a set of confounding variables (economic, social, demographic and criminogenic) through bivariate correlations and multiple regressions with the aim of examining the presence of a significant link between the rate of homicides by firearms (dependent variable), the possession of firearms and the severity of legislation. *Results* The results observed seem to indicate no significant link between our dependent variable and our variables of interest. However, the different analyses repeatedly underlined the presence of a strong link between one of our confounding variables, the infant mortality rate and the rate of homicides by firearm in the countries included in our sample. *Conclusion* Much more than the possession of firearms or the severity of legislation, it seems that child mortality is one of the most important predictors in understanding the variations in the rates of homicides by firearm between countries, thus paving the way towards greater attention to the socio-economic conditions in the apprehension of criminal phenomena linked to firearms but also to reorientation of the policies applied in this area.

■ KEY WORDS

Firearms – homicides – laws – ownership – poverty

INTRODUCTION

In most countries in the world civilians may buy and own firearms, even though the purchase and possession of these arms are usually restricted and controlled in different ways. The Small Arms Survey (Parker, 2011) highlights that arms owned by civilians represent almost three quarters of the firearms in circulation in the world, whereas paradoxically only a fraction of civilians are the owners of these arms as a whole.

In parallel, the proliferation of these firearms is an issue that has worried numerous world leaders and governments for many years. (UNODC, 2013).

One of the main reasons for these worries certainly stems from the fact that the weapon most used in homicides is a firearm. The United Nations thus estimates that **almost four out of ten homicides are carried out by a firearm** (UNODC, 2013).

Moreover, the economic, social and moral stakes around the problem of firearms makes this a particularly sensitive matter that draws a lot of attention from the general public. Because of this it is high on the agenda of political and institutional players.

Authors like Hemenway and Wintmute (Hemenway, 2009, Wintmute et al., 2010), highlighted the influence of these different stakes on the quality of research on the subject. They pointed out that a number of studies were presented in such a way as to show results that would justify certain political choices. Similar biases may be observed both among partisans and opponents of the free circulation of firearms,

warning us of the **possible contagion of ideologies on the results shown by the studies on this subject.**

Separate and apart from this matter, it is also worth noting that **legislating on access and the acquisition of firearms** seems to be regarded, rightly or wrongly, as a means of restricting the availability of firearms and, therefore, their circulation. This type of policy often implies a desire to **reduce the number of violent crimes and thereby the number of firearm-related crimes carried out**.

However, within this impetus for legislation there is a **wide diversity of arms control measures** across the countries under consideration. Some countries impose a **complete ban** on the sale or possession of arms, while others stress **tougher conditions for acquisition** or they **only legislate on certain categories of arms.**

Finally, although there are **measures to make these regulations more consistent**, particularly at a transnational level, they are usually developed and discussed at various levels of governance, thus rendering **implementation of them complicated at times.**

In this context, we believe it is essential to examine the fact that, in addition to the availability of firearms in a given country, the control measures established at national level could play a role in protecting a particular form of violent crime, namely firearm homicides.

In terms of scientific literature, many authors are addressing the global topic "firearms and crime". This interest has led to a significant amount of research, using diverse methodologies, to examine specific phenomena such as violent gun crimes, the rate of suicides or general homicides or those carried out with a firearm, using various analysis units (local, regional, national or international).

These studies also focus on individual and macroscopic analyses, particularly through the use of case study analyses or by using a set of measures reflecting variables that could be linked to the availability of firearms, to the legal framework surrounding this availability, and also to phenomena.

Finally, some have employed a longitudinal method in their research, filtering out any developments or changes emerging over time, while others have examined a limited period of time.

Within this body of research it is, however, important to stress, besides the wealth of the different lessons to be learnt, that few of the studies focused on the link between the possession of firearms or the legislation on firearms and crime related to firearms outside the United States.

This low number seems to be due to the fact that there is no current standardized means of determining the rates of possession or reporting on a specific legislation or its severity, and the difficulty in obtaining comparable data from one country to another around the world. It should also be noted that this difficulty increases if we attempt to understand different types of legislations from countries with a variety of legal systems, each written in the language of that country; this problem does not arise when the American states are examined.

On the other hand, it should be stressed that none of the results presented in these studies show a connection between the possession of or the legislation on firearms and the rate of homicides by firearm. In fact, the statistical tests employed do not make it possible to draw any conclusions from cause and effects findings, but rather from the way in which the variables studied co-vary, or make it possible to explain the influence of one variable on the variations of another. The possibility that the relationships observed in reported research may be due to the fact that some variables have been omitted cannot be excluded either. It is for this reason, in light of the diverse considerations, the varied methodology, the measures, the regions used, that the results of studies commonly mentioned in relation to this topic should be interpreted with a great deal of caution.

METHOD

The research is based on a sample of 52 countries (not including the USA), chosen according to 3 criteria: population size (min. 1,000,000 inhabitants.), the political regime (excluding authoritarian regimes) and the absence of conflict zones within the country (for the previous 10 years).

Our research hypotheses are based on the link between the rate of homicides by firearms and two distinct variables: the possession of firearms and the severity of firearms legislation. Thus, we are attempting to determine if: there is a significant link between the rate of homicides by firearms and the possession of firearms (H1); there is a significant link between the rate of homicides by firearms and the severity of firearms legislation (H2). We are also interested in the link there may be between the possession of firearms and, not the rate of homicides by firearm, but rather the overall homicide rate (H3).

In addition to the variables presented above, we have also investigated a number of confounding variables, which the literature shows as linked to the rate of homicides by firearms or some related phenomena (homicides, violence committed by firearms, suicides by firearms, etc.). We have grouped these variables into four categories - economic, social, demographic and criminogenic.

The data used for each of our variables comes from official international data bases - the World Health Organization (WHO), the United Nations Office on Drugs and Crime (UNODC) and the Organization of American States (OAS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), the data collected relates to the years 2011-2013. When the data was not available for these years, we used the most recent accessible data. The oldest dates to 2008.

STATISTICAL ANALYSIS

First, we will use the Pearson correlation to examine the link between our dependent variable and our different independent variables. These initial bivariate correlations shall be complemented by partial correlations, controlling the economic variable relating to the GDP per capita. Many works (Agha, 2009, Altheimer, 2008) have in fact underlined the importance of the neutralization of this variable in the analysis of correlations on homicide rates, mainly due to the link between this variable and the set of our confounding variables. Secondly, these correlations shall be complemented by a series of multiple regressions in order to illustrate, within the different relevant variables, those which are most significant and thereby, better predict the variations that might be seen in the rate of firearm homicides in our sample.

The significance threshold used in each of our tests is $p<0.05$.

RESULTS

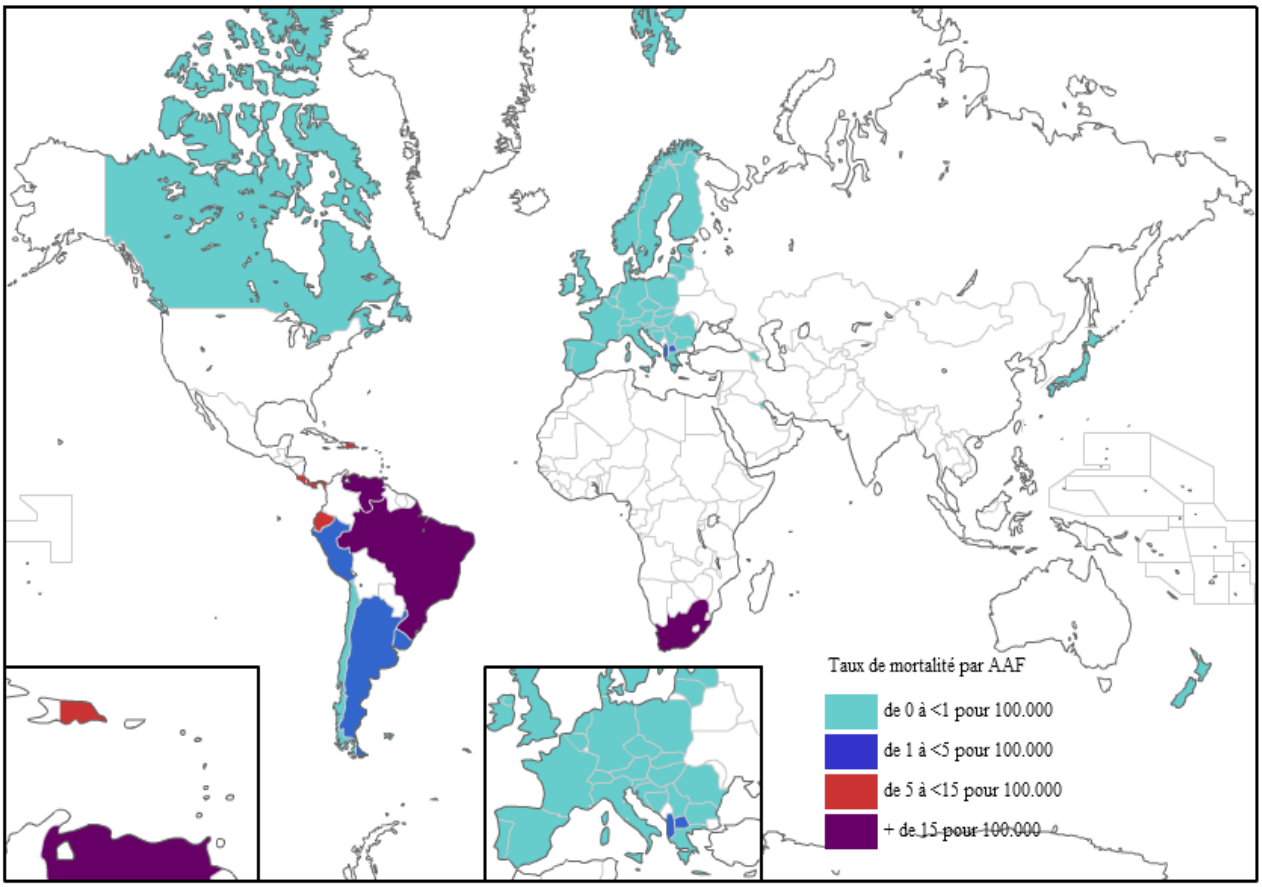
■ FIREARM HOMICIDES RATE

Our dependent variable, representing the rate of firearm homicides per 100,000 inhabitants in our sample of countries studied (N=52) sees an average of 3.67 firearm homicides per 100,000 inhabitants. The standard deviation is 8.08, which represents a significant variation in the different rates observed.

The countries with the lowest rates of firearm homicide records are the Republic of Hong-Kong, Japan, Kuwait and Ile Maurice. In fact, these countries have rates that are not above 1 homicide by firearm per 1,000,000 inhabitants.

As the world map below shows, a large number of countries that make up our sample have a low rate of homicides by firearms. Of the 52 countries that make up our sample, 73% (N=38) have a rate of less than 1 homicide by firearm per 100,000 inhabitants. By contrast, 5 countries have rates of over 15 homicides by firearm per 100,000 inhabitants. Among those countries Venezuela sadly comes in first with a rate of 39 homicides by firearm per 100,000 inhabitants, followed by Jamaica (28.4), Trinity and Tobago (21.77), Brazil (18.5) and South Africa (17).

BOX 1



*Representation of the rate of firearm homicides within the countries of the sample based on data from the WHO database

■ THE AVAILABILITY OF FIREARMS

Our first variable of interest corresponds to the prevalence of firearms within a given country.

This variable, which is difficult to measure, has been the subject of a large number of studies aiming to evaluate the substitution measures that would best allow one to reach a figure of the actual number of firearms in circulation among a given population (Azrael and Hemenway, 2001). The measure that we used in this study is the proportion of the number of suicides by firearm compared to the total number of suicides in the country as chosen by Kleck (2004). The values obtained for this variable has led to our first observation with regard to the observable dispersion of this variable. The proportions calculated are spread between 0 (Hong Kong, Kuwait, Singapore, Costa Rica, Jamaica, Bosnia) and 20.34 (Greece). It is noteworthy that one out of 10 countries from our sample show nil scores (N=6). The average score obtained is 6.65 with a standard deviation of 6. The countries showing atypical values are characterised by high scores. They are two European countries, Switzerland (20.31) and Greece (20.34).

In parallel, you may observe in BOX 2 below the comparison between this index (*suicides by firearms/total suicides)* and the proportions of homicides by firearm *(homicides by firearms/total homicides)* previously obtained for these same countries.

As we can already note from this chart, the contours observed between the countries with high proportions of homicides by firearm compared to total homicides, do not seem specifically characterised by high proportions of possession.

■ THE SEVERITY OF LEGISLATION

There is no index as such to apprehend the severity of firearms legislation in different countries around the world. The only index that seems to come close to this reality is the Gun Rights Index, which covers elements such as the registration of arms, restriction on stocks, carrying an arm, etc. which aims to judge the ease of access to firearms by civilians in a given country. Although this index is not scientifically valid, it is to the best of our knowledge, the only one related to legislative measures put in place with regard to firearms in different countries around the world.

This index, taking a value between 0 and 10, was inverted for our study, in order to report not on the leniency of regulations regarding firearms but rather on the severity of these.

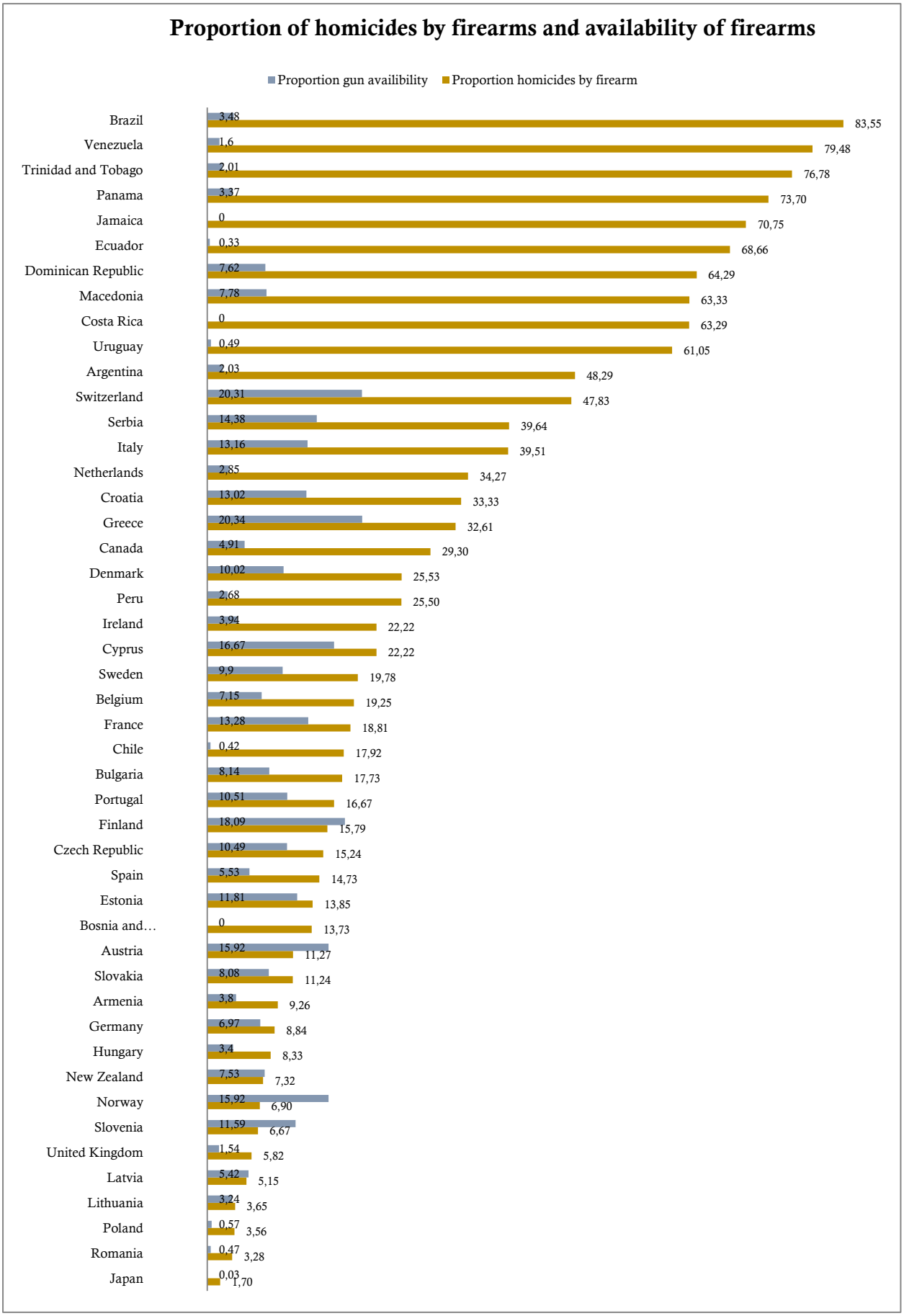
BOX 3 below shows the various scores obtained by our sample. The average score obtained in the countries studied is 6.439 with a standard deviation of 1.351, representing a low dispersion.

Only one country shows a slightly higher atypical value, Kuwait with 9.25 (limit at 9.141), whereas Bulgaria and the Czech Republic present lower values, below those of the sample (3 and 3.6 respectively).

One country out of 10 (N=6) have less severe legislation according to the index used, with a score below score 5/10: Bulgaria (3), Czech Republic (3.6), Peru (4), Switzerland (4), South Africa (4) and Lithuania (4.8).

38.5% of our sample of countries are characterised by high scores, equal to or above 7/10. Six of these countries had scores above 8/10. They are New Zealand (8), Hong Kong Republic (8.5), Japan (8.5), the United Kingdom (8.5), Venezuela (8.9) and Kuwait (9.25).

BOX 2


Proportion of homicides by firearms and availability of firearms
Proportion gun availibility
Proportion homicides by firearm
Brazil 3,48 83,55
Venezuela 1,6 79,48
Trinidad and Tobago 2,01 76,78
Panama 3,37 73,70
Jamaica 0 70,75
Ecuador 0,33 68,66
Dominican Republic 7,62 64,29
Macedonia 7,78 63,33
Costa Rica 0 63,29
Uruguay 0,49 61,05
Argentina 2,03 48,29
Switzerland 20,31 47,83
Serbia 14,38 39,64
Italy 13,16 39,51
Netherlands 2,85 34,27
Croatia 13,02 33,33
Greece 20,34 32,61
Canada 4,91 29,30
Denmark 10,02 25,53
Peru 2,68 25,50
Ireland 3,94 22,22
Cyprus 16,67 22,22
Sweden 9,9 19,78
Belgium 7,15 19,25
France 13,28 18,81
Chile 0,42 17,92
Bulgaria 8,14 17,73
Portugal 10,51 16,67
Finland 18,09 15,79
Czech Republic 10,49 15,24
Spain 5,53 14,73
Estonia 11,81 13,85
Bosnia and… 0 13,73
Austria 15,92 11,27
Slovakia 8,08 11,24
Armenia 3,8 9,26
Germany 6,97 8,84
Hungary 3,4 8,33
New Zealand 7,53 7,32
Norway 15,92 6,90
Slovenia 11,59 6,67
United Kingdom 1,54 5,82
Latvia 5,42 5,15
Lithuania 3,24 3,65
Poland 0,57 3,56
Romania 0,47 3,28
Japan 0,03 1,70

BOX 3

The Severity of Legislation *

COUNTRY	GUNRIGHTS INVERTED
Albania	6,5
Argentina	7,5
Armenia	7,2
Austria	7,5
Belgium	6,9
Bosnia Herzegovina	5
Brazil	6,5
Bulgaria	3
Canada	7
Chile	5,3
Costa Rica	6,4
Croatia	7,4
Cyprus	6,4
Czech Republic	3,6
Denmark	7,5
Dominican Republic	5,5
Ecuador	5,8
Estonia	5,2
Finland	6
France	6
Germany	6,8
Greece	5,2
Hong Kong	8,5
Hungary	7,5
Ireland	6,8
Italy	6,4

COUNTRY	GUNRIGHTS INVERTED
Jamaica	5,8
Japan	8,5
Kuwait	9,25
Latvia	5,5
Lithuania	4,8
Macedonia	7,5
Mauritius	7
Netherlands	7,5
New Zealand	8
Norway	7
Panama	5
Peru	4
Poland	6,8
Portugal	7
Romania	6,6
Serbia	6,3
Singapore	8,5
Slovakia	6,2
Slovenia	6,3
Spain	7,4
Sweden	6,8
Switzerland	4
Trinidad and Tobago	7
United Kingdom	8,5
Uruguay	5,8
Venezuela	8,9

*Source: Free Existence Gun Rights Index 2014

■ CONFOUNDING VARIABLES

A confounding variable describes a variable that is linked to the research subject which must be checked or eliminated so as not to affect the analysis of the association between the variables studied and consequently, the validity of the study. A Confounding Variable is an extraneous variable whose presence affects the variables being studied so that the results you get do not reflect the actual relationship between the variables under investigation.

The confounding variables used will be incorporated as independent variables in different statistical tests. The selection of these variables is made with regard to the literature and the influence they can have on the rate of homicide by firearms.

The attached BOX 4 gives an overview of the variables taken into account. You will also find an appendix of the different values obtained for all the variables considered in our sample.

■ CORRELATIONS

As we stated at the start of this article, analysis of the connection between our dependent variable and the independent variables selected will be carried out by means of two distinct types of statistical tests: the bivariate correlations of Pearson on one hand and multi-regression analyses.

The first part corresponds to the results of bivariate correlations. These bivariate correlations were carried out in two stages: firstly, we will try to detect the significant associations between our dependent variable (the rate of homicide by firearms) and each of the independent variables taken into account. Then we will test these associations by examining a third variable– the PIB per habitant.

This final (partial) correlation, will enable us to check the economic influence hidden behind the selected variables. Research carried out in order to study the variation in the rate of homicide for a group of countries showed that **economic variables** were likely to influence this rate. In the same way, the wealth of a country seems to provide an undeniable explanation for criminality in general, or more specifically, in the variations observed in the rates of homicide from one country to another. More specifically, many studies, by focusing on different economic variables, have shown the link between the **per capita GNP** and the rate of homicide in a country. (Agha, 2009; Altheimer, 2008; Cochran & Bjerregaard, 2012; Lin, 2007).

Thanks to this processing step, once the partial correlation was established, we were able to determine that the variables for which there was a significant correlation with the rate of homicides by firearms could be considered as having a strong connection with our main dependent variable.

BOX 4

OVERVIEW OF THE VARIABLES TAKEN INTO ACCOUNT IN THE DESIGN OF THE RESEARCH	
CODES	VARIABLES
Dependant variable	
HOMFA	Rate of homicide by firearms
Variables of interest	
POSS	Availability of firearms
GUNRI	Severity of the legislation
Economic variables	
GDP	Gross domestic product by habitant
GINI	Income inequality in the population
UNPL	Unemployment rate
IMORT	Infant mortality rate
Demographic Variables	
URBPOP	Degree of urbanization of a country
YMPOP	Proportions of young men in the population
Social variables	
EDUY	Average number of school years
EDU25	Proportion of the population reaching higher studies
Criminogenic variables	
ALC	Consumption of alcohol
DGCAN	Consumption of cannabis
DGCOC	Consumption of cocaine
DGXTA	Consumption of ecstasy

BOX 5

PEARSON'S CORRELATION COEFFICIENTS **p<0.05 ***p<0.01			
CODES	(P)[i]	(GDP)[ii]	(N)
HOMFA X Economic variables			
GDP	-0.431***		50
GINI	0.683***	0,494***	51
UNPL	0.164	-0.178	51
IMORT	0.585***	0,552***	52
HOMFA X Demographic Variables			
YMPOP	0,591***	0,540***	51
URB POB	-0,136	0,001	52
HOMFA X Social variables			
EDU25	-0,369***	-0,236	51
EDUY	-0,428***	-0,326**	51
HOMFA X Criminogenic variables			
ALC	-0,292**	-0,310**	51
DGCAN	-0,041	0,061	51
DGCOC	0,155	0,184	48
DGXTA	-0,244	-0,216	49
HOMFA X Variables of interest			
POSS	-0,257	-0,167	51
GUNRI	0,004	0,112	52

[i] Pearson's correlation coefficients
[ii] Partial correlation coefficients (with GDP controlled)

As BOX 5 shows, each of the categories of confounding variables considered showed at least a significant correlation with the rate of homicides by firearm, thus showing the importance of considering them in the study of the phenomenon.

It is also important to underline that none of the correlations between our dependent variable and our variables of interest seem to be related.

Economic variables

As various authors have shown (Agha, 2009; Altheimer, 2008; Cochran & Bjerregaard, 2012; Lin, 2007), **GDP has a significant link to the rate of homicides.** The results obtained point in the same direction as those shown in the literature: **GDP** is linked in a negative manner to the rate of homicides by firearm (r=-0.431), the value obtained indicates a strong correlation, with important significance ($p<0.01$), which would tend to indicate that the *lower the income per inhabitant the higher the expected rate of homicides will be.*

We also find two other important correlations between our dependent variable and the economic variables measuring **the Gini coefficient and the rate of child mortality.**

The Gini coefficient is a ***measure of income inequality*** in a given country. It is one of the most used indices in transnational studies that aim to understand how poverty may be linked to criminality. Numerous studies have shown a **positive association between the number of homicides and this index of income inequality** (Cochran and Bjerregaard, 2012; Cole and Gramajo, 2009; Stamatel, 2009; Pridemore, 2008; Messner, Raffalovich and Shrock al., 2002 ;). The correlations obtained in this research also demonstrate a very significant correlation ($p<0.01$), which can be considered important or even very important (r=0.683), although it weakens a little when GDP is controlled (r_{gdp}=0.494). *Thus, the greater the income inequality, the higher the rate of firearm homicides will be.*

The same assessment may be highlighted regarding the association found between the rate of homicides by firearm and **the variable corresponding to the rate of child mortality**. This variable, corresponding to the rate of child mortality for 1000 births, is in fact considered as a **substitution variable of interest for measuring poverty** (Pridemore 2008)**.** Besides, various authors (Pare, 2006) consider that the **rate of child mortality as a measure of poverty is the best predictor of violent crimes.** Our results seem to point to a strong positive correlation between this variable and the rates of homicides by firearm (r=0.585), leading us to consider that *the higher the rate of child mortality, the higher the rate of homicides by firearm will be.* It can be noted that the strength of the correlation between this variable and our dependent variable remains almost unchanged once GDP is controlled (r_{gdp}=0.552), which would show that this measure differs from that of GDP or at least that it acts differently on the rate of homicides by firearm.

Contrary to some studies that show a positive link between unemployment and crime levels (Jongman, 1983; Raphael et Winter-Ebmer, 2001), we have not observed any significant correlation between this variable and the rate of homicides by firearm. Although, in general, unemployment has been associated with criminality, it is possible that it is only associated with certain forms of crime.

Demographic variables

Although a number of transnational studies show that more urbanization is associated with a higher number of homicides and the prevalence of greater social problems within a country, (Jacobs and Richardson, 2008 ; Pratt and Godsey, 2002), the correlations made in our sample of countries show no significant association between the degree of urbanization and the rate of homicides by firearm .

On the contrary, **the proportion of young men among the population** is correlated very significantly ($p<0.01$) to the rate of homicides by

firearm. This positive correlation may be considered important (r=0.591) even after having controlled GDP (r_{gdp}=0.540). This result follows along the same lines as the literature reports: there is a positive link between homicides and the proportion of young men (15-29 years old) among the population (Jacobs & Richardson, 2008). Thus, *the greater the number of young men among the population, the higher the rate of firearm homicides*. In fact, research on crime tends to show that it is men who are most often represented as the perpetrators in crime statistics and that it is also from among the young population that we find the higher rate of crime levels.

Social variables

Some authors demonstrated that informal social control could explain the variations in rates of violence among a population. The important social institutions such as family, school and work from a tender young age right up to adulthood, would exercise a certain amount of social control on individuals.

Similarly, a lower level of education would be linked to a lower level of social control and hypothetically to a higher proportion of victimization (Pridemore and Shkolnikov 2004; quoted by Pridemore, 2008).

The social variables that we have envisaged focus on the data linked to the education of the population. It is a question of the **average number of years spent at school** and **the proportion of the population aged over 25 having reached the equivalent of higher education** within a country. These two variables studied respectively present very significant correlations (p<0.01) with our dependent variable (r=-0.428, r=-0.369). In the two cases the correlations observed are negative which leads us to suppose that a higher level of education is linked to a lower rate of homicides by firearm. These results seem to underline the protective effect, highlighted in the literature that education could have on criminality in general.

It is, however, important to stress that these relationships weaken when the richness of the country is controlled. In fact, the variable "**proportion of people over 25 years of age who have reached level ISCED 5 or 6**" does not reach the significance threshold of (p<0.05) when GDP is controlled. The variable **"average number of years of study"** remains an important threshold of significance (p<0.05) but its relationship with the rate of homicides by firearm loses its strength as it decreases to rgdp=-0.326 representing a moderate negative association between the two variables.

Criminogenic variables

The variables considered in the "criminogenic" category concern the **prevalence of alcohol and drug use** (ecstasy, cocaine and cannabis) among the population.

Many studies throughout the world have, in fact, constantly demonstrated the association between alcohol and violent crime. More particularly, the association between the consumption of alcohol and homicides has also been highlighted in the literature (Adler et al. 1998; quoted by Van Dijk, 2012).

Our results also highlight a moderate correlation between this variable and the rate of homicides by firearm (r=-0.292; p<0.05). However, the correlations are all negative. This rather surprising analysis is the contrary of that generally stated in the literature. It assumes that *the higher the alcohol consumption of the inhabitants of a given country, the lower the rate of homicides by firearm*. Even when GDP is controlled this observation still applies (r_{gdp}= -0.310; p<0.05). Similar values and a similar result may be found for the overall homicide rate. We also tried to check this conclusion with the help of other data that could be an indicator of the alcohol consumption (number of deaths from cirrhosis of the liver per 100,000 inhabitants and recorded alcohol consumption per capita). The results and the parametric and non-parametric correlations lead to similar conclusions. However, we do not

have any explanation that is sufficiently supported to allow us to interpret this result.

With regard to drug consumption, even though there is consensus on the **association between drugs and crime** (Robert 2003), none of the correlations between our variables representing the prevalence of drug use (ecstasy, cocaine and cannabis) and the particular form of crime studied, homicides by firearm, reach a conclusive threshold of significance.

We obtain the same results when we cross-reference these "drugs" variables with the overall rate of homicides. No variable related to drugs is significant.

Variables of interest

Our first variable of interest, representing **the availability of firearms** among the sample of countries studied shows no significant correlation with the rate of homicides by firearm.

The second variable of interest, representing **the severity of legislation** related to firearms (the Gun Right Index inverted), does not seem to have a link to homicides by firearm either.

We note, therefore, that none of the variables related to our two hypotheses show a significant link to our dependent variable. This would lead us to suppose that none of the legal elements studied by the Gun Right Index or by the index reflecting the availability of firearms in the countries of our sample have a clear influence on the rate of homicides by firearm.

■ MULTIPLE REGRESSIONS

In order to refine the results, our second statistical test phase monopolizes the multiple regressions with a view to testing which variable(s) best predict the rate of homicides by firearm when severable variables are considered simultaneously.

We have devised 4 different models:

- The first will consider the **economic variables**
- The second will integrate the demographic and social variables
- The third model integrates the **criminogenic variables**
- Finally, the last model brings together the **variables which had been significant** and had presented most of the explanation in the preceding models.

These models will integrate in turn our two variables of interest that is to say **the availability of firearms and the severity of legislation** in relation to the rate of homicides by firearm, for a total of 8 models.

Indeed, despite the fact that, during the bivariate analyses, we could only observe marginal relationships between our variables of interest and the rate of homicides by firearm, it may be interesting to include them in the multiple regression models. It is, in fact, possible that these variables play a role in the explanation of the rate of homicides by firearm when we check the other variables simultaneously.

Each of the models has therefore 4 to 5 indices, which meet the requirements of our N (~50), knowing that it is considered that the regression may integrate an additional variable by tranche of 10 units of the total.

Before turning our interest to the results obtained, it is also important to specify that the observation of tolerance, allowed us to reject the hypothesis of the existence of a multi collinearity problem. This means that the indices studied do not present too much similarity. In fact, as the tolerance for the indices in general is higher than 0.10, we can therefore conclude that there is not too great an inter-correlation between the explanatory variables of the models

OVERALL ANALYSIS OF MULTIPLE REGRESSIONS WITH INSERTION OF THE VARIABLE, **AVAILABILITY OF FIREARMS** **p<0.05 ***p<0.01				
CODES	M1	M2	M3	M4
POSS Availability of firearms	**0,121**	**-0,003**	**-0,228**	**-0,059**
GINI Income inequality in the population	0,164			
UNEM Unemployment rate	0,116			
IMORT Infant mortality rate	0,157***			0,394**
YMPOP Proportion of young men in the population		0,414**		0,298
URBPOP Degree of urbanization		0,015		
EDU25 Proportion of the pop reaching higher studies		-0,109		
EDUY Average number of school years		-0,128		
ALC Consumption of alcohol			-0,338**	0,0158
DGCAN Consumption of cannabis			0,0767	
DGCOC Consumption of cocaine			-0,004	
DGXTA Consumption of ecstasy			-0,201	
R^2(ADJUSTED)	45%	33%	27%	43%

OVERALL ANALYSIS OF MULTIPLE REGRESSION WITH INSERTION OF THE VARIABLE, **SEVERITY OF LEGISLATION** **p<0.05 ***p<0.01				
CODES	M1	M2	M3	M4
GUNRI Severity of legislation	**0,250****	**0.094**	**0,228**	**0,229**
GINI Income inequality in the population	0.343**			0.285
UNEM Unemployment rate	-0.101			
IMORT Infant mortality rate	0.470***			0.382**
YMPOP Proportion of young men in the population		0.405**		0.151
URBPOP Degree of urbanization		0.01		
EDU25 Proportion of the pop reaching higher studies		-0.100		
EDUY Average number of school years		-0.140		
ALC Consumption of alcohol			-0.381**	0.01
DGCAN Consumption of cannabis			0.053	
DGCOC Consumption of cocaine			0.073	
DGXTA Consumption of ecstasy			-0.228	
R^2(ADJUSTED)	49%	32%	22%	49%

Overall analysis of multiple regressions with insertion of the variable, availability of firearms

Economic model

The economic model, using economic variables, allows us to highlight that only the **rate of child mortality** is significantly linked to the rate of homicides by firearm.

The relationship between our dependent variable and the rate of child mortality is, therefore, the only relationship which remains constant when the variables are integrated into the regression model.

This relationship is positive but weak (r=0.157), although it reaches a substantial significance threshold ($p<0.01$). The other economic variables, as well as our variable of interest related to the availability of firearms, do not reveal any significant result.

Socio-demographic model

The second model considering the social and demographic variables show that only the **proportion of young men among population** seems to be a good predictor (=0.447) of the rate of homicides by firearm when all the social and demographic variables are considered. The link observed is positive and significant at $p<0.05$.

Criminogenic model

In this third model only the consumption of alcohol remains linked to the rate of homicides by firearm when the other criminogenic variables are taken into account, with a significance threshold of $p<0.5$.

It is notable here again, that the standardized regression coefficient is negative (r=-0.381), confirming the correlations previously made. The consumption of alcohol is still negatively linked to the rate of homicides by firearm.

Explanatory variables model

As explained above, the fourth model integrates the variables that have had the highest explanatory power regarding the variation in rates of homicides by firearm. This model is, therefore, made up of significant variables from the preceding models, to which we have added, as in each of the previous models our variable of interest "availability of firearms".

In the preceding models the best explanatory indices were:

- the child mortality rate,
- the proportion of young men among the population,
- Alcohol consumption.

Once the different variables having a significant explanatory power are brought together in the same model, **only one explanatory one still seems to have a significant link to the rate of homicides by firearm** and that one is **child mortality ($r=0.394$; $p<0.5$).**

This result means that in this series of regressions, integrating our variable of interest "availability of firearms", child mortality is the indicator that best explains the variations observed between the different rates of homicides by firearm. Moreover, the positive relationship observed seems to indicate that *the higher the rate of child mortality, the higher the rate of firearm homicides will be*. It is therefore the variable which best predicts what the extent of the rate of homicides by firearm in a given country will be.

This last result must be completed by analyzing the coefficients that determine each of the models created in order to be in a position to establish the strength of the explanatory power of the latter.

This analysis is based on the percentage variance of our dependent variable that can be explained with the help of the models that we have just presented.

Regression coefficients

By examining the determination coefficients produced form our multiple regression, we can observe the percentages of variance of rates of homicides by firearm that can be explained by each of the models.

	M1	M2	M3	M4
R^2	45%	33%	27%	43%

By comparing the variance of the first and the last model (R^2) (45% and 43%) we can notice that more than 40% of the variance in rates of firearm homicides in our sample can be explained by the variables specific to each of these.

As these models are linked to the most significant economic and explanatory variables respectively, it seems acceptable to consider that it is the variable that is common to these two models, that is to say, **the infant mortality rate** that has the most explanatory role.

Finally, regardless of the model considered, the availability of firearms does not play a significant role in the explanation of the variation in rates of homicides by firearm in our sample.

The latter assessment, therefore, allows us to refute our original hypothesis (H1) setting forth a link between the availability of firearms and the rate of homicides by firearm.

OVERALL ANALYSIS OF MULTIPLE REGRESSION WITH INSERTION OF THE VARIABLE, SEVERITY OF LEGISLATION

Economic model

In this first model, we can notice that 3 variables are significant among the economic variables taken into consideration with the severity of legislation. **The Gini coefficient (r=0.343), child mortality (r=0.470) and the severity of legislation (r=0.250).**

The Gini variable and child mortality were already linked to the rate of homicides by firearm during the bivariate analysis and they remain so here, in a positive way, with high thresholds of significance ($p<0.5$ and $p<0.01$ respectively).

On the other hand, the index on the severity of legislation is linked positively to the rate of homicides by firearm. Even though the bivariate correlations did not provide evidence of a significant association with the rate of homicides by firearm in this economic model, the variable maintains a positive significant relationship with the rate of homicides by firearm. This would lead us to understand that in this economic model, *severe legislation is associated with a high rate of homicides by firearm*.

Therefore, we can conclude that in this economic model, three of the variables considered are significant predictors of variations that may be observed between the different rates of homicides by firearm in our sample.

Socio-demographic model

The second model which takes into account the demographic and social variables, shows that the **proportion of young men in the population** seems to be a good predictor (=0.447) of the rate of homicide by firearms because all the demographic and social variables are taken into account. The observed link is positive and significant at $p<0.05$.

Criminogenic model

In this third model, only **alcohol consumption** remains linked to the rate of homicide by firearms when the other criminogenic variables are taken into account with a significance threshold of $p<0.5$.

It is to be noted that here as well, the standardized regression coefficient is negative (r=-0.381), confirming the previously observed correlations. Alcohol consumption is therefore

still negatively linked to the rate of homicide by firearms.

Model with the best explanatory variables

The fourth model incorporates the best explanatory variables for the rate of homicides by firearms from previous models and the severity index for firearms.

- The severity of the legislation
- The GINI coefficient
- The infant mortality rate
- The proportion of young men in the population
- The consumption of alcohol

The results show that only one explanatory variable always seems to be significantly linked to the level of homicide by firearms when it is incorporated into the regression model, **the infant mortality rate.**

In a similar way to the series of regressions previously carried out, it therefore seems that the variable representing infant mortality is that with the strongest explanatory power.

This result signifies that in this series of regressions, incorporating our variable of interest "severity of the legislation", infant mortality is the most explanatory indicator of the variations observed between the different rates of homicide by firearms in our sample.

Here again, the latter observation must be completed by analysis of the determination coefficients of each of the models created in order to be able to establish the explanatory power of these models.

Correlation coefficients

We can observe that the determination coefficients of the first and last models are identical (49%). In this sense, nearly 50% of the variance of the rate of homicide by firearms in our sample can be explained by the variables of these models. In view of these two models, it seems acceptable to consider that the **infant mortality** variable plays an important role in this explanation.

	M1	M2	M3	M4
R^2	49%	32%	22%	49%

In this global model, the severity index for legislation is no longer significant. In addition, as previously stated, it is probable that the entire explanation for the variance in the rate of homicide by firearms is due to the infant mortality variable.

These results therefore allow us to **invalidate our second research theory: we were unable to find any substantial significant link between the severity of the legislation in any given country and the rate of homicide by firearms.**

Here also, **the variable having the biggest impact on the rate of homicide by firearms is the economic variable representing the infant mortality rate.**

SUPPLEMENTARY CORRELATIONS

In the last section of this statistical part we looked at the question as to **what influence the availability of firearms might have according to the types of homicide taken into account.** This preoccupation also allows us to find an answer to our third secondary theory according to which **"there is a significant link between the availability of weapons and the overall rate of homicide".**

In this way we were able to distinguish:

- The overall rate of homicide
- The rate of homicide by firearms
- The rate of homicide by other means than firearms

SPEARMAN'S RANK CORRELATION COEFFICIENTS [I] **p<0.05 ***p<0.01		
	(S)[I]	(N)
Rate of homicides	-0.175	51
Rate of homicides by firearm	-0.012	52
Rate of homicides by other means	-0.235	51

We carried out analyses of bivariate correlations with the aid of the Spearman's non parametric statistics as this test is the least sensitive to data that varies greatly from the average.

By using a critical threshold of $p<0.05$, no significant association was found between the variables studied.

These results lead us to the conclusion that the **availability of firearms as we have conceptualized it, is not associated with the overall rate of homicides in our sample and consequently, to reject our third theory suggesting the existence of this link (H3).**

LIMITATIONS

The principal limitation of this study, as in any transnational study, lies in the fact that analysis at a national level masks local and regional differences that can exist in the countries studied. The rate of homicides can vary greatly within a single country, this observation also applies to homicides by firearms. The ecological and transversal design of our study does not allow us to take these variations into account.

In addition, as we highlighted several times, the variables studied were conceptualized by different means. While some of them unequivocally represent one or other variable and by extension one or other reality (for example the rate of homicides by firearm), others are more open to interpretation despite the fact that they are used in various research programmes (such is the case with our variable of interest "availability of firearms"). In addition, while most indicators are collected in a standardized way by world organisms, the possibility remains that some variables are not accounted for in an adequate or rigorous manner at a local or national level causing a loss of data or approximations with regard to the figures produced.

Finally, once the analyses have been carried out, the interpretation of an indicator, and consequently the link it is likely to have with another can sometimes be vague. Vigilance and subtlety are necessary during any process that aims to quantify, with a view to interpreting, the links that exist between social, educational, cultural or economic realities. We will finish with a reminder that the connections detected by our tests are linear, other connections could exist between certain variable.

CONCLUSION AND DISCUSSION

At the end of our analysis, we can now return to our main research hypotheses focusing on the link between the rate of homicides by firearms and the availability of firearms (hypothesis 1), as well as the link between the rate of homicides by firearm and the legislation with regard to firearms (hypothesis 2).

None of the tests carried out on our data, (n=52) seem to consistently indicate that the two variables of interest have indicated a significant relationship with the rates of homicides by firearm or, more generally, with the overall rate of homicides.

This assessment, therefore, leads us to reject our first two hypotheses: neither the severity of legislation nor the availability such as we conceptualized them seem to have a significant link to the rate of homicides by firearm.

In the following paragraphs we will re-examine in more detail the relationships observed between the variables studied.

LINK BETWEEN AVAILABILITY, HOMICIDES AND HOMICIDES BY FIREARM

The substitution measure representing the availability of firearms among the population did not appear significant in any of the correlations carried out. Moreover, it did not appear as significant in any of the tested multiple regressions.

Our hypothesis H1 (setting forth a link between homicides by firearm and the availability of firearms) as well as the secondary hypothesis H3 (setting forth a link between the overall rate of homicides and the availability of firearms) are thus rejected due to the absence of any consistent significant result during the various test phases.

If we put the results obtained in relation to the studies on the link between the availability of firearms and mortality by firearm into perspective, we can also underline, like Kleck, that there is general inconsistency in the results put forward by the literature, no doubt because of the very diverse measures used to conceptualize the availability of firearms in a given country.

With regard to the theoretical hypotheses presented by the literature on the possible link between the availability of firearms and crime, our results force us to reject the hypothesis whereby the possession of firearms would increase the rate of homicides and especially homicides by firearm (a hypothesis of facilitation or an incitement factor). None of the results shown in our series of analyses on the sample of countries selected allow us to follow this path.

If the negative correlation obtained could, at first, make us lean towards the first hypothesis, the weak significance of this result, and especially, the absence of a significant link detected between the availability variable and the rate of firearm homicides in our various models of multiple regressions, each time checking a set of confounding variables (social, economic, demographic and criminogenic), lead us to the assumption that there is no link showing a linear relationship between the availability of firearms and the overall rate of homicides by firearm. Therefore, it is possible to conclude that an increase or decrease in one of these variables concurs with an increase or a decrease in the other.

The explanation put forward by the partisans of this approach may be, according to them, the result of two elements:

- The availability of firearms may simply not influence crime levels. Thus the use of an arm could reflect greater motivation to undermine the victim vis-a-vis the perpetrator (Wolfgang, 1958, quoted by Altheimer, 2010). If this hypothesis is true, the absence of available arms would lead the attacker to use another type of arm to achieve his target.
- The second possibility is the link between the availability of firearms and crime may not be detected because of the defensive use of a firearm. Firearms used in the case of legitimate defence could neutralize the effects of firearms used for criminal attacks. (Kleck, 1997 quoted by Altheimer, 2010).

So, the observable link could be neutralized by opposing or compensation effects.

When applied to a macro-analytical perspective, these assertions suggest that a change in the availability of firearms will not influence or will not be linked to crime.

If it is not possible for us to pronounce on the authenticity of these two explanatory avenues, it is however possible to maintain that, in light of our results, no concrete and quantifiable link could be detected between this variable of interest and our dependent variable, nor more generally between the availability of firearms and the overall rate of homicides.

Finally, let's recall that our analyses are drawn from a substitution measure which, although it is recognized as the one best reflecting the reality related to the availability of firearms within a country, may not be suitable for all the countries selected.

In fact, we can note that some countries show extremely low rates of availability. Therefore, this indicator may only be effective in regard to some countries that have one or more specific characteristics that cannot now be used as evidence in the research carried out on this subject.

Moreover, this variable takes into account all the firearms available in a country. No distinction can be made to evaluate illegal and legal possession of arms in circulation. Yet, it would certainly be interesting to compare the results obtained during this study to those that could be obtained of we only considered the prevalence of illegal firearms.

In fact we have to note, like Stolzenberg and D'Alessio (2000), the importance of the use of illegal arms in criminal activity.

Similarly, as Cook highlighted (1979, quoted by Stolzenberg), it is possible that the illegal possession of arms increases the number of violent crimes, whereas the possession of legal arms would reduce this type of crime.

These statements suggest that the possession of both legal and illegal arms influence the rate of homicides by firearm but in the opposite way, which would be in line with the explanation advanced by Kleck (2004) regarding the absence of a link that could be observed between the availability of firearms and the rate of homicides by firearm.

In order to verify this supposition, Stolzenberg and D'Alessio carried out a study in South Carolina between 1991 and 1994, using the number of licenses sold (legal possession) and the number of arms stolen (illegal possession). Their research tried to highlight the existence of a negative association between the legal possession of firearms and the rate of violent crimes and a positive association between the illegal possession of firearms and the rate of violent crimes.

Their results show that:

1. There is no link between legal possession of arms and violent crimes

2. There is a positive association between illegal possession of arms and violent crime.

If their basic hypotheses have only been partially verified (the legal possession not being significantly linked to the rates of violent crimes) the association between illegal possession and violent crimes, is the only significant association and it is positive that they manage to show this, showing how this type of study can be useful.

Of course, the big problem with this strategy lies in the difficulty to quantify, or, put more simply, to assess the extent of illegal possession of firearms in a greater or lesser number of countries. Nonetheless, we can state that some researchers have recently focused on this problem while recommending measures that can shed some light on this problem that is so difficult to investigate (Morselli and Blais, 2013), thus encouraging future research in the area.

■ THE LINK BETWEEN LEGISLATION AND HOMICIDES BY FIREARM

The analyses of bivariate correlations have not demonstrated any significant link between the legislation relative to firearms as we have conceptualized it and the rate of homicides by firearms in our sample.

This observation is much more conclusive than when the variable "severity of the legislation" is integrated into our regression models, this variable is systematically positive and is seen to be significant in the regression model that takes economic variables into account and their links to the rate of homicides by firearms.

As the established relationship is positive, this leads to the conclusion that the more severe the legislation is, the higher the rate of homicide by firearms is. Here also, once transferred to the model that integrates the most explanatory variables, the relationship between the severity of the legislation and the rate of homicides by firearms loses all significance to the benefit of variables whose explanatory power seems much greater.

With regard to the literature, it should be noted that the results obtained are convergent and divergent in equal measure given the absence of scientific consensus in this field. In fact, while some studies relative to the link between legislation and the rate of homicides by firearms point to a link between certain specific laws and firearms-related criminality, the evaluation of these studies by the Task Force on Community Preventive services (Hahn et al., 2005) reports that no definitive conclusion can be drawn from these because of certain significant methodological biases.

It is also important to point out that both in the context of the study of the link between legislation and homicides by firearms and that which links the latter to the availability of firearms, very little research has been done in countries outside the United States.

In addition, concerning the measure of "legislation", no standardized index is available. Studies tend to be focussed on a specific legislation or a specific country making national and international comparisons complicated or even meaningless.

It is to be noted also that while our study tends to measure the severity of legislation in each country studied, there is a variable that is part of this severity which could not be taken into account. This variable relates to the effective application of checks and sanctions put in place with regard to firearms.

In effect, if the Gun Right index attempts to measure in a more or less in-depth way the manner in which states have legislated for the availability of firearms through prohibition and checks, the issuing of licenses, stocking rules among others, it is certainly evident that the severity of these regulations could be entirely fictitious.

While the different rules, regulations, laws and measures are enacted at both a national and international level but are not applied or are applied in a way that is too lax or random, it is evident that the actual severity of the law will be somewhat greatly reduced. A gulf between the written law and the application of these laws remains.

If it were possible to imagine research designed to be able to measure or at least attempt to approach this part of reality, studying the effectiveness of this at an international level would seem to be subject to important constraints of both a human and financial nature and would require an associative approach involving research centers, services and universities, each one being capable of gathering standardized data.

This conclusion is also to be applied to the collection of other measures relative to the availability of firearms or more specifically, illegal possession thereof.

In conclusion, and given the observations made by means of our tests, our data does not allow us to identify a significant effect of the availability of firearms or the legislation relative to firearms on the rate of homicides by firearms.

We want to underline the fact that, with regard to our basic theories, and therefore the objective of the present research, that the biggest difficulty posed by our theories lies in the adequate conceptualization of the variables of interest.

While the variable of "availability of firearms" has already been the subject of a large number of studies and debates, evaluating the relevance and validity of alternative measures such as the one we have already used, that is to say the number of suicides by firearms on the total number of suicides, the variable linked to the "severity of the legislation" has unfortunately not enjoyed the same scientific enthusiasm.

We would also highlight the fact that the general lack of interest in this problem in the European scientific sphere has left a great void in the scientific literature on this subject.

It must be noted however, that the analyses carried out have enabled us to consistently distinguish that a certain number of our confounding variables, whether they be economic, social, demographic or criminogenic, were valuably linked to the rate of homicide by firearms in a given country regardless of the statistical processing planned.

As well as the interest of these results, they underline the importance that needs to be accorded to understanding these different variables when carrying out studies on our subject. As we pointed out, these variables are still too often ignored, causing biases in the interpretation of results and undoubtedly, also causing a number of "fictitious" relationships between the variables studied.

THE CONFOUNDING VARIABLES

All the tests carried out seem to consistently indicate that a certain number of confounding variables taken into consideration are linked, through bivariate correlations and multiple regressions that were carried out, to the rate of homicides by firearms.

The most significant linked variables are:

- Infant mortality
- income inequality
- the proportion of young men in the population
- the consumption of alcohol

We find two variables linked to an economic dimension (infant mortality and income inequality), a demographic variable (proportion of young men in the population) and a criminogenic variable (consumption of alcohol).

Our results therefore point in the same direction as those studies that point to a link between economic variables and homicides, and more specifically, while our results are verified in equal measure for the overall level of homicides and the homicides by firearms. In the spirit of researchers such as Cochran and Bjerregaard (2011), Cole and Gramajo (2009), or Chamlin and Cochran (2006), we have also shown an important positive association between the income inequality and homicides. Our results show a partial correlation with a control of GNP of 0.494 ($p<0.01$), while our second economic multiple regression model indicates a beta coefficient of 0.343 while a set of economic variables are controlled.

With regard to the proportion of young men in the population, our observations also point in the same direction as research carried out in this area establishing a positive association between this variable and homicides by firearms. Our correlations give us an r_{GNP} of 0.540 ($p<0.01$), while our two socio-demographic models of multiple regressions show beta coefficients of 0.414 and 0.405 each with a significance threshold of 0.05.

With regard to the consumption of alcohol, the results detected are very surprising here because, notwithstanding the types of analyses, the continually indicate a negative association between the consumption of alcohol and homicides or homicides by firearms. Even when changing the indicator for this variable, the meaning of this correlation stays the same. Our analyses have allowed us to show correlations of r_{GNP}= -0.310 ($p<0.05$), and our multiple regression models have revealed coefficients of -0.338 and -0.381 ($p<0.05$). These results are therefore in total contradiction with the research studying the link between the consumption of alcohol and homicides that we were able to detect in our literature review (Adler et al. 1998, Rossow, 2001, quoted by Van Dijk in 2012). To the best of our knowledge, no other study has shown similar results.

Finally, we have also shown the relationship linking the overall level of homicides, homicides by firearms and infant mortality. The partial correlation obtained after checking the GNP is 0.552 ($p<0.01$) and those obtained in our economic multiple regression models are 0.157 for one 0.470 for the other ($p<0.01$).The particularity here comes from the fact that when this variable is integrated with the most explanatory regression models, it remains the only significant variable with coefficients of 0.394 and 0.382 ($p<0.05$) when the other more explanatory variables are checked.

In other words, this signifies that in the different variables taken into account by this study, the

indicator which seems to have the greatest explanatory power is the rate of infant mortality. The link between this variable and our dependent variable, the rate of homicides by firearms, subsists regardless of the tests used (bivariate, multivariate), with a large significance threshold.

This observation leads us to think that more than the availability of firearms or the severity of the legislation, the extent of the infant mortality rate in a given country is the best predictor of the extent of homicides by firearms.

As astonishing as this may seem, it should be remembered that this type of variable can reflect another reality entirely. Indeed, following these results we tried to identify other studies that focused on the link between "infant mortality" and criminality, and more particularly, to homicides. As Pridemore (2008) pointed out, too few transnational studies outside the US have taken into consideration the influence that economic variables can have on the rate of homicide in a given country, particularly due to lack of access or availability of comparable data from one country to another.

In order to compensate for this shortcoming, he encouraged researchers to use the measure relative to infant mortality as a substitution variable.

His research (Pridemore 2008) then led him to detect a positive and significant correlation between this "substitution" variable and the rate of homicide in a sample of 46 countries.

Pridemore, added, following these results, that infant mortality was in fact a superior indicator, in terms of measurement and validity with the other economic variables habitually used (for example, GNP per habitant), and this by virtue of the quality of the definition, the data gathering and through this, the standardization of this data throughout the world. He then suggested that infant mortality seem to capture the significance of "poverty" better than traditional measures. (Messner et al. 2010) Other researchers interested in poverty also concluded that infant mortality was capable of reflecting a set of elements that are difficult to measure across different countries such as access to drinking water, the quality of air, the quality of diet etc. (Ross 2006, quoted by Messner et al. 2011).

Behind these conclusions, as demonstrated by Messner et al., is the distinction that can be made between the "absolute" and "relative" poverty of a population.

It is possible to distinguish these two concepts and the variables that are linked to them. The "absolute" poverty of a person can be defined as the fact that "the level of resources" at his disposal is insufficient to meet the basic needs of life. (Messner 1999, quoted by Messner and al 2010). This "absolute" poverty can, for example, be conceptualized by GNP per habitant.

However, this approach of viewing poverty omits a very important factor: "what people judge as the fact of being poor, varies in time and space" (Messner and al 2010). This observation reflects the "relative" aspect that can relate to poverty. As Messner points out, the well-being of a person is always relative to the conditions and well-being of those around them.

From the point of view of these different observations, Messner and al (2010), decided to investigate the link that was likely to associate infant mortality, relative poverty, absolute poverty and the rate of homicide in a sample of countries.

As well as the significance and robustness of the link between homicides and infant mortality, this study showed the association between infant mortality and "relative" poverty (conceptualized by the GINI coefficient). In fact, the results show, by means of different regression models, that if absolute poverty does not seem to be a good predictor of the variations in the rates of homicides in the selected countries, relative poverty and infant mortality are good predictors.

In addition, the study demonstrates a predominant influence of infant mortality on the rate of homicides, even after controlling the variable relating to the "relative "poverty of countries. This result shows; as in the context of our research, that infant mortality seems to be the best predictor of the rate of homicides.

In order to explain these results, Messner et al. suggest that this last variable is more sensitive to the institutional context of a country. They go further by concluding that infant mortality seems to better capture the social conditions relevantly

linked to the rate of homicides and which go beyond strict material conditions.

"Especially in Europe, poverty researchers have increasingly expanded the conceptualization of disadvantage to encompass not only restricted access to material resources but also barriers to meaningful participation in society more generally. Such disadvantage is often discussed under the rubric of social exclusion, which has been conceptualized as a distinctively multidimensional and multilevel construct (Hills et al., 2002; Iceland, 2005; Sen, 2000)." (Messner and al, 2010)
"In short, it seems plausible to propose that the infant mortality rate yields independent explanatory power in our sample of advanced nations because it captures aspects of the adverse social conditions confronting excluded, marginalized populations that are not fully reflected in any of the income-based poverty measures." (Messner and al, 2010)

For Messner, the fact that in the United States the rates of homicides could be reasonably predicted by absolute poverty in contrast with the European countries, stems from the fact that the European countries possess more elaborate and general state social security systems than in the United States. In these countries, it is noticed that relative poverty (conceptualized by the GINI index) does not manage to take into account social conditions of the "theoretical" population in their entirety, particularly for a part of the population that is marginalized or excluded, while the infant mortality index manages to do so.

■ FURTHER REFLECTION

To complete this research, we will return one last time to the variables of interest which guided our study.

With regard to our variable relative to availability of firearms, it is possible that it is not the possession of firearms in general which is linked to criminality, or more specifically, the rate of homicides by firearms, but the illegal possession of firearms.

Here too, this theory is certainly linked to prescriptive and repressive frameworks implemented in a given country to control the possession of firearms. As a good number of criminal phenomena show, the impact of an adequate prescriptive system should not be sought directly in the reduction of the phenomenon in question but in the means made available to manage and control the phenomenon it refers to.

As Messner et al. Point out in the conclusion to their research (2010), it is indeed the illegal possession of firearms that appears to be the most explanatory variable for the rate of violent crime, this result implies an important change of perspective, whether this be for future research or for political reactions to be granted to these facts, namely, a reorientation of actions to be implemented.

If the possession of illegal arms (in this case stolen arms) is really linked in a consistent way with criminality by firearms, it would be useful to concentrate efforts with regard to legislation not on purchasing restrictions or licencing, but on a strengthening of secure storage practices and action on firearms theft as possible actions to reduce violent crime.

To finish, it is important to point out that if we pursue this line of reasoning a little further, promoting more extensive regulations but restricting access to firearms could provide transparency to the legal loopholes and black markets resulting from prohibition which are by definition almost impossible to control.

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