DIMENSIONS OF SOCIAL CAPITAL AND HOMICIDE RATES IN BRAZILIAN MUNICIPALITIES

By

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Submitted to

Central European University - Department of Public Polices

Institut Barcelona D'Estudis Internationals

In partial fulfillment of the requirements for the degree of Eramus Mundus Master in

Public Policy

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I hereby certify that this dissertation contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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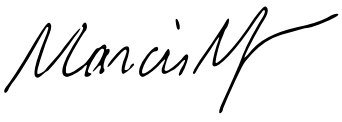
Signature: 

Location and Date: Barcelona - July 1st, 2016.

ABSTRACT

Based on a measure of social participation and political interest, derived from the concept of social capital, this study empirically investigates the relation between civil associations and homicides rates in Brazilian municipalities. Using data from the social-economic survey filled in by the candidates of the High School National Examination, known by its Portuguese language acronym ENEM, this study checks if municipalities with bigger frequency of social activities have a tendency to present lower homicide rates and if participation in different types of social activities impacts differently on homicide. Complementarily, the study checks if municipalities with citizens that declared higher levels of political interest have a tendency to present lower homicides rates. Based on linear regression models, the investigation controls for demographic and economic aspects. Data analysis shows positive relation between homicide rate and social participation as well with political interest. Additionally, different types of social participation influences differently in homicide. The result seems to contradict the dominant theoretical approach and underscore the need for further investigation considering the reciprocal relations that homicide might have with social capital. Finally, the research set the bases for further investigations that might help to cast light over the complex phenomenon of violence using Brazil as a study case.

ACKNOWLEDGEMENTS

It is a pleasure to express my deep gratitude for my family who made the Master Project feasible, supporting me – as always – in every single step I have made since the admission process to the final project. I would not have made it without my competent backup-team.

Special thanks for Lara, for constant encouragement, companionship, dedication and love. To find appropriated words to use in this paragraph might be the most difficult task in this project but I at least take this opportunity to register my profound admiration for her and her expertise in making wishes reality. Thank you for creating our history and making me a better person everyday.

I profusely thank professors Sara Svensson and Robert Kissack who gave me total autonomy and trust during the process of this project. Special mention also to professor Xavier Marín who introduced me to the world of statistical computing. I am sure that the current project is just the first exercise in an area that I will dedicate more in the future years.

Finally, thanks to my program colleagues. I have definitely broadened my understanding of the world due to our daily interactions.

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INTRODUCTION

With the unprecedented current pace of urbanization, the whole notion of violence is currently becoming less structured around wars and conflicts and more focused around criminal violence, terrorism and civil unrest. Increasing number of military and law enforcement specialists state that "fragile cities" in urban peripheries constitute sites for the "future war of this century". According to Muggah, in 1950, just 30% of the world's population were considered urban dwellers. This rate is expected to go up to 70% by 2050. Moreover, this growth is expected to be mainly concentrated in the less developed regions, especially in Sub-Sahara Africa, Asia and Latin America.

Although rapid growth is not solely responsible for the existence of violence, it is evident that the metropolitan areas in those regions are the most sensible areas that are already witnessing a sharp escalation in the incidence and severity of various forms of violence. Thus, this century is likely to testify the sharp escalation of various forms of violence that will occur in the spatial area of the cities highlighting the importance of studies related to the behavior of violence in municipalities (Muggah, 2012).

Giving a strong contribution to the bad performance of the Latin America, Brazil is the world leader of homicide in absolute terms: over 64,000 inhabitants were killed in 2014; in relative terms considering the size of the population, the homicide rate is currently equivalent to 23,32 deaths per 100 thousand inhabitants (Waiselfisz, 2015). Analyzing Brazilian's homicides time series, despite the recent reduction in social vulnerability experience by the country in the last decade, the national homicide rate has stabilized in a very high level that ranges from 25 to 30 homicides per 100 thousand inhabitants. The reduction in social vulnerability was not automatically translated into lower levels of violence in many municipalities. This variation on social situation of the country without the correspondent decrease in violent levels, creates the opportunity to investigate the associations of social indicators and violence.

The present study is inserted in this context. The idea is to use measures derived from the concept of social capital in an empirical exploratory exercise that looks into violence across municipalities in Brazil. As detailed in the following sections, the study analyses the relation

between the participation on social activities (such as participation on religious groups and neighbourhoods associations), political interest and homicides rate, across municipalities.

This study is structured in four chapters. In Chapter 1, there is a brief literature review covering comprised by sections related to homicides and social capital studies and more specifically provides a view of the dynamic figures of homicides in Brazil.

Subsequently, Chapter 2 displays aspects related to the research design such as the statement of the research question and hypotheses. Considerations about the operationalization of the exercise are also presented.

Chapter 3 presents and discuss the findings. Chapter 4 summarizes the study dedicating a specific session to the possibilities of further investigation based on the findings and methodology adopted on this thesis.

Chapter 1 – Literature Review

This chapter is comprised of a brief literature review positioning this study in the theoretical debate. Specifically, the following sections identify the conceptualization and theory related to homicide studies and link that with the studies of social capital. Additionally, this chapter aims to contextualize the study in light of the current debate about homicides in Brazil. Finally, it is presented some remarks in terms of public policies related to violence.

1.1 Homicides Studies

Through the last century, criminology has dedicated massive efforts in tracking what are the determinants of a crime. Yet, the study of violence is not an exclusive objective of criminologists: economists, anthropologists, architects, behavioral analysts, demographers, geographers, political scientists, sociologists and urban planners already contributed substantially to the debate (Muggah 2012). All areas conducted empirical experiments that identified diverse factors related to violence.

Cerqueira and Lobão did an extensive review of the theoretical models concerning the determinants of crime and empirical studies based on those theories. Table 1 presents a brief description of the mainstream theoretical approaches and the most frequent used variables in empirical research related to each approach (Cerqueira, Daniel; Lobão, 2004). The table indicates that, according to the theory adopted, a specific understanding of violence is assumed and a specific set of variables is used.

Table 1- Summary of Theories and Variables

Theory	**Approach**	**Variables**
Social Disorganization	Systemic approach around the community, understood as a complex network system of formal and informal associations.	Socioeconomic Status; ethnic heterogeneity; residential mobility; family breakdown; urbanization; networks of local friendships; unsupervised groups of teenagers; institutional participation; unemployment; and the existence of more than one occupant per room.
Social Learning	Individual behavior is determined	

	by personal experience in personal interactions and on the communication process used in conflict situations	Family supervision of degree; cohesion intensity in the friendship groups; existence of friends in trouble with the police; perception of young people about others involved in delinquency problems; young people living with their parents; and contact with criminal techniques
Rational Choice	The individual decides their involvement in criminal activities from the rational assessment of gains and expected losses arising from illicit activities vis-à-vis the alternative gain in the legal market.	Wages; family income; income inequality; access to social welfare programs; Police efficiency; population density; magnitude of punishment; criminal inertia; social learning; and education.
Social Control	Individual belief and accordance with the social contract (agreements and social current values) established the link with society and avoid crime incidence.	Citizen involvement in the social system; accordance with the values and rules in force; affiliate link; delinquent friends; and deviant beliefs.
Self-Control	The non-development of psychological self-control mechanisms in the phase following two years of pre-adolescence, which distort the socialization process by the lack of limits.	Individual capacity to relate choices and consequences; individual capacity to denied joyful opportunities in face of obligations.
Anomie	Inability of the individual to achieve desired goals. 3 approaches: a) individual aspiration differences and available means; b) blocked opportunities; and c) relative deprivation	Social networks; Social sources of tension; Negative life events; daily suffering; negative relationship with adults; family fights; disputes with neighbors; and tension at work.
Interactional	Dynamic interaction process with two ingredients: a) evolutionary perspective, whose criminal career begins at 12-13 years, gains intensity at 16-17 and ends by the	The same as those contained in the theories of the social learning and social control

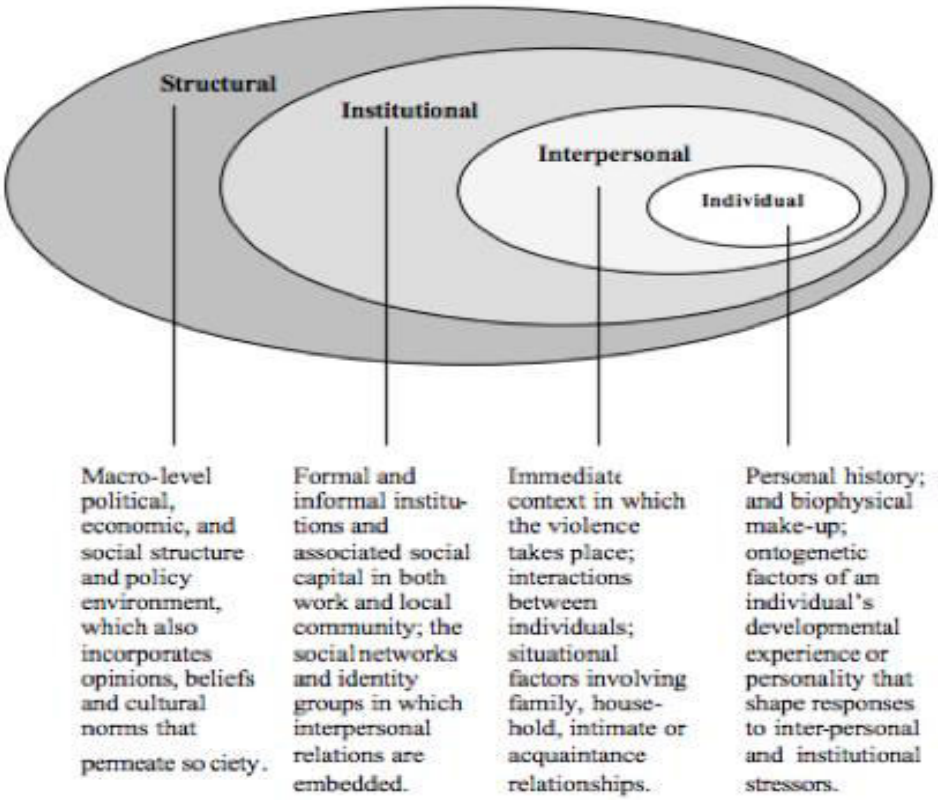
	age 30; b) interactional perspective that understands the crime as a cause and consequence of a number of factors and social processes.	
Ecological	Combination of attributes belonging to different categories subject to delinquency. These attributes, in turn, would be included at various levels: structural, institutional, interpersonal and individual.	All of the above variables can be used in this approach
Source: Determinants of Criminality – Theoretical and Empirical Results (Cerqueira, Daniel; Lobão, 2004)		

The authors' systematization shows the complexity of the phenomenon under debate: the variables used to empirically research violence go from the subjective process of physiological formation of a child to the macro-structural organization of a society. The disputes over the concept of violence and the vast spectrum of variables might explain the divergences in empirical findings: according to the chosen approach, particular importance is regard to one variable in detriment of others, resulting in a specific narrative of the observed phenomenon.

The Social Disorganization Theory is notably important to this study. The theory directly links crime rates to neighborhood characteristics. According to the development of Shaw and McKay, delinquency was not caused at the individual level, but is "a normal response by normal individuals to abnormal conditions". Under that theory, the residential location is a substantial factor that shapes the likelihood of involvement in illegal activities (Bond, 2015).

In fact, some authors point that Social Disorganization theory derives from the Ecological Theory. The Ecological Theory sustains the understanding that forms of violence vary significantly between societies, between communities and between different individuals. The theory is an attempt to integrated the various levels of violence causality identified in the other theories (Shrader, 2001). Thus the Ecological Approach assumes a very comprehensive perspective, in which similar relevance

is given to variables in various levels (structural, institutional, interpersonal and individual), as illustrated in Figure 1 below.



Source: Methodologies to Measure the Gender Dimensions of Crime and Violence (Shrader, 2001)

Figure 1 - The Ecological Theory - Comprehensive perspective

More important for this research is the fact that the Ecological Approach recognizes the mutually reinforcing role played by factors at different levels of causality. It demonstrates that no singular level is exclusively determinant or explanatory of violence but, when combined with one or more additional variables, may yield in a situation where violence occurs (Shrader, 2001). In other words, the Ecological Theory understands violence as precursor of violence.

The mutual relation among factors certainly adds complexity to the theoretical disputes turning empirical exercises a harder task. This difficulty is further intensified if scarcity of reliable and disaggregated data is taken into consideration. Homicide data are the most collected and more often used indicator of violence. However, even in homicide data there is divergence in the methodology

related to the classification of the causality and circumstances of death. Moreover, the issue of under notification is commonly mentioned in literature (Cerqueira, 2014).

Lack of reliability also applies to the explanatory variables. Often studies about violence rely on indirect ways of measurement that requires a number of assumptions and limit the external validity of the findings. Therefore, most of the empirical experiments on violence are only meaningful to specific situations in which the assumptions and simplifications of the model reasonably hold (Cerqueira, Daniel; Lobão, 2004).

Although limited to describe a universal behavior of violence, empirical exercises are effective to identify certain statistical regularities that are useful to map criminal dynamics of particular areas. Depending on the culture, the specificity of the region and the moment, some variables can contribute more decisively to explain specific criminal dynamics. Empirical models, recognizing statistical regularity of concrete factors (for instance, presence of weapons or drugs) or subjective factors (for instance, family supervision, social recognition or social capital) may be used to guide the elaboration of effective policies. That might be not enough to explain the "universal truth" of the behavior of violence but it is surely useful to backup the design of public policies in order to transform violent societies.

1.2 Homicides in Brazil

Brazil has the highest incidence of homicide in the world in absolute terms: over 64,000 inhabitants were killed in 2014. That represents more than 10% of homicides registered in the world in that year. This level of violence means that annually more people is killed in Brazil that in most of military conflict zones. Indeed, Waiselfisz compared Brazilian homicides with the reported death related to armed conflicts in the world between 2004 and 2007. In this period, the twelve most violent conflicts were responsible for the death of 169,574 people. In Brazil - a country without territorial disputes, emancipatory movements, civil wars or religious clashes - during the same 4 years, there were 192,804 victims of homicide (Waiselfisz, 2013).

Considering the rate, the national homicide rate has stabilized in a very high level that ranges from 25 to 30 homicides per 100 thousand inhabitants since 1992, as depicted in the figure 2. World Health Organization describe regions with death rate above 10 per 100 thousands inhabitants as "epidemic" (UNDP, 2013). In other words, Brazilian society is living with epidemic levels of mortality throughout the last decades. The figures presented illustrate the importance of studying the dynamics of homicides in the territory.

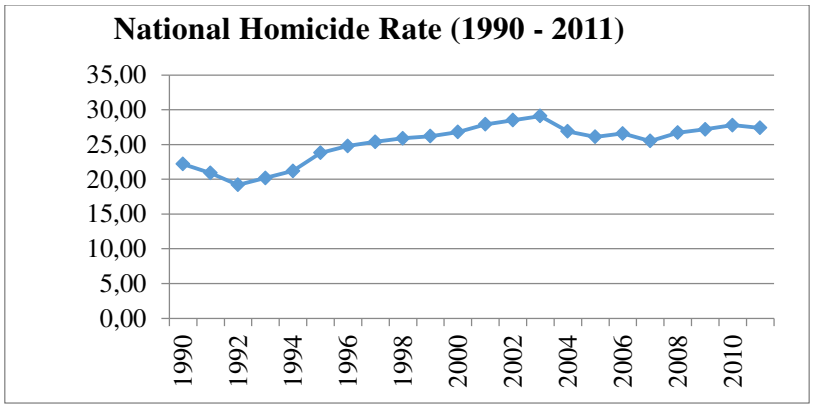
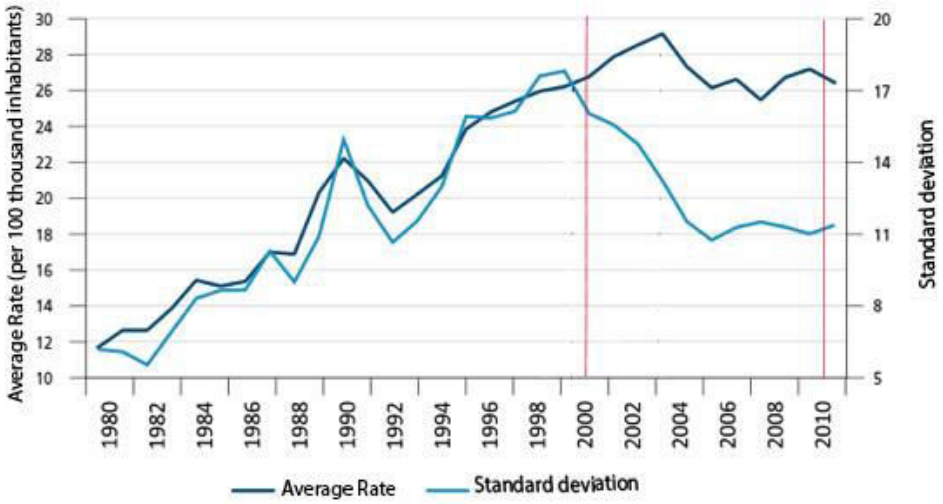


Figure 2 - National Homicide Rate: data from System of Mortality Information – SIM

Note that the stabilization on the national level hides the dynamics of homicides in the internal territory. The study "The Singular territorial dynamics of Brazilian homicides" traces back homicide in Brazil since 1980, using the 27 states as unit of analysis. Specifically, the authors observed that during 2000 and 2010, the average homicide rate of the states has increased, meanwhile the standard deviation has decreased, as depicted in figure 3. In other words, in the last decade, Brazil faced a process of dispersion of homicides among the 27 States. States that traditionally were associated with violence, namely Rio de Janeiro e São Paulo, managed to diminish consistently their levels. Simultaneously, States with historical better levels worsen significantly, specially in the north and northeast region of Brazil (Daniel, Morais, Vieira, & Matos, 2013).



Source: The singular territorial dynamic of homicides in Brazil (Daniel et al., 2013)

Figure 3 - The average homicide rate and standard deviation (1980 - 2010): State level

In a complementary way, adopting the municipalities as unit of analysis, it is possible to conclude that from 2000 to 2010, Brazilian municipalities witness a concentration of the violence in the territory. Considering the 5.560 municipalities, the average homicide rate increased. Standard deviation and amplitude of the homicide rate has also increased. In other words, homicides rate has diverged in the local level resulting in bigger differences among the 5.560 municipalities. This indicates the concentration of violence in specific municipalities.

Interestingly, the described movements occurred simultaneously with social transformations in the country that might correlate with the violence. Aiming to capture the social changes experienced by the country in the last decade, the Applied Economic Research Institute, known by its Portuguese language acronym IPEA, created the Index of Social Vulnerability (IVS). The IVS is a synthetic index composed by three dimensions: Urban Infrastructure, Human Capital and Income and Employment. The main objective of the index is to identify the territory where there is an overlapping of situations indicative of social exclusion and vulnerability. IVS ranges from 0 and 1, where the closer to 1, the higher the social vulnerability of the area. As depicted in figure 4 and 5, there was a significant improvement in the decade related to the reduction of social vulnerability.

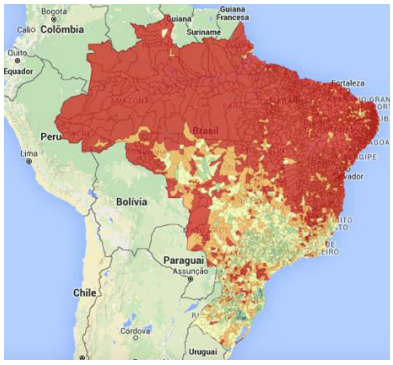


Figure 4 - Index of Social Vulnerability in 2000

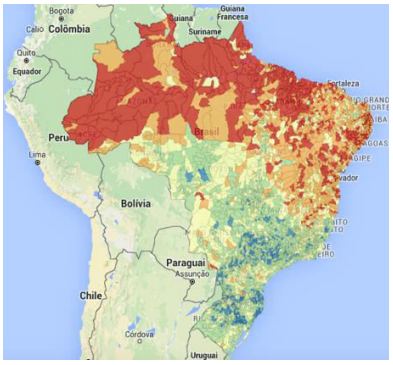
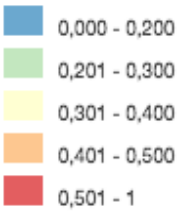


Figure 5 - Index of Social Vulnerability in 2010



Social Vulnerability (IVS) levels:

Connecting the debate of social-economical improvement and homicides, an apparent contradictory movement is described: social vulnerability has diminished substantially meanwhile violence is increasing. The increase of violence is led by specific municipalities that drive the convergence in the state level and the disparities in the local level.

Specialists diverge on the possible explanations to the apparent contradictory movement. Some authors regard the movement as a resultant of a particular economic growth mainly fostered by the increase in consumption in a society with fragile security policies. Others authors, regard the movement as the consequence of the shift in the industrial activities and the emergence of legal and illegal markets in less developed areas - mainly in the north and northeast of Brazil. (Kahn, 2013).

It is beyond the scope of this study to test the hypotheses that better describe the behavior of homicide in the last decade. The idea here is to analyze the marginal contribution that social capital might have in homicides. In order to do so, this research relies on previous studies about the drivers of homicide in Brazil to select meaningful control variables. The following section summarizes seminal work about the the drivers of homicide in Brazil.

1.2.1 The drivers of homicide in Brazil

The seminal work “Causes and Consequences of Crime in Brazil” empirically investigated the drivers of homicides in Brazil, relying on the utilization of econometric models. In this research it is

identified demographic and socio-economic factors that are associated with homicides in Brazil from 1980 until 2010. The author created a database, aggregating secondary sources and applying statistical treatment to address missing values. Data related to guns' availability and drugs consumption were derived from the percentage of people killed by firearms and overdoses respectively, as backed up by criminal theories.

Despite the limitations imposed by the fragility of the dataset, the study identified the clear prevalence of firearms in homicides in Brazil. The same conclusion has been systematically highlighted by the annually report Map of Criminality (Waiselfisz, 2015). The study indicated other risks factors and characteristics of Brazilian society intimately related to homicides: economic aspects (income and inequality), demographic aspects (percentage of young man), policies aspects (incarceration rate and the police force) and "transversal" risk factors (consumption of drugs) (Cerqueira, 2010).

1.2.2 Homicide policies in Brazil

One key aspect related to security policies in Brazil is the institutional framework under which the policies are designed. Despite the existence of channels for financial support from the federal level, since 1988 security in Brazil is a State competence. In other words, each of the 27 States is in charge to organize their own security force and policies. That resulted in a complex fragmented scenario with huge disparities of implementation among States. Moreover, that fragmentation is also reflected in the lack of unified and reliable data related to crimes in Brazil, which is by far the biggest constraint of empirical studies on the topic.

In addition to the institutional framework, the debate on security policies is historically deeply guided by ideological beliefs. On one extremity, advocated by the most conservative sectors, violence is understood as a consequence of impunity or lack of strong police force. This particular view is influenced by the long period of military dictatorship in which the police were explicitly used as a power control instrument. On the other extremity, endorsed by progressive sectors of society, violence is understood as consequence of social vulnerability. This position often leads to immobility in terms of offering a solution to tackle directly the epidemic levels of homicides in Brazil (Souza, 2011).

This polarized debate happens in a context of intense urbanization where criminality is - not exclusively - but mainly associated to the under development areas of the cities. That territorial concentration of violence in less economical privileged areas reinforced the discourse that violence should be addressed adopting mainly a repressive approach. Many actors oppose to this narrative referring to that as the "criminalizing poverty" (Global, 2009).

1.3 Social Capital and Homicide

In the essay "Bowling Alone", Putnam defines social capital as "connections among individuals - social networks and the norms of reciprocity and trustworthiness that arise from them." (Durlauf, 2002). In alignment with the aforementioned Ecological Approach, this concept derives from the communitarianism philosophy which emphasizes the connection between the individual and the community. Under this perspective, a person's social identity and personality are largely molded by community relationships, with a smaller degree of development being placed on individualism (Goodin, 2013).

Based on a cross sectional analysis situated in United States, Putnam makes a persuasive argument for the relevance of social capital to various community problems, including violent crime. The author claims that States with high murder rates generally register lower levels of social capital according to an index that incorporates measures of civic and political involvement, volunteerism, informal sociability and social trust. The author concludes that higher levels of social capital translate in lower levels of crime (Messner, Rosenfeld, & Baumer, 2004)

Putnam provides a systematic description of the multidimensional nature of social capital. The author distinguishes several dimensions of the concept. The most general forms of social capital are trust and social participation. Social participation is subdivided into political, civic and religious participation, workplace connections, informal social ties and philanthropy, altruism and volunteering. Among the possible forms of political participation, Putnam emphasizes political interest and knowledge; party identification; involvement in campaigns; attendance at a political rally, speech, or public meeting;

committee service for a local organization; participation in social movements and political protests (Messner et al., 2004).

Finally, it is important to highlight that Putnam recognizes that not all forms of social capital produce positive outcomes. Some kind of negative bonding activities are associated with hostility to outsiders and may impede the flow of information. Nevertheless, Putnam clearly emphasizes the benefits of social capital in the construction of a more harmonious society.

Approximating the debate to Brazilian's reality, when analyzing the social environment of the areas where violence occurs more often in Brazil, there are some recurrent aspects: high proportion of young people, high population density, high levels of social vulnerability. In a deeper analysis, the absence of the State - as the public authority or provider of services - is also frequently indicated as a common characteristic of violent areas. The lack of public leisure spaces, sports and culture as well as the lack of basic infrastructure contribute to a sense of abandonment and degradation (PAZ, 2005). Those factors might constitute elements of social disorganization that enhance the sense of insecurity and erode social capital.

In this context, lethal violence is manifested as a result of numerous trivial conflicts, fueled by a culture of violence that values individualism over communitarianism. That "requires" an immediate and violent response to any disagreement. Thus, bar fights, discussions because of banal issues and other non-criminal matters end up being the cause of about half of the homicides. Even when those incidents do not result in death, these conflicts perpetuate a culture of devaluation of dialogue, negotiation and associations. (PAZ, 2005).

Therefore, there is a clearly opportunity and relevance in the application of social capital on the investigation related to homicide rate in Brazil. Note however, that systematic empirical evaluations of the links between the dimensions of social capital and violence are limited by the lack of adequate measures to track social capital itself and other homicide relevant factors such as illicit markets and firearms. That is especially true in Brazilian reality where disparities among different subnational levels often constraint the consistency of available data. As a matter fact, no national comprehensive

survey on social capital was identified. However, database created for other purposes might be used to track some aforementioned dimensions of social capital.

That is precisely the objective of the present study. As detailed in the following sections, this study analyses the relation between the participation on social activities and political interest with homicides, across Brazilian municipalities. The objective is to check if higher levels of social capital lead to lower homicides rates in Brazil.

Chapter 2 – Research Design

As previously introduced, the idea of this research is to test if municipalities with higher social capital level present lower homicides rates. In the absence of a proper indicator to capture all the dimensions of social capital, this exercise considers two dimensions of social capital: participation and political interest. The main purpose is to empirically test if the construction of a safer society is neatly related to associative practices such as neighborhood associations, recreational clubs, religious associations or political parties. In the same way, the research checks if societies where citizens declare more interest in politics present lower level of homicides. Additionally, it hypothesized if all mentioned forms of social participation might be equally related to homicide or if some specific associations might impact in homicide differently. The research relies on 4 public datasets as detailed below.

2.1 Research Question and Hypotheses

The research question that guides the present study is "Do higher levels of social capital lead to lower homicides rates in Brazil?".

The hypotheses are: "H1: Municipalities with more associative practices – such as neighborhood associations, recreational clubs, religious associations or political parties – have a tendency to show lower homicides rates" and "H2: Municipalities where citizens have declared more interest in politics have a tendency to show lower homicides rates." Finally, the third hypothesis is "H3: Does participation in different types of activities relate differently to homicide?"

To address the research question and hypotheses, data of homicides rate and socioeconomics indicators were appended. The choice of the indicators was based on previous empirical studies mentioned in Chapter 1.

2.2 Data Sources

This study relies on four public datasets: Mortality Information from the Ministry of Health, Social Economic Survey from National Institute of Education, Census from Brazilian Institute of Geography

and Statistics and Social Vulnerability Atlas – from IPEA. The present session details specifications related to the extraction of data from those datasets.

2.2.1 Mortality Information (SIM) – Ministry of Health

The absolute number of homicides in Brazilian's municipalities were extracted from this dataset selecting the category CID-10, subcategories X850 to Y059. This category follows the international standard of mortality classification. Data were provided by municipality. Information of homicides dates from year 2010. All aforementioned studies related to homicide in Brazil used the same source with slightly differences in the subcategories selected.

2.2.2 ENEM Social-Economic Survey from National Institute of Education

Data to proxy social capital were obtained from the social-economic survey conducted by National Institute of Educational Research (INEP). Specifically, data were collected from the social-economic form filled in by candidates of the National High School Examination, known by its Portuguese language acronym ENEM.

The ENEM is a non-mandatory national exam, implemented since 1998 with the original aim to evaluate high school education in Brazil. Students' grades are used to generate schools' rankings that guides Ministry of Education policies in Brazil. Since 2009, ENEM's grade has been also used as the entrance exam to public universities intensifying significantly the participation.

The attendance of ENEM is representative of the Brazilian municipalities because the exam is held in almost all 5.560 municipalities of the country. Note, however, that answering to the social-economic survey is not mandatory. Candidates can opt not to answer the social-economic survey. Therefore, the available data do not comprise information about all municipalities. The significance of this limitation to the present study is further explored in the following sections.

The social-economic survey is a form with more 200 questions that tries to map the profile of the candidates and the school. Despite the original purpose, the survey presents many questions that might capture dimensions of social capital, following Putnam's conceptualization. In this study,

questions related to *Social Participation* and to *Political Interest* of the candidates were selected. Table 2 below indicates the original questions and the attributed social capital dimension and components. Note that not all dimensions of social capital as proposed by Putnam were captured. Due to dataset availability, data selected dates from year 2008.

Table 2 - Selecting questions from ENEM's survey to track Social Capital

SOCIAL CAPITAL DIMENSION	SOCIAL CAPITAL DIMENSION COMPONENTS	QUESTION ID	ORIGINAL QUESTION ENEM 2008 SOCIO-ECONOMIC SURVEY
SOCIAL PARTICIPATION	Political, philanthropy, altruism, volunteering*	Q172 Q173	Are you affiliated with any political party? Do you participate in any NGO or social movement?
	Civic	Q168 Q170	Do you participate in any neighborhood association? Do you participate in any student union?
	Religious	Q171	Are you member or attend to any religious group?
	Informal social ties	Q174	Do you participate in any recreational or sport association?
POLITICAL INTEREST	Local politics	Q178	How is your level of interest in local politics?
	National politics	Q175	How is your level of interest in national politics?
	Access to public services in health and education	Q185	How is your level of interest in access to public services in health and education

* According to Putnam's concept, Political and Philanthropy, Altruism and Volunteering are distinct categories. On the current study, the categories were merged due to the assumed low youth political association in parties in Brazil and the reference to "social movements" in Q173. Thus, answers to Q173 and Q168 were counted under the same category.

2.2.3 CENSUS SURVEY from IBGE

This study uses data from the Census Survey conducted by the Brazilian Institute of Geography and Statistics, known by its Portuguese language acronym IBGE. Data related to Population, Percentage of male youth, GINI, Income per capita were used as control variables to test the relation between social capital and homicides. Data selected dates from year 2010.

2.2.4 SOCIAL VUNERABILITY INDEX from IPEA

As previously introduced, this study uses the index IVS compiled by IPEA. Operationally, the ISV is composed by 16 indicators structured in three dimensions: Urban Infrastructure, Human Capital and Income and Employment. The ISV is an integer ranging between 0 and 1. The closer to 1, the higher the vulnerability of a social area. This study uses IVS data from 2010 as a control variable in the investigation of homicide rate and social capital.

2.3 Operationalization

To operationalize the research, social and demography indicators that are frequently used in classical studies related to homicides were merged with information used to proxy social capital obtained by the ENEM's survey. This section details the operationalization of the selected variables and treatment prior to the analysis. Additionally, there is information about the final sample.

2.3.1 Homicide Rate

In order to obtain the homicide rate, the absolute number of homicides obtained from the SIM database is divided by the number of inhabitants of each municipality and multiply by 100.000. The final result is the independent variable *Homicide Rate per 100 thousand inhabitants* (HR).

The original sample (N) displays homicides data of 5,565 municipalities, which represent all municipalities in Brazil. As illustrated in Figure 4, the *HR* data have a strong positive skewness. This behavior is due to the existence of 1,911 municipalities with no homicides in the year of 2010. In other terms, 34% of cities in Brazil registered no homicides in the year of study. Additionally, substantial variation exists around the mean, with HR ranging from 0 to 192.20, as depicted in Table 3.

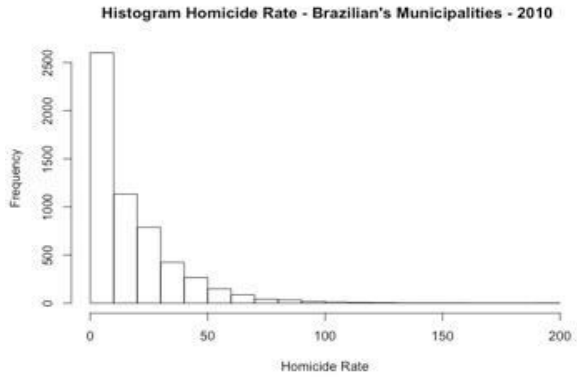


Figure 4 - Histogram - HR (2010)

Table 3 - Homicide Rate Descriptive Statistics						
Min	1st Q.	Median	Mean	3rd Q.	Max	N
0.00	0.00	11.61	16.55	25.27	192.20	5,565

In order to reduce skewness and induce homogeneity in errors variance, HR is transformed with the application of natural logarithm (log). Note, however, that mathematically the log transformation has constraints when homicide rate is close to zero resulting in values that equals to minus infinite. Therefore, for the sake of simplicity, municipalities where HR was equal to zero were arbitrarily eliminated. Figure 6 and table 4 below display the behavior of homicide rate after log transformations. With the elimination of cities with HR near zero, the sample is reduced to 3,654 municipalities.

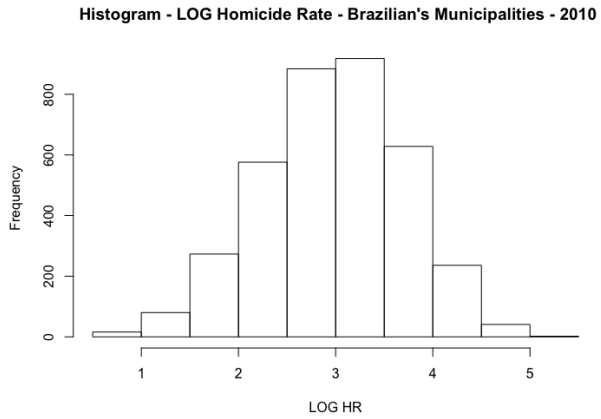


Figure 6 - Log Homicide Rate - Transformation to reduce original skewness

Table 4 - Log Homicide Rate Descriptive Statistics						
Min	1st Q.	Median	Mean	3rd Q.	Max	N
0.5068	2.4800	2.9980	2.9740	3.4950	5.2590	3,654

2.3.2 Social Capital variables

In the present study, social capital is partially captured by two dimensions: *Social Participation* and *Political Interest*. *Social Participation* is measured by the answers in the survey related to the direct participation of the candidates in social gatherings such as recreational clubs, neighborhoods associations or churches. By its turns, *Political Interest* tracks the declared interest of the candidates in topics related to local politics, national politics and public services.

In 2008, the ENEM's socio-economic survey was delivered to 4,018,070 candidates. Originally, the sample comprised candidates from 4,553 municipalities. However, only 2,485,531 candidate answered the socio-economic survey. It is important to note that ENEM's dataset provides information of every individual candidate. However, as stated before, this study aims to establish comparison between municipalities. This creates the necessity to aggregate individual candidate's information by municipality.

Answers to questions related to *Social Participation* were originally binary. In other words, to answer the questions Q168, Q170, Q171, Q172, Q173, Q174 – previously commented in table 2 – the candidate could answer "A" indicating participation and "B" indicating no participation. The results were transformed to a standardized binary code in which "1" indicates participation and "0" indicates no participation. The result was aggregated by municipality, creating a measure of the *Average Social Participation by Municipality* as summarized in table 5.

The same logic was applied to questions related to *Political Interest* (Q175, Q178, Q185). Here, however, the original survey offered the possibility for the candidate to answer according to three levels where "A" stands for "high interest", "B" stands for "low interest" and "C" stands for "no interest". The results were transformed to a standardized binary code in which "1" indicates "high interest" and "0" indicates "low or no interest". The results were aggregated by municipality, creating a measure of the *Average Political Participation by Municipality* summarized in table 5 as well.

Finally, the variable *Social Capital* was created by averaging the *Municipal Social Participation* and *Municipal Political Interest.*

Table 5 - Individual answers transformed into Municipal indicators		
Ref	Dimension	Calculus
1	Social Participation	Average of Political, Civic, Religious and Informal social ties
1.1	Political, philanthropy, altruism, volunteering	Municipal average of the individual answers to questions Q172, Q173
1.2	Civic	Municipal average of the individual answers to questions Q168, Q170
1.3	Religious	Municipal average of the individual answers to questions Q171
1.4	Informal social ties	Municipal average of the individual answers to questions Q174
2	Political Interest	Average of National, Local, Public Services
2.1	National	Municipal average of the individual answers to questions Q178T
2.2	Local	Municipal average of the individual answers to questions Q185T
2.3	Public Services	Municipal average of the individual answers to questions Q175T
3	Social Capital	Average of Political Interest and Social Participation

The resultant dataset gathers information about 4,514 municipalities. Note, however, that in this sample there are municipalities with relatively small number of candidates. In other words, some municipalities had few candidates participating on the ENEM's national exam as indicated by the descriptive statistics in table 6. From this table, it is possible to understand that in 25% of the municipalities the information come from equal or less than 12 candidates. That might represent a limitation because the information of few people might be considered as representing the municipality. Therefore, it is advisable to comprise the sample, assuring that the information of social capital is provided by a reasonable number of candidates.

Table 6 - Descriptive statistics of the number of candidates by Municipalities						
Min	1st Q.	Median	Mean	3rd Q.	Max	N
1.0	12.0	65.0	500.3	223.00	143900.0	4,514

Instead of immediately eliminating cities with small number of candidates, the chosen strategy is to eliminate cities by population size. The idea here is to check if the elimination of small cities might simultaneously solve the problem of underrepresentation regarding *Social Capital.*

The decision of comprising the sample is based on the understanding that the utilization of small population municipalities in studies with homicide rate may disturbed the results. The effect of random homicide episodes might be magnified in smaller cities when applying linear homicide rate formula without any statistical treatment that differentiates smaller cities. The variability of linear estimation becomes very high, which decreases the confidence of the indicator. For example, if an isolate case of homicides in which five people had been killed happens in a municipality with five thousand inhabitants, the murder rate would go up to 100 and this city would be wrongly among the most violent cities in the world. Epidemiology literature developed the idea further and prescribe strategies to balance the study of homicide rate in small cities (Dever, 2006).

The utilization of those techniques is out of the scope of this research. Due to the high concentration of homicide in Brazil in specific cities, municipalities with small population were eliminated from the final sample without compromising the validity of the findings. Therefore, the problem related to applying rate in small cities were indirectly addressed. The following section "Transformation of variables" details the need to comprise the sample by population and by the amount of participants from each city in the ENEM's Survey. The section "Final Sample" discusses the representatives of the comprised sample in light of the total cases of homicides in Brazil.

2.3.3 Control Variables

Based on the aforementioned empirical studies, the main drivers of the homicides in Brazil are size of population, income, inequality, percentage of young man, guns, drugs, presence of State – understood as policies and infrastructure for health, education, cultural and security policies. Unfortunately, not all indicators are systematically collected and public available. Moreover, the available data suffers with inconsistency, specially for the municipal level. Therefore, the main drivers of homicides in Brazil, namely guns, repressive police and presence of State will not be considered in this research. That might compromise the significance of the developed model in terms of how much of the homicide phenomenon can be accounted as due to social capital. However, rather than providing a revision of the drivers of homicide, the main purpose of the research is to check the marginal contribution that social capital might offer to the homicide, controlling for the available

demographical and economical variables. Therefore, in this study, the analysis of social capital and homicide rate will use as control variables: poverty, income per capita, inequality (Gini), percentage of male youth and social vulnerability.

2.3.4 Transformation of variables

Brazilian's municipalities data on population also display strong positive skewness. There are in the Brazilian territory a significant amount of small municipalities with 25% of the municipalities having less than 14,000 inhabitants, as indicated in Table 7. In contrast, substantial variation exists around the mean with the existence of big metropolis (namely São Paulo) with the population of 11,250,000.

Table 7 – Descriptive statistics of POPULATION						
Min	1st Q.	Median	Mean	3rd Q.	Max	N
815	13,310	6,214	40,340	27,450	11,250,000	4,514

The disparity among municipalities is better captured when contrasting the population size with the amount of homicides as displayed in figure 11 bellow. Therefore, a log transformation of population is also recommended to investigate the contribution of municipalities with smaller populations, as demonstrated in figure 12.

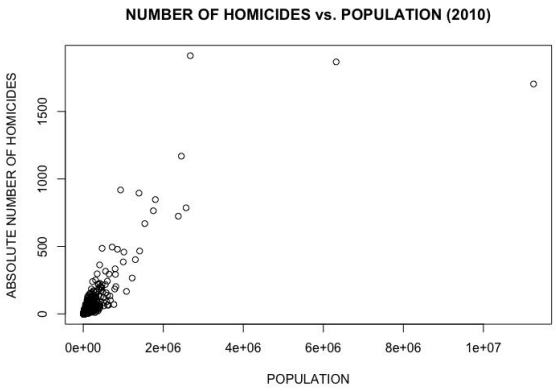


Figure 11 - Homicide vs. Population

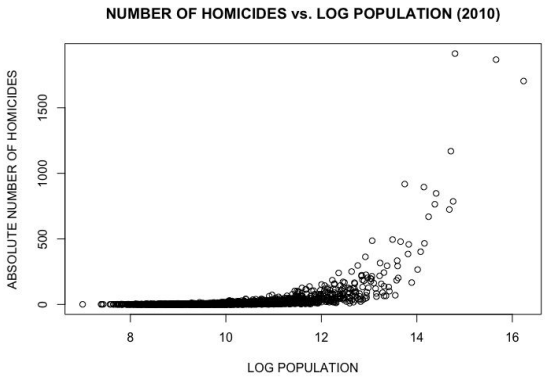


Figure 12 - Homicide vs. Log Population: closer look on the contribution of smaller cities

Note however that Figure 12 is based in the absolute number of homicides. Since this study aims to establish a comparison between municipalities homicide rates plays a better role. Nevertheless, it is important to show that the majority of homicides are concentered in specific cities. Therefore, due to

the characteristics of the data distribution, the study uses log population as control variable and the log of homicide rate as the dependent variable.

2.4 Final sample

Due to distortions that municipalities with small population can introduce in studies that uses homicide rate, the original sample is arbitrary reduced according to the number of inhabitants. Therefore, only cities with more than 50.000 inhabitants were considered. After reducing the sample, it still remained some municipalities in which the information of social capital was based in few candidates of ENEM's survey. Aiming to guarantee the representativeness of the information obtained in the survey, the sample was arbitrarily comprised again in a way that only municipalities with at least 30 candidates were considered.

The final sample gathers data from 580 municipalities, which accounts for proximally 10% of the total municipalities. Those municipalities sum 124,446,520 inhabitants, which accounts for proximally 63% of the total population. Finally, around 39,544 homicides happened in these municipalities, which accounts for proximally 80% of homicides of the year.

The final sample is coherent with the previous description of the current dynamics of homicide in Brazil: despite the outstanding national level, homicide in Brazil is a focalized problem. Even after important reduction in the original sample, 80% of the homicides were considered in the final sample. From a public policies perspective, it is interest to note that considerable part of the phenomenon under study can be addressed with a small fraction of the total 5.556 municipalities.

Figure 13 identifies the 580 municipalities of the final sample in the territory and illustrates the respective homicide rate. The final sample gathers information of 1,777,550 candidates from ENEM's survey to proxy social capital.

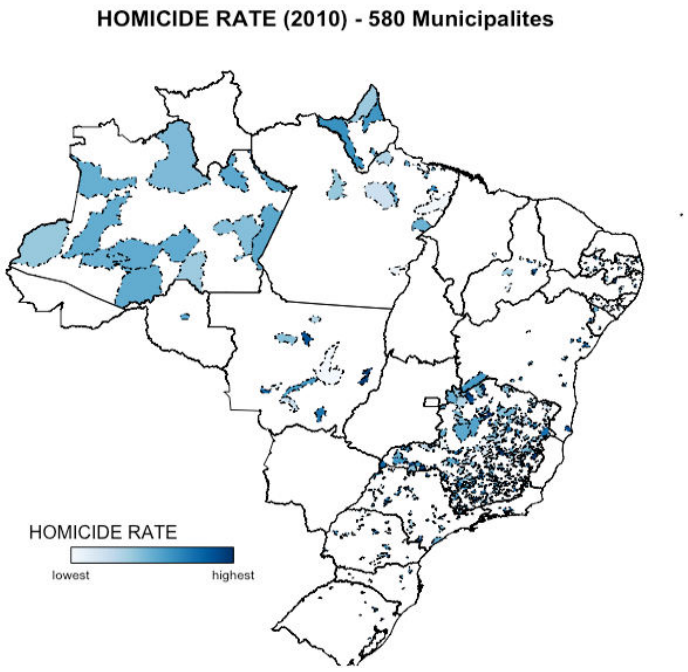


Figure 13 – Final Sample: 580 Municipalities - 80% of absolute homicides

Chapter 3 – Analysis and Findings

This chapter presented data analysis and findings. In order to address the research question, the analysis was segmented in three main parts: (i) investigation of bivariate patterns, (ii) creation of multi regression models and (iii) verification of the assumptions of the linear model. Those parts were applied in the investigation *of Social Participation* and *Political Interest* separately in order verify the hypotheses H1 and H2. Finally, the last section explores the effect of different types of participation on homicides, in order to address hypothesis H3.

3.1 Bivariate Patterns

The matrix of correlation shows the bivariate relation between variables used in the study. Note that in Figure 14, the independent variable (logHR) presents a low correlation with all the other variables. Although it would be desirable to have higher correlation, as sustained in the theoretical debate, homicide is understood as multifold complex phenomenon that might be driven by unaccountable factors that are not considered in this research. In that sense, the low correlation between the independent variables and the depended variables neither aggregate much value to the investigation nor constitute a failure.

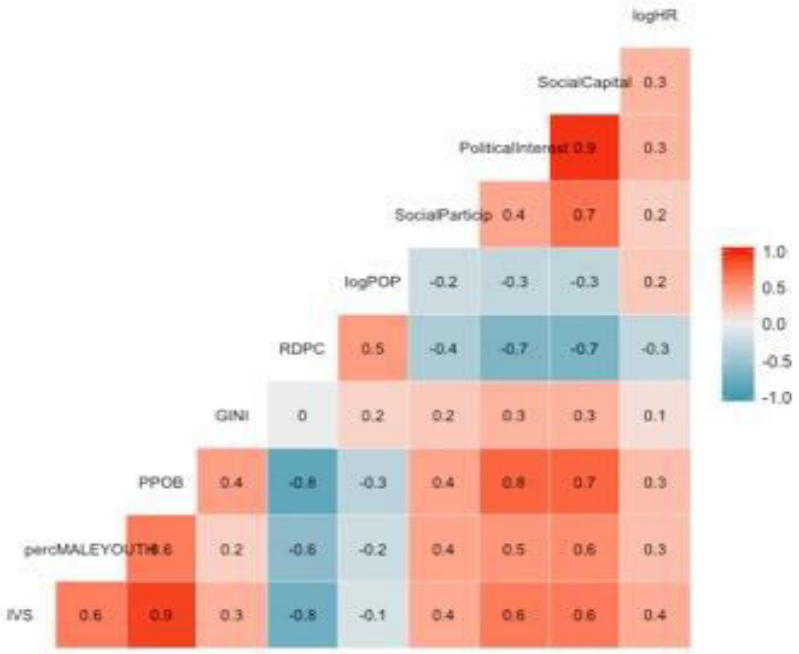


Figure 14 - Matrix of correlation between LOGHR, Social Capital, Components and Control variables

More interesting than using the matrix of correlation to investigate the independent variable is to use the matrix to analyze the relation among independent variables. The lower is the correlation between the chosen variables, the bigger is the individual contribution of each variable and the lower is the standard error. In other words, the matrix of correlation allows multicolinearity analysis (Stanton, 2013).

Based on Figure 14, it is possible to observe that *Social Capital* displays strong correlation with *Political Interest* and *Social Participation*. This naturally derives from the fact that *Political Interest* and *Social Participation* are dimensions of *Social Capital*. Therefore, the high correlation was expected and the result consistent.

Social Capital is strongly correlated with *Income per capita* (RDPC) *and Percentage of poverty population (PPOB)*. The high correlation between independent variables is not a desirable situation. As matter fact, the absence of multicoliniarity is one of the assumptions of the linear model regressions. Therefore, to increase the robustness of the results, variables that showed high correlation were not simultaneously used in the same models as reported in the following section.

Assessing the relation among control variables, it is noticeable that RDPC and PPOB presented strong correlation. The same relation can be observed between RDPC and the *Index of Social Vulnerability* (IVS). Those variables - despite of theoretically capturing different aspects - seem to be driven by common phenomena and should not be used simultaneously in a linear model.

Note that RDPC and GINI presented zero correlation. This might be capturing an important aspect of of Brazilian disparity among municipalities. For the chosen municipalities, the average income does not relate with the level of inequity. Wealth and how wealth is distributed are orthogonal indicators.

Finally - and more interestingly - note that *Social Capital* and *Political Interest* presented the similar coefficients of correlation with other variables. *Social Participation*, however, seems to be less correlated with the other independent variables than *Political Interest*. In the sense, this preliminary

analysis indicate that *Social Participation* might be better fitted to multi regressions with the chosen control variables than *Political Interest.*

Finally, just for the sake of analyzing all considered variables, figure 15 displays the relations between the components of *Political Interest* and homicide rate. This analysis shows high correlation among *Political Interest* components and low relation with the independent variable HR.

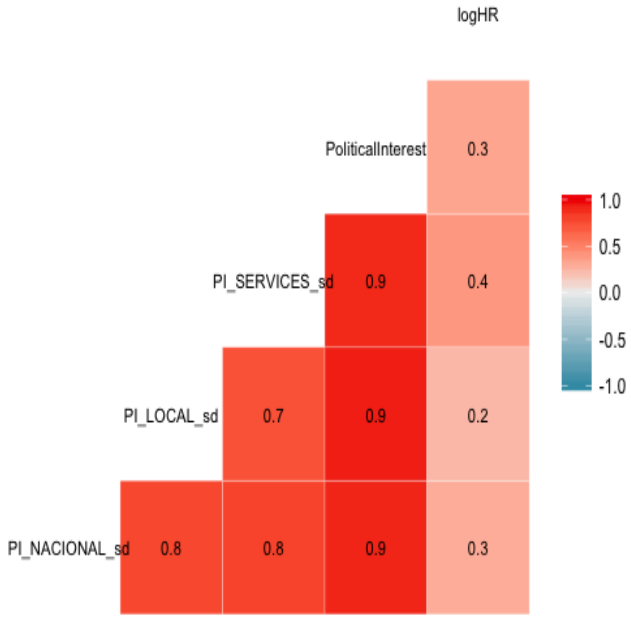


Figure 15 - Matrix of Correlation - HR, Political Interest and components

In the following section, *Social Participation* and *Political Interest* are regressed in linear models against *homicide rate*. Since the *Social Capital* and *Political interest* presented a very similar correlation behavior with other variables, *Social Capital* was not used isolated in one model. In other words, it might be more elucidative to regress *Social Participation* against *Homicide* and separately *Political Interested* against *Homicide*, instead of regressing *Social Capital*. It is expected that the regression of *Political Interested* provides the similar results to the ones that *Social Capita* would produce, since those indicators relate very similarly to the other variables. Finally, based on the analysis of bivariation, aiming to diminish the influence of multicolinearity, variables with strong correlation were not considered together in the following models.

3.2 Linear Regression Models

Regression analysis can be used to investigate how the typical value of the dependent variable changes with the variation of the independent variables while other independent variables are fixed (Gelman & Hill, 2007). In the present study, the idea is to investigate the behavior of *Homicide Rates* explained by *Social Participation*, controlling for demographic and economic indicators. In the same way, the variation of homicide rate is investigated in light of the variation of *Political Interest* controlling for demographic and economic indicators. The elected model was submitted to statistical tests to verify the assumptions of the linear model.

3.2.1 Homicide Rate vs. Social Participation

The approach to create models emulates a forward-selection-method. The forward-selection-method creates a base-model with few variables. New models are created by the successive addition of new variables to the base-model. To each variable added, it is checked if the new model is best fitted. The process is repeated until the addition of new variables does not result in improvement of the model. (Efroymson, 1960). Table 8 displays the created models. All coefficients are centered and standardized.

Table 8 – Linear Model Homicides Rates, Social Participation

Explanatory or Control Variables	MODELS Standardized Coefficients and Significance codes					
	M0	M0_1	M0_2	M0_3	M0_4	M0_5
Intercept	3.06314 ***	3.06314 ***	3.06314 ***	3.063135 ***	3.0631353 ***	3.06314 ***
Social Participation	5.47963 ***	7.09246 ***	7.11266 ***	3.077019 **	2.3451302 .	2.93360 *
Log Population		0.25504 ***	0.25559 ***	0.418772 ***	0.4092545 ***	0.27889 ***
Gini			-0.03738			
Average Income per capita				-0.001109 ***	- 0.0009441 ***	
Percentage of Male Youth					11.5491656 *	
Social Vulnerability						2.78088 ***
Adjusted R^2	0.03367	0.1001	0.09855	0.2258	0.2327	0.221
Degrees of freedom	578	577	576	576	575	573

Signif. Codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The iterated exercise resulted in the election of MODEL M0_4 as the most fitted model to explain *Homicide Rates* in light of of *Social Participation*. The model has an Adjusted R-square of 0,23. The level of uncertainty related to *Social Participation* is higher in this model than in the others, but the significance of the result remains below 0.05. Finally, it is interest to note the behavior of GINI which is not statistically significant for any model tested.

Continuing the analysis, figure 17 displays a scatterplot with the relation of *Homicide Rate* and *Social Participation,* with an indication the dispersion of the sample and the model 0_4 traced. Note that contrary to intuitive expectations, the slope of the regression is positive. In other words, considering the social participation captured by the survey, the primary expectative was that bigger social participation would have led to smaller homicide rate. Therefore, a negative slope was expected.

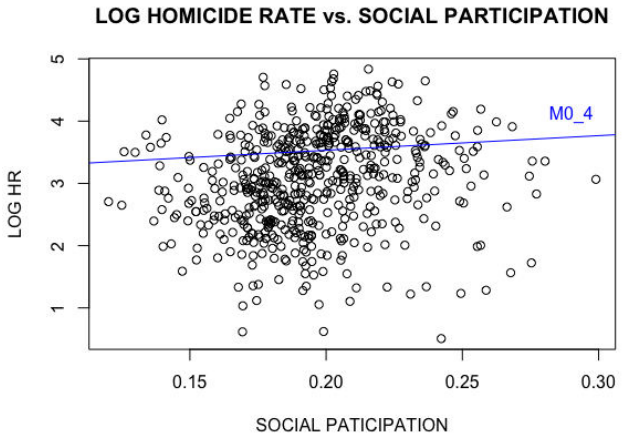


Figure 17 - Model M0_4

In that sense, the hypothesis “H1: Municipalities with more associative practices – such as neighborhood associations, recreational clubs, religious associations or political parties – have a tendency to show lower homicides rates” was not confirmed.

It is important to keep in mind that the model explains around 23% of the phenomenon, as indicated by the R-square. Therefore, the model does not capture important aspects that might be determining

homicide rate behavior. It reasonable to speculate that if key aspects of homicide rate - such as guns and drugs - were inserted on the model, the slope would assume the expected negative behavior.

Moreover, in alignment with the ecological approach, some authors understand that *Social Participation*, as well as other components of *Social Capital*, are as consequences as causes of homicides. In other terms, not only homicide rate might influence the possibility of social participation but the relation might be applied in the other direction as well (Messner et al., 2004). This effect however is not captured by the applied linear model. The present study only considered one direction effect in alignment with the research design. H1 was framed in a way to test only the influence of *social participation* in *homicide rates*. Nevertheless, aware of the limitation of the chosen tool, under this analysis, the hypothesis H1 does not hold.

3.2.1.1 Testing the linear regression assumptions - Social Participation

Regression analysis relies on assumptions about the relation of the chosen variables. The present section briefly discusses to which extent the assumptions of a linear model were respected in the chosen model M0_4. Namely some considerations are made related to (i) linear relationship (ii) absence of colinearity (iii) error distribution and (iv) homoscedasticity (Wooldridge, 2011).

Assumption of linear relationship

In other to fulfil the requirement of a multi regression, it is assumed that the relationship between variables is linear. In the present exercise this assumption was difficult to ensure. As mention in the previous sessions, *Homicide Rate* and *Population* were transformed due to the evident necessity of unfolding the behavior in small cities. The other components of the model (*Percentage of male youth population* and *Income per capita*) also do not display a clear linear relation – as represented in the scatterplots in figure 18. However, there is no clear quadratic, exponential nor polynomial pattern among those variables.

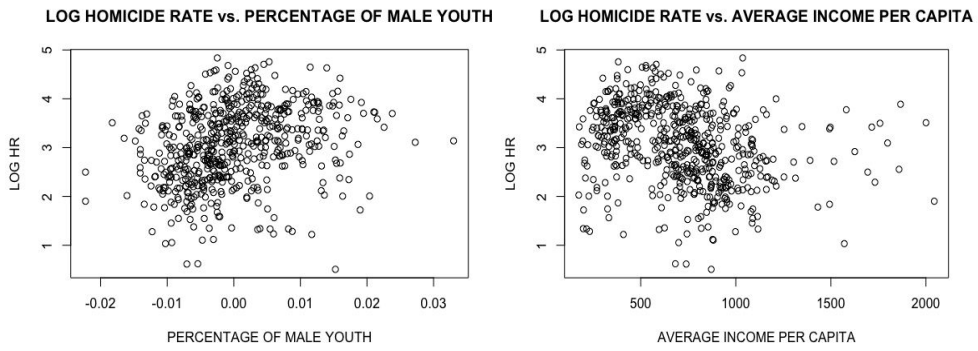


Figure 18 - Lack of linearity, lack of pattern

Note that despite the lack of linearity, the main objective of this research, is not to find a model to predict homicide rate behavior. The purpose is to generally portray the relation between *Social Participation* and *homicides rates*. In that sense, the utilization of those variables do not perfectly fit in the assumptions but the requirement might be relaxed without loosing the finality of the model

Absence of Colinearity

Colinearity might occur when many variables involved in the model are redundant or influenced by the same external factor. In other terms, when checking for colinearity, the idea is to assure that it is not possible to express any predictor as a linear combination of the others (Stanton, 2013). In the concrete exercise, the investigation of the mutual influence was performed before running the regressions through the matrix of correlations. That analysis based the decision of the chosen variables in the investigation of *Social Participation* and *Homicide*. Figure 19 below displays the matrix of correlations of the predictors utilized in the final model (M0_4). As it is possible to note, variables with high correlations (>0,7) were not used in the final model. The final model considered only variables with low to medium correlation indicators.

Figure 19 - Matrix of correlation Model 0_4

Error distribution

Ideally the error is distributed randomly following a normal distribution (Gelman & Hill, 2007). In the concrete case under study, the model M0_4 roughly observed these requirement as illustrated in figure 20 and table 9. As ideally desirable, the expected value of the error is zero.

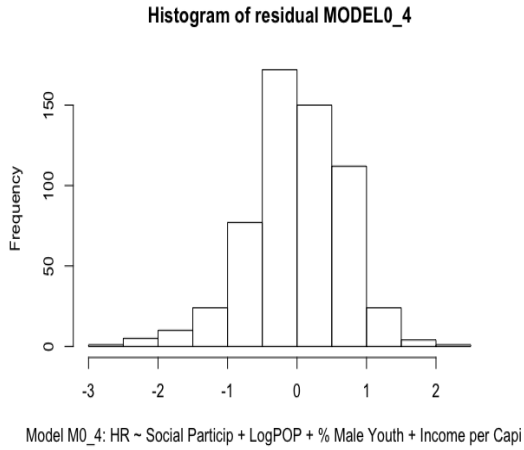


Figure 20 - Histogram RESIDUALS model 04 - Normal Error Distribution

Table 9 - Descriptive statistics of residual Model M0_4					
Min	1st Q.	Median	Mean	3rd Q.	Max
-2.71300	-0.42000	0.01442	0.00000	0.47900	2.36000

Homoscedasticity

The homoscedasticity assumption is related to the variance of the error across observations. In other words, the idea is to check if the model works consistently to all possible values of the regressors

(Gelman & Hill, 2007). In the concrete case, as illustrated in figure 22, the analysis of the regressors in comparison with the errors of the elected model (residuals) show relatively constant behavior. That means that the confidence and predictions about the HR is quite similar throughout the possible of the independent variables fulfilling the assumption of homoscedasticity.

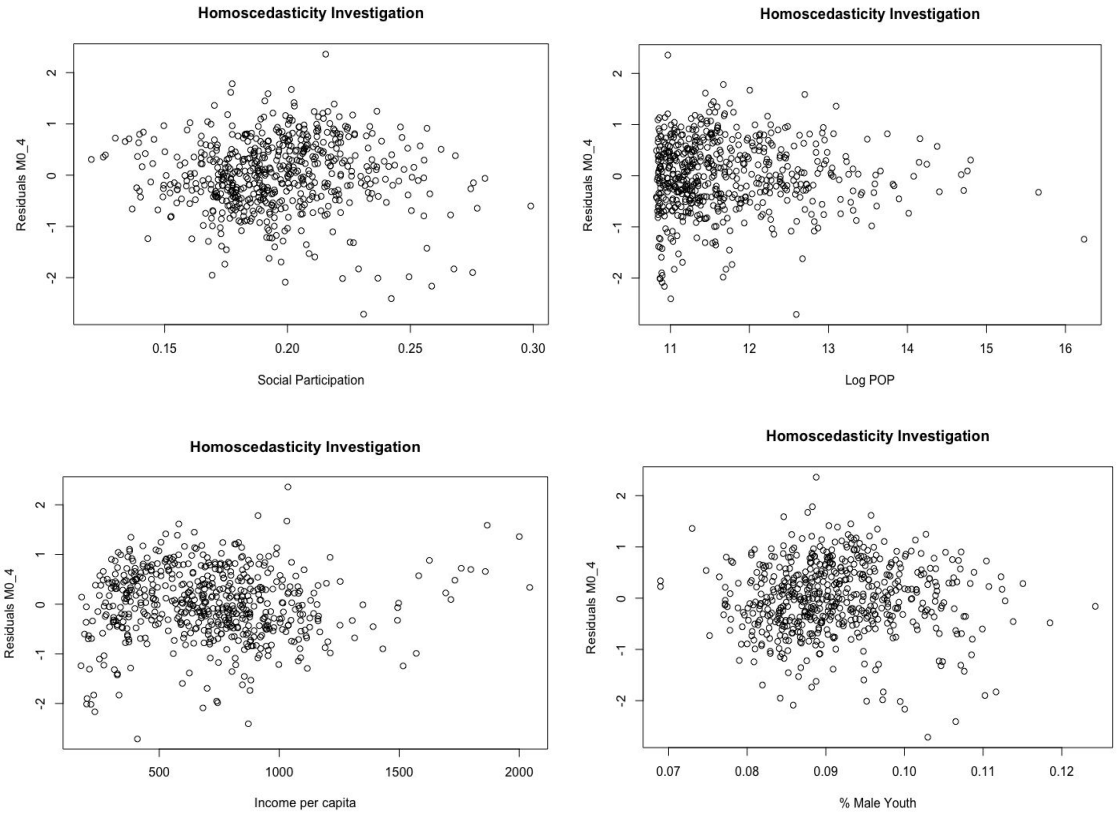


Figure 22 - M0_4 Homoscedasticity Investigation

3.2.2 Homicide Rate vs. Political Interest

Using the same procedure demonstrated in the previous section, models were created to identify the relation of *Political Interest* and *Homicide Rate* in light of the controlled variables. The variable of *Political Interest* represents the average of the answers related to local politics, national politics and access to public services. Table 10 displays the tested models. All coefficients are centered and standardized.

Table 10 – Linear Model Homicides Rates, Political Interest.					
Explanatory or Control Variables	MODELS Standardized Coefficients and Significance codes				
	M1_0	M1_1	M1_2	M1_3	M1_4
Intercept	3.06314 ***	3.06314 ***	3.06314 ***	3.06314 ***	3.06314 ***
Political Interest	4.40231 ***	5.61484 ***	6.28325 ***	5.10082 ***	3.74904 ***
Log Population		0.31657 ***	0.34836 ***	0.36513 ***	0.35805 ***
Gini			-1.68856 **	-1.77903 **	-2.29107 **
Percentage of Male Youth				18.78794 ***	8.21666 .
Social Vulnerability					1.89576 ***
Adjusted R^2	0.1065	0.2064	0.2174	0.2428	0.2718
Degrees of freedom	578	577	576	575	574
Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

The iterated exercise resulted in the election of MODEL M1_4 as the most fitted model to explain *Homicide Rates* in light of of *Political Interest*. The resultant model has an Adjusted R-square of 0.27.

The level of uncertainty related to *Percentage of Male Youth* is higher in this model than in the others, with the significance of the result above 0.05. Interested to note that GINI, in this case, is significant. However, it has a negative signal, indicating that the bigger the disparity is, the lower is homicide rate. That fact is counterintuitive and deserves further investigation. All other indicators presented levels of uncertainty below 0.05 and signal according to intuitively expectations.

Finally, figure 13 displays a scatterplot with the relation of *Homicide Rate* and *Political Interest*, an indication the dispersion of the sample and the elected linear model traced. Note that similarly to what happened to *Social Participation* and contrary to intuitive expectations, the slope of the regression is also positive. In other words, the primary expectative was that higher levels of reported political interest would have led to smaller homicide rate. However, based on this sample, the slope is positive, showing a positive relation between *Political Interest* and *Homicide.*

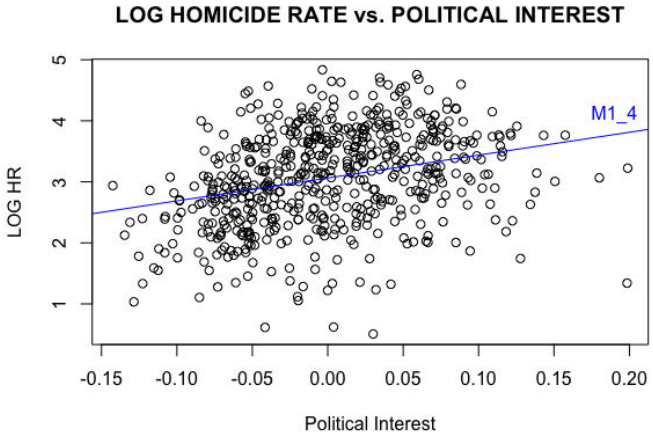


Figure 13 - Model 1_4

In that sense, the hypothesis "H2: Municipalities with higher level of reported interest have a tendency to show lower homicides rates" was not confirmed. The same speculation regarding *Social Participation* is reasonable here: if key aspects that drives homicide rate were inserted on the model such as presence of guns or drugs, the sign for the coefficient of *Political Interest* might change. Note that the present model address only 27% of the phenomenon, as indicated by the R-square. Moreover, the model does not consider the mutual influence between political interest and homicide.

3.3.2.1 Testing the linear regression assumptions – Political Interest

In this section, the same procedures previously implemented to check the robustness of the *Social Participation model* are used to test the *Political Interest model*. The observed requirements were related to (i) linear relationship (ii) absence of colinearity (iii) error distribution and (iv) homoscedasticity.

Assumption of linear relationship

The analysis of linearity of HR, Population and *Percentage of male youth* were presented in the model *Social Participation.* As indicated in figure 25, the remaining variables of the *Political Interest* Model also do not display a clear relation with *Homicide Rate.*

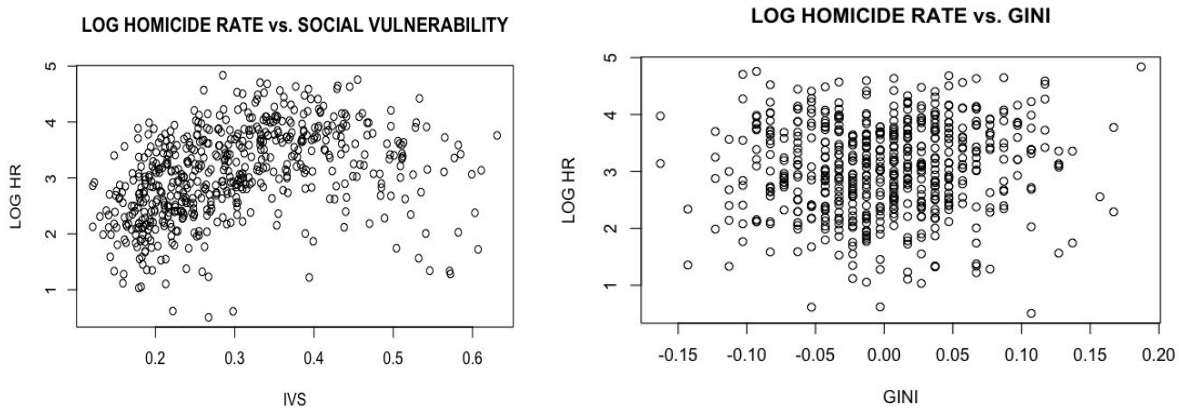


Figure 25 - Lack of linearity, lack of pattern

However, there is no clear quadratic, exponential, nor polynomial pattern among those variables. Reaffirming that the main objective of this exercise is not to find a model to predict neatly homicide rate behavior, it is understood that the lack of linearity does not compromise the investigation between between *Political Interest* and *homicides rates*. In that sense, despite not perfectly fitting the requirement, those variables were kept in the model. In light of the lack of an identifiable non linear pattern, it was considered that the linear requirement can be relaxed without compromising the objective of the proposed investigation.

Absence of Colinearity

Figure 26 below displays the matrix of correlations of the predictors utilized in the final model M1_4. As it is possible to note, variables with high correlations (>0,7) were not used in the final model. The matrix indicates absence of colinearity among the chosen independent variables. Nevertheless, it is also possible to note that the chosen variables also present low correlation with the dependent variable.

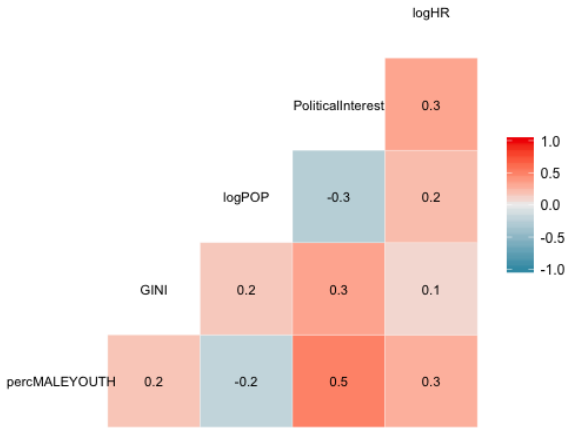


Figure 26 - Matrix of Correlation – Model 1_4

Error distribution

Roughly the error distribution of the Model1_4 follow a normal distribution. In the concrete case under study, the model M0_4 roughly observed these requirement as illustrated in figure 15 and table 11. As ideally desirable, the expected value of the error is zero. The model fulfilled the requirement of error distribution.

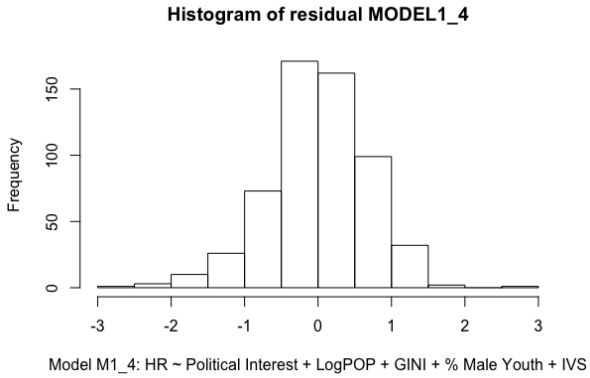


Figure 27 - Histogram RESIDUALS model 1_4 - Normal Error Distribution

Table 11 - Descriptive statistics of residual Model M1_4					
Min	1st Q.	Median	Mean	3rd Q.	Max
- 2.58000	-0. 39420	0.00959	0.00000	0.44200	2.52800

Homoscedasticity

As illustrated in figure 29 bellow, the analysis of the regressors in comparison with the errors of the elected model (residuals) show relatively linear and constant behavior. That means that the confidence and predictions about the HR is quite similar throughout the possible of the independent variables fulfilling the assumption of homoscedasticity.

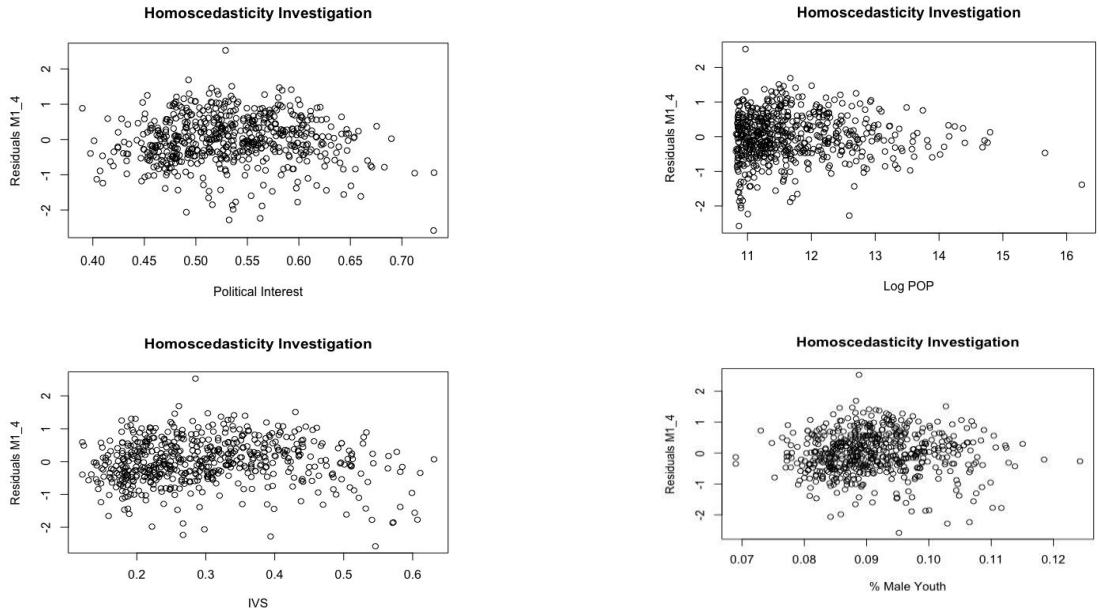


Figure 29 - M1_4 Homoscedasticity Investigation

3.3 Homicide Rate vs. Social Participation Components

One final exercise in this study aims to investigate how the linear model reacts using the components of *Social Participation* to relate to *Homicide Rate*. The idea is to investigate if participation on different types of activities relates differently to homicide rate, as stated in hypothesis H3. In order to do so, *Social Participation* components is regressed against *homicide rate*. Table 12 summarizes the results of this exploratory investigation.

Table 12 - Linear Model Homicides Rates, Social Participation Components	
Explanatory or Control Variables	M2_0 MODEL Standardized Coefficients and Significance codes
Intercept	3.0631353 ***
RELIGION GROUPS	1.7611521 ***
INFORMAL GROUPS	- 4.9538567 ***
POLITICAL AND NGO GROUPS	3.7899961
CIVIC GROUPS	- 3.6655805 *
LOG POPULATION	0.3124440 ***
AVERAGE INCOME	0.0005290 ***
PERCENTAGE OF MALE YOUTH	8.9776624 *
Adjusted R^2	0.3348
Degrees of freedom	578

It is interesting noting that not all groups have the same signals. *Informal Groups* and *Civic associations* display a negative relation with homicide. By its turns, *Religion groups* appear with a positive relation. The result for *Political and NGO groups* have no statistical significance. Thus, this analysis confirms H3, which questions if the participation on different types of activities relates differently to homicide.

Figure 18 displays the distribution of *Homicide Rate* and *Social participation* and identify the model under discussion. Note that the slope of the model - considering all components - remains positive, exposing that the weight of the coefficients of activities with positive relation with HR outweighed the influence of the coefficient of activities with negative relation with HR. Despite the confirmation of the hypothesis H3, the analysis of *Social Participation* components deservers further research to check how robust is the proposed model and to what extent the assumptions of the linear model were respected.

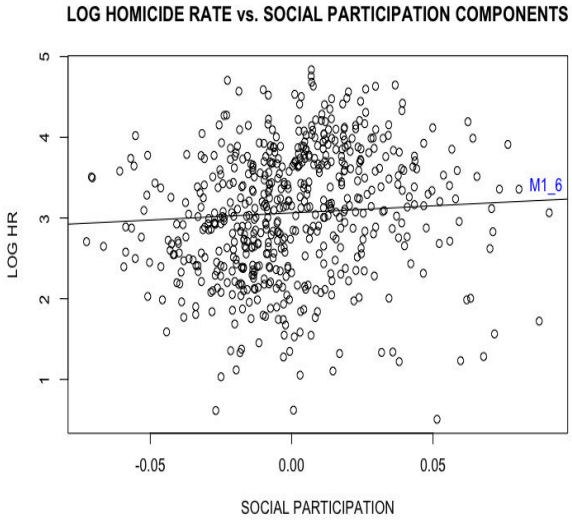


Figure 18 – Participation (components) vs. Homicide

This section addressed the hypothesis H1, H2 and H3 and consisted in an exploratory exercise to approach the question that aim to investigate the relation between social capital and homicide rates in Brazilian municipalities. The resultant models indicate that higher levels of social capital do not necessarily lead to lower rates in Brazil. However, due data availability and methodological approach this research incurs in a series of limitations. The following section discusses the limitations of the explained exercise.

3.4 Limitations

The described research incurs of a series of limitations. The present section points out the main aspects that might curb the validity of the findings. Complementary, by exposing the limitations, the present session creates the bases for an enhanced version of the same study.

3.4.1. Reverse causality

All tested models considered only the influence of social capital might have in homicides. However, more in tune with ecological approach, it is possible to conceive that homicide also influences the social capital. In other words, it is a valid theoretical assumption that communities with more social participation or political interest has tendency to have less homicides. However, the relation also goes in the opposite direction: violence itself might erode social capital, creating a negative cycle. High

homicide rate might diminish the changes of engaging in social activities. Therefore, it is temerarious to assume that causality was well demonstrated by the explained models. In that sense, instead of using linear regressions, probably simultaneous equation models to accommodate a possible negative effect of homicide rates on social capital could constitute a better investigation of the relation between social participation and homicide.

3.4.2 No differentiation of homicides

The exposed research design does not consider different natures of homicides. Homicides associated to urban context are deeply different from homicides resultants of territorial disputes such as border conflicts or deforestation zones. Specifically, in Brazil those disputes are concentrated in the North, Northeast and Center-West. Coincidently the same areas that had the worst homicide rate indicators in the period of analysis. The definition of the final sample and the utilization of the survey as a proxy for social capital without controlling for the nature of the homicide or the characteristics of the area constitute a clear possibility to improve this research.

3.4.3 Control for the representativeness of ENEM candidates

Social capital information derived from data provided by candidates of the National Exam. However, considering the Brazilian society, relying on citizens that completed high school and aim to enter in the university might be biased selection of public. In that sense, the question raised here is to what extend the answers provided by those candidates might reflect properly the average social participation of the municipality the candidate belongs. In other words, validity might be constraint because the selection of data regarding social capital might be considering one specific segment of society that might have schooling level above the average level of inhabitants of the municipality. It is important to further investigate to what extent the opinion of those candidates really capture the phenomenon under study. Although, captured by one component of IVS, average municipal schooling was not directly included as a control variable.

3.4.5 Community unit

Another possible constraint offered by the research design is that municipalities areas do not correspond to communities in the sense used in classical social disorganization theory, neither in the sense of the concept of social capital stated by Putnam. Due to the immense discrepancies in the urban structures of Brazil, in the same municipality different neighborhoods might face completely different and isolated realities. In those cases, the averages municipals indicators might have a limited capacity of capturing the phenomenon.

3.4.6 Endogeneity

Despite the statistic significance of the findings, further investigation related to endogeneity is advisable. Endogeneity occurs when an explanatory variable is correlated with the error term. One common cause of this is attributed to an uncontrolled factor affecting both independent and dependent variables of a model (Wooldridge, 2011). In other words, there is a risk that an uncontrolled variable might be influencing homicide rate and social capital. Precisely, based on the R-square information, the derived models explained around 23% of the behavior of the dependent variable. Although that might be valid for the sake of checking the marginal contribution that social capital might have in homicides, there is a big probability that others factors related to *HR* and to *Social Capital* were not considered and influenced both *HR* and *Social Capital*. The absence of tests related to endogeneity is a limitation of the presented research.

3.4.7 Data Availability

As discussed in the introductory sections, the absence of surveys specifically designed to capture social capital is a strong limitation. However, the present study showed that the utilization of existent data originally made for different purposes can be useful. Note that, there was a date difference between data from Social Capital (2008) and homicides and controls (2010). This offset was due to the preliminary treatment that the database with social capital information required. Nevertheless, using data from different dates in the present case constitutes a limitation.

Chapter 4 – Conclusion

The debate about violence is currently becoming less structured around wars and more focused around criminal violence, terrorism and civil unrest centralized in cities. In the near future, the process of urbanization will occur mainly in the less developed regions, especially in Sub-Sahara Africa, Asia and Latin America. It is expected that this process will intensify the high level of violence of those areas. The behavior of violence in those regions is, therefore, a relevant study.

Brazil presents the highest incidence of homicide of in the world in absolute terms. Despite the recent evolution on the social and economic aspects, Brazilian's homicide rate has stabilized in an epidemic level. This impose the maintenance of security policies in the priority agenda of Brazilian and highlights the importance of the present investigation.

Despite data limitation, this thesis contributes to the debate investigating the influence that social capital might have in homicides in Brazil across municipalities with different social and economic levels. Using database, from the National High School Exam (2008) two dimensions of social capital were tracked: Social Participation and Political interest.

Robert Putnam's classical study claims that higher levels of social capital translate in lower levels of crime. Based on linear multi regression models, the investigated hypotheses: "H1: Municipalities with more associative practices – such as neighborhood associations, recreational clubs, religious associations or political parties – have a tendency to show lower homicides rates" and "H2: Municipalities where citizens have declared more interest in politics have a tendency to show lower homicides rates" were not confirmed. The third hypothesis "H3: Direct participation in different types of associations relates differently to homicide" was confirmed.

From a public policy perspective, the research is underpinned by the assumption that State should not be seen as the only responsible to guarantee security. Citizens behaviors and believes are also constituents of society. Political and civic socialization can foster communication channels and might catalyze social enhancement.

The results demonstrated the potentiality and strong limitations of connecting theory and empirical exercises and set bases for future research as briefly explored in the next section.

4.1 Further Research

One steady contribution of the present research is the indication of the possibility of using the ENEM'S database to relate to social capital and homicide studies. Based on the fact that the ENEM's database offers available data from 2000 to 2015, future research might use data from different years to track variation through a cross sectional study. Note, however, that the questions from the socio-economic survey varied substantially through time. In that sense, cross sectional studies might require a systematization of the dimensions of social capital that was out of the scope of this research.

Moreover, the dataset allows the execution of an enhanced version of this research addressing the limitations of miss conceptualizing community. Using the same database, it is possible to use school as the unit of analysis instead of the municipality. That would approximate the theoretical unit (community) and the empirical unit (municipality) enhancing the findings and grounding properly the theory to the exercise.

Additionally, other controlled variables should also be included in a more elaborated version of this study. Controlling for the nature of the region (urban, rural, deforestation) and for the representativeness of the candidates in comparison to the average schooling level of the community might also result in different findings.

Finally, the utilization of models that consider the multi constitutive relation that social capital and homicides have can raise the investigation to a higher level of validity.

REFERENCES

Bond, M. (2015). Criminology: Social Disorganization Theory Explained. Retrieved from https://www.linkedin.com/pulse/criminology-social-disorganization-theory-explained-mark-bond

Cerqueira, Daniel; Lobão, W. (2004). Determinantes da criminalidade: Arcabouços Teóricos e Resultados Empíricos. *Revista de Ciências Sociais*, *47*(2), 233–269. http://doi.org/10.1590/S0011-52582004000200002

Cerqueira, D. (2010). *Causas e Conseqüências do Crime no Brasil Tese*.

Cerqueira, D. (2014). Mapa dos Homicídios Ocultos no Brasil. *Texto Para Discussão*, (1884), 1–64. Retrieved from http://www.ipea.gov.br/portal/images/stories/PDFs/TDs/td_1848.pdf

Daniel, C., Morais, D. P., Vieira, M., & Matos, M. (2013). *A SINGULAR DINÂMICA TERRITORIAL DOS HOMICÍDIOS*. Brasilia.

Dever, G. E. A. (2006). *Managerial epidemiology : practice, methods, and concepts*.

Durlauf, S. N. (2002). Bowling Alone: A review essay. *Journal of Economic Behavior and Organization*, *47*(3), 259–273. http://doi.org/10.1016/S0167-2681(01)00210-4

Efroymson, M. A. (1960). Multiple regression analysis.

Gelman, a, & Hill, J. (2007). Data analysis using regression and multilevel/hierarchical models. *Policy Analysis*, 1–651. http://doi.org/10.2277/0521867061

Global, J. (2009). *The Criminalisation of Poverty - A report on the Economic, Social and*

Cultural Root Causes of Torture and Other forms of Violence in Brazil.

Goodin, R. (2013). Individualism , Communitarianism and Consensus, *5*(2), 105–120.

Kahn, T. (2013). Crescimento econômico e criminalidade: uma interpretação da queda dos crimes no Sudeste e aumento no Norte/Nordeste. *Revista Brasileira de Segurança Pública*, 152–164.

Messner, S. F., Rosenfeld, R., & Baumer, E. P. (2004). Dimensions of Social Capital and Rates of Criminal Homicide. *American Sociological Review*, *69*(6), 882–903. http://doi.org/10.1177/000312240406900607

Muggah, R. (2012). Researching the Urban Dilemma: Urbanization, Poverty and Violence. *Ottawa: Centro Internacional de Investigaciones Para …*, 1–118. Retrieved from http://www.iadb.org/intal/intalcdi/PE/2012/12203.pdf

PAZ, I. S. DA. (2005). *Formação de Grêmios Estudantis*.

Shrader, E. (2001). *Methodologies to Measure the Gender Dimensions of Crime and Violence*.

Souza, R. S. (2011). Política de segurança pública: grandes desafios. *Forum Brasileiro de Segurança Pública*.

Stanton, J. (2013). An introduction to data science. *Syracuse University*, (2012), 195.

UNDP. (2013). Regional Human Development Report 2013-2014.

Waiselfisz, J. J. (2013). MORTES MATADAS POR ARMAS DE FOGO.

Waiselfisz, J. J. (2015). *Mortes Matados por Armas de Fogo*. Retrieved from www.juventude.gov.br/juventudeviva

Wooldridge, J. M. (2011). *Introductory Econometrics*. *Journal of contaminant hydrology* (Vol. 120–121). http://doi.org/10.1016/j.jconhyd.2010.08.009

Appendices

The presented analyses were all elaborated using the open software R. To obtain the script with the analyses, please send a request to marcio2t@gmail.com.