PUBLIC SPENDING *VERSUS* CRIMINALITY: NORTHEASTERN BRAZIL

LAURO CÉSAR BEZERRA NOGUEIRA

Professor do Centro Multidisciplinar de Pau dos Ferros da Universidade Federal do Semi-Árido e Professor do Programa de Pós-Graduação em Economia da Universidade Estadual do Rio Grande do Norte. Graduação em Ciências Econômicas pela Universidade do Estado do Rio Grande do Norte. Mestre em Ciências Econômicas pela Universidade Federal do Pernambuco. Doutor em Economia pela Universidade Federal da Paraíba.

CARLOS RANGEL PEREIRA VIEIRA

Bacharel em Ciência e Tecnologia pela Universidade Federal Rural do Semi-Árido

BIANCA ALENCAR VIEIRA

Graduada em Engenharia Civil pela Universidade Federal Rural do Semi-Árido e em Ciência e Tecnologia pela Universidade Federal Rural do Semi-Árido. Especialista em Engenharia de Estruturas de Concreto Armado. Atualmente é bolsista CAPES de mestrado no Programa de Pós-Graduação em Engenharia Civil pela Universidade Federal do Rio Grande do Norte.

ADRIANO DAVID MONTEIRO

Doutorando em Administração e Controladoria na Universidade Federal do Ceará. Mestre em Engenharia de Produção pela Universidade Federal da Paraíba. Especialista em Direito Administrativo e Gestão Pública pela FIP, Especialista em Democracia e Direitos Fundamentais pela UEPB, Especialista em Gestão da Saúde pela UEPB, Especialista em Direitos Humanos pela UFCG, Bacharel em Administração pela FMN e Bacharel em Administração Pública pela UEPB.

ABSTRACT

The main objective of this study is to investigate the index of efficiency in public spending on public safety in the Northeast of Brazil from 2008 to 2012. For this purpose, we have collected information from the Brazilian Yearbook of Public Safety and the Brazilian Finance platform for federal revenues. Data Envelopment Analysis (DEA) was used to achieve the proposed objectives. The main results report a high percentage of inefficiency in the management of public resources related to security. Although there was a significant increase in public safety spending during the period examined, there was also a significant increase in crime indicators. The results also show that only the states of Paraíba and Piauí have been efficient, even though the number of rapes increased by 176.8% and 636% respectively.

Keywords: Public Safety. Efficiency. DEA

RESUMO

GASTOS PÚBLICOS VERSUS CRIMINALIDADE: O CASO DA REGIÃO NORDESTE DO BRASIL

Esse estudo teve como principal objetivo investigar o índice de eficiência dos gastos públicos em segurança pública na Região Nordeste do Brasil no período de 2008 a 2012. Para tanto, coletou-se informações no Anuário Brasileiro de Segurança Pública e na plataforma Finanças Brasil oriundas da receita federal. Adotou-se o método de Análise Envoltória de Dados – DEA – a fim de alcançar os objetivos propostos. Os principais resultados relatam um elevado grau de ineficiência na gestão dos recursos públicos em segurança. Pois, embora haja um crescimento significativo dos dispendidos em segurança pública no período estudado observa-se elevação significativa nos indicadores de criminalidade. Além disso, os resultados apontam que apenas os estados da Paraíba e Piauí são eficientes, mesmo com a quantidade de estupro tendo evoluído 176,8% e 636% respectivamente.

Palavras-chave: *Segurança Pública. Eficiência. DEA.*

Public spending versus criminality: Northeastern Brazil

Lauro César Bezerra Nogueira, Carlos Rangel Pereira Vieira,
Bianca Alencar Vieira and Adriano David Monteiro

INTRODUCTION

According to the traditional literature on the theory of crime, the practice of criminal acts is essentially determined by the cost-benefit of crime. According to Becker (1968), the more criminal acts are punished, the less inclined individuals will be to practice illegal acts.

Society over time has normalized a wide variety of forms of containment and punishment with the objective of protecting citizens from individuals with violent behavior. Punishments range from verbal and written warnings to fines, community service, payment of damages, indemnification and imprisonment (SCHERER, *et al* 2011).

In essence, incarcerators seek to transform and rehabilitate these individuals. In practice however, especially in underdeveloped countries, these objectives are largely unmet. Usually the measures to achieve this transformation are inefficient, and this leads to a high recurrence of crime and convicts returning to prison (SCHERER, et al 2011).

According to data collected from the National Penitentiary Report – INFOPEN – between 2008 and 2012 the prison population in Brazil was young, single and had little education, with more than half of the prisoners not having completed primary education and just 1% having higher education. The data reveal that two thirds of this population is black and the recurrence of crime is quite high. The costs of the prison system and public safety in Brazil have risen considerably in recent years. However, the resources appear to be insufficient in the face of the growing wave of criminality and violence in this country.

According to information from the 2018 Atlas of Violence, 63,880 intentional violent deaths were registered in Brazil in 2017. This figure represents an increase of 2.9% in relation to the previous year. The three states most affected by this problem are Rio Grande do Norte (68); Acre (63.9) and Ceará (59.1) which have almost double the homicide rates per 100,000 inhabitants as the national average. There has also been a growth of 8.4% in the registration of occurrences of rape in Brazil, with 60,018 official occurrences recorded in 2017. In this year 119,484 firearms were apprehended, with 94.9% of them having no registration with the Federal Police system (SINARM). Another issue has to do with the substantial regional heterogeneity of the indices of violence in Brazil. Over the last ten years, for example, the number of homicides in São Paulo has declined 56.7% against an increase of 256.9% in Rio Grande do Norte. The indicators show that this problem is of much greater concern in the North and the Northeast of this country.

To give an idea of the size of the problem, in 2017 R$ 84.7 billion was spent on public safety in Brazil. In per capita terms (spending per inhabitant), the federal, state and municipal governments spent R$ 408.13 per citizen, which represents an increase of 0.85% compared to the previous year. Currently public safety spending represents 2.5% of the country's Gross Domestic Product (GDP).

The literature points out that spending on prisons is quite high and is becoming more and more unsustainable and less effective.[1] They usually result in a considerable drain on federal, state and

---

1   *More details can be found in Aos et al. (2004)*

municipal budgets, taking scarce resources away from essential areas such as education, health and welfare. According to Drake, Aos and Miller (2009) the prevention of precocious delinquency and subsequent crimes represents a viable option as a public policy alternative to later individual punishment, which generally occurs through the prison system.

FIGURE 1

Evolution of Public Safety Spending in Brazil
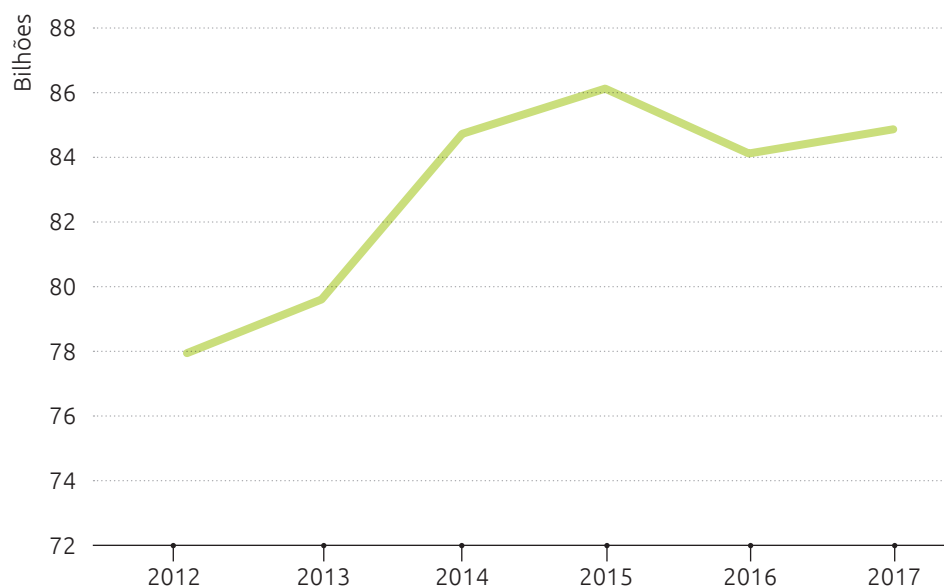
Source: 2018 Brazilian Yearbook of Public Safety.

Given the above aspects, various important economic problems appear. For example, is public spending on safety currently allocated efficiently and well? If the answer is yes, then why has criminality and violence in Brazil, and especially in the northeastern region, grown so much? What are the cost-benefits of public policies designed to prevent crime in Brazil? Finding answers to these problems are fundamental to the construction of public policies related to the issue at hand.

That being said, this study seeks to examine the efficiency of public spending on public safety in the northeastern states of Brazil. To do this, we will estimate the efficiency of spending through Data Envelopment Analysis – DEA. The main reason for adopting the DEA method is that it does not require the identification of a functional form that explains exactly the relationship between spending and/or investment in public safety and violence indicators. It is also a simple tool that can be objectively applied. The area of study (the Northeast) has been chosen for two fundamental reasons: i) the region's particular and distinct reality compared to other regions; ii) the wave of violence and criminality that has swept urban Brazil.

This work is divided into four sections besides the introduction. Section 2 discusses the theoretical references that deal with the elements addressed in this study, and Sections 3 and 4 present its methodology and results. The study concludes with the presentation of our final considerations in Section 5.

ARTIGO

Public spending versus criminality: Northeastern Brazil
Lauro César Bezerra Nogueira, Carlos Rangel Pereira Vieira,
Bianca Alencar Vieira and Adriano David Monteiro

THEORETICAL REFERENCES

BRAZILIAN PENITENTIARY SYSTEM

The Brazilian penitentiary system has suffered countless changes over its long history. According to Araújo (2009), prisons in Brazil began during the colonial period with the sole aim of guarding suspects or individuals who were awaiting sentencing, but without any intention of rehabilitating them. It was only in the 19th century that the first penitentiary appeared in Rio de Janeiro, the first in Latin America. During this period, Perrot (1988) affirms that prison was transformed into its current form, consisting of three basic functions: punishment, protecting society and rehabilitating the prisoners. In other words, converting the convict into a good citizen.

Prisons and houses of correction for women also appeared in the 19th century. These locations were normally philanthropic or religious centers, which were not under great control by the State. "*They believed that women needed a loving environment for rehabilitation and men a rigid one*" (MARANHÃO; AGUIAR, 2016, p. 84).

The Constitution of 1824 and the Criminal Code of 1830 were responsible for introducing imprisonment as it is conducted in this country. The Constitution determined that jails should be secure and clean with good ventilation and the prisoners separated according to the nature of their crimes (MARANHÃO and AGUIAR, 2016). In arriving at the present system, modernization of the Brazilian penitentiary system has been characterized by a mix of foreign models.

According to the National Penitentiary Report – INFOPEN – Brazil began the 21st century with the number of prisoners far outnumbering capacity, with 232,755 prisoners occupying buildings with a capacity for 135,710, a deficit of 97,045 spaces. Over time the numbers have grown to the point that the alarming data of 2014 tell us that the country has 1,450 prison units, 37,444 security/prison secretariat jails and 397 federal units. Despite the large number of prisons, the country has an occupation rate of 167%, with 371,884 spaces occupied by 622.202 prisoners, or in other words, a deficit of 250,318 spaces. According to this data, the country has 299.7 prisoners for every 100,000 inhabitants, and 41% of these have not been convicted. (DE ANDRADE and FERREIRA, 2016).

Despite the overcrowding, Monteiro and Cardoso (2013) argue that prisons do not have a large number of dangerous and violent individuals, but rather those deprived of their liberty due to involvement with drugs, theft, disobeying public orders, or in other words, petty crimes. Incarcerated in Brazilian prisons, most of these individuals end up "growing" in their criminality, and later commit violent crimes.

PROFILE OF BRAZILIAN PRISONERS

Data collected by the National Penitentiary Report – INFOPEN – in June 2014 allow us to outline the profile of those deprived of their liberty in Brazil. This database takes into account factors such as age group, race, color/ethnicity, marital status, handicaps, education, foreigners, number of children, type of prisoner, gender and sentence duration.

From this point of view, we can see that young people make up the majority of the prison population, that is 56% of those deprived of their liberty are young people between the ages of 18 and 24. Incarceration

of this population is observed in every state in the nation. According to Monteiro and Cardoso (2013) this is a very complex picture which is characterized by these young people entering prison at an early age, which contributes to them becoming "career criminals".

In relation to race, color and ethnicity, what stands out is the proportion of black prisoners: two out of every three prisoners are black; this is true of both the male and female populations. In the Northeast, the number is even greater, with 4 out of every 5 prisoners being black (MOURA and RIBEIRO, 2015).

According to Moura and Ribeiro (2015), in terms of marital status, most Brazilian prisoners are single (57%). As mentioned above, the prison population is composed mainly of youths, which explains in part the large number of single individuals. Of the total, 29% of them are in stable unions and just 10% are married. There is not much difference between the male and female population. The numbers for the country are similar to those of the Northeast.

PUBLIC SAFETY *VERSUS* EDUCATION

In their studies, Batella and Diniz (2010) state that a lack of education conditions criminality. According to the authors, the regions that have low education indicators are susceptible to becoming areas where criminality is constant. Individuals who are in prison with low levels of education have a greater propensity for violence. In this sense, we can observe that education improves the professional qualifications of citizens, thus improving their income and offering these individuals better living conditions, which distances them from crime.

According to Pino (2007), education is the only solution for ending urban violence. That being so, individuals need to be educated so they find sufficient concrete reasons not to opt for a life of crime. However, the main issue that needs to be studied is what leads youths to lead lives far from crime.

Duenhas, *et al,* (2014) affirm that education contributes to the fight against crime, with those who are educated focusing less on the present and placing greater value on the future, in other words, being patient and risk averse. Education also teaches a group of moral values, discipline and cooperation, which give individuals a lower propensity for crime. In this sense, keeping children off the streets and in school over the long term helps reduce violence.

IMPORTANT RESULTS IN THE LITERATURE

In their study, Almeida and Gasparini (2011) propose an index for the efficiency and quality of public spending on education in the state of Paraíba. The main objective of this indicator is to identify which cities have the most and least efficient education systems. According to the DEA Analysis, 28.5% of the 179 municipalities analyzed served as a reference for the rest. Several of the efficient municipalities have been cited repeatedly as benchmarks. For example, educational development in the municipality of Diamante is above the average observed in Paraíba. In general, the results conclude that smaller municipalities are in a worse situation, while the states' large cities have a positive influence on the performance of neighboring cities.

Cândido Júnior (2009) theoretically and empirically analyzes the relationship between public spending and economic growth in Brazil between the years of 1947 and 1995. In general, the results reveal that the country

has low indices of productivity and that the proportion of public spending is above the optimal level. Thus, a satisfactory reallocation of resources would result in an improvement in the productivity of this spending.

Rezende *et al,* (2005) diagnose the variables that condition public policies and the level of human development in the municipalities of the state of São Paulo. Using the cluster analysis method, they find that the municipalities of the state that have the largest investments are not in the cluster that has the best indices of human development. It also verifies that economic variables and socio-economic characteristics have discriminatory power, given that the regression model classified 85% to 91% of the cases correctly. It concludes, therefore, that the HDI of these municipalities is due to other factors, such as public investment.

Ribeiro (2008) empirically evaluated the efficiency of public spending in Brazil compared to a group of 17 countries in Latin America from 1998 to 2002. Using DEA analysis, Brazil presented below average results in terms of the efficiency of public spending and roughly average results in terms of public services, compared to other countries in Latin America. The best results were obtained by Costa Rica, Uruguay and Chile.

RESEARCH METHODOLOGY

DEA is a mathematical methodology developed to determine the efficiency of Decision-Making Units (DMUs). To do this it uses linear programming rules. In the public sector, the DEA method has been widely used in the empirical evaluation of the efficiency or productivity of public services. This occurs mainly due to the fact that the sector has a large number of inputs and outputs (MELLO *et al.* 2005).

According to Mesa *et al.* (2003), DEA compares a given number of DMUs that realize similar tasks that differ from each other in their inputs and outputs, in which the individual observations of the decision-making units is designed to create an efficiency frontier at which DMUs have Pareto efficiency. That is, a DMU has Pareto efficiency if it is not possible to change one characteristic without worsening the situation of the other characteristics.

FIGURE 2

BCC and CCR Models – Oriented towards Inputs
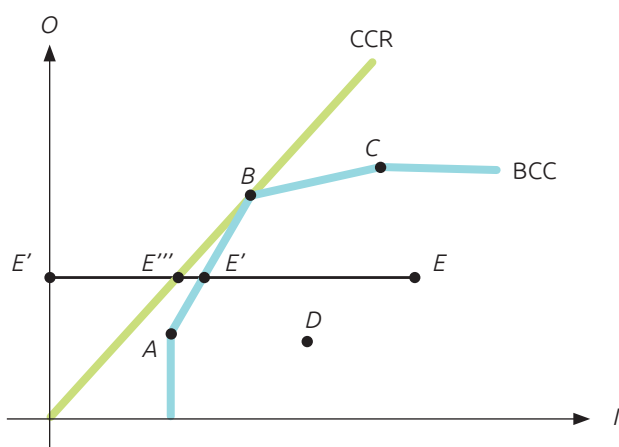
Source: Prepared by the authors.

There are various ways to present multidimensional DEA models. However, there are two classic models. The CCR model assumes Constant Returns of Scale (CHARNES *et al.* 1978), where any variation in the inputs generates a proportional variation in the outputs. The BCC model considers Variable Returns of Scale (BANKER *et al.* 1984), that is, there is no perfect correlation between inputs and outputs. Figure 2 outlines the production process in terms of inputs for both models.

Nominally the BCC model admits that returns vary with the scale of production. This is unlike the CCR model, which adopts the axiom of proportionality between inputs and outputs; the BCC model works with the convexity axiom.

$$Min\ h_0 \qquad s.a$$

$$x_{i0} - \sum_{k=1}^{n} x_{ik}\lambda_k \geq 0, \forall i$$

$$-h_0 y_{j0} + \sum_{k=1}^{n} y_{jk}\lambda_k \geq 0, \forall j \tag{1}$$

$$\sum_{k=1}^{n} \lambda_k = 1$$

$$\lambda_k \geq 0, \forall\ k$$

$$Max\ h_0 \quad s.a$$

$$x_{i0} - \sum_{k=1}^{n} x_{ik}\lambda_k \geq 0, \forall i$$

$$-h_0 y_{j0} + \sum_{k=1}^{n} y_{jk}\lambda_k \geq 0, \forall j \tag{2}$$

$$\sum_{k=1}^{n} \lambda_k = 1$$

$$\lambda_k \geq 0, \forall\ k$$

The dual models of Linear Problem Programming presented in (1) and (2), respectively, give rise to BCC models of multipliers oriented towards inputs and outputs expressed in (3) and (4). The dual variables u_* and v_* are united with the condition $\sum_{k=1}^{n} \lambda_k = 1$ and represent the factors of scale.

$$Max\ Eff_0 = \sum_{j=1}^{s} u_j y_{j0} + u_*$$

$$s.a$$

$$\sum_{i=1}^{r} v_i x_{i0} = 1 \tag{3}$$

$$-\sum_{i=1}^{r} v_i x_{ik} + \sum_{j=1}^{s} u_j y_{jk} + u_* \leq 0 \ \forall k$$

$$v_i, u_j \geq 0, u_* \in \mathbb{R}$$

ARTIGO

Public spending versus criminality: Northeastern Brazil
Lauro César Bezerra Nogueira, Carlos Rangel Pereira Vieira,
Bianca Alencar Vieira and Adriano David Monteiro

$$Max\ Eff_0 = \sum_{j=1}^{s} u_j y_{j0} + u_*$$

$$s.a$$

$$\sum_{i=1}^{r} v_i x_{i0} = 1$$

$$-\sum_{i=1}^{r} v_i x_{ik} + \sum_{j=1}^{s} u_j y_{jk} + u_* \leq 0\ \forall k$$

$$v_i, u_j \geq 0, u_* \in \mathbb{R}$$

(4)

where Eff_0 represents the efficiency of DMU$_0$ under analysis; v_i relates the weights attributed to inputs i, (i=1,…,s); u_j denotes the weights designated to outputs j, (j=1,…,s); x_{ik} and y_{jk} represent inputs i and outputs j of DMU k, (k=1,…,n), and x_{i0} and x_{j0} represent inputs i and outputs j of DMU 0.

The optimal value of h_0 is located between zero and one. Its difference (1-h_0) represents the efficiency by which investments can be removed without modifying the value of the indices. In this way, the closer it is to one, the more efficient the DMU is.

The adoption of the BCC model oriented towards outputs occurs especially when the proposal is centered on identifying the allocative efficiency of the resources invested in public safety. In other words, the key issue is combatting violence and reducing the indicators of urban criminality; in other words, the interest lies in the output (reducing criminality). In addition to other reasons, this choice is based on the hypothesis that the returns – results – obtained by the states do not vary in a constant manner. The estimates were arrived at by using the Integrated Decision-Making System – *SIAD*. Below is an overview of DEA BCC modeling oriented towards inputs and outputs.

VARIABLE SELECTION – MULTIPLE CRITERIA

This method seeks to overcome problems related to significant quantities of variables and few DMUs giving rise to a large number of efficient units. The selection of variables by multiple criteria is designed to choose variables summarily that have a better fit to the efficiency frontier.

According to Cunha, Mello and Meza (2006), this technique takes into account two measures: best fit with the calculated efficiency frontier and maximum discrimination. Best fit is obtained by way of the average efficiency and its normalization, which just generates the variable SEF, the best fit for the frontier. A perfect score is 10, indicating maximum efficiency, and 0 indicating minimum efficiency. In terms of maximum discrimination, this is measured by the total number of efficient DMUs. In other words, the lower the number of efficient DMUs, the greater the discrimination obtained by the model. In this case, normalization creates the variable S$_{DIS}$, which denotes maximum discrimination. This variable has a value of 10 when the lowest number of efficient DMUs is observed, and 0 otherwise.

The two criteria are associated with a variable S according to the expression $S = \omega S_{EF} + (1 - \omega)S_{DIS}$:. The value ω is established according to the importance attributed to the efficiency measurement and the model's discrimination. In this sense, we have opted to consider the value ω =0,5 to avoid overlapping criteria. Given this, the model that presents the greatest value for S is the one that has the best fit. However, it should contain the minimum number of variables, which corresponds to more than 33.33% of the DMUs (CUNHA, MELLO AND MEZA, 2006).

OUTLIER ANALYSIS – GRUBBS'S TEST

The literature presents many ways to detect the presence of outliers – extreme values – in a group of data. In general, calculations are developed in relation to the studied sample compared with the critical statistical value. In this study, we have opted to apply Grubbs's test (1969). It is defined by this equation (3).

$$Z = \frac{|x_i - \bar{x}|}{s} \qquad (3)$$

where x_i denotes the specific observation of the sample $x_{1}, x_{2, \dots}, x_n$; $\bar{x}$ represents the sample average; and s denotes the standard error for the sample to test the following hypotheses:

$H_0 = x_i$ Observation considered an extreme value;

$H_1 = x_i$ Observation did not consider an extreme value.

The significance is assumed to be 95%. That is, for any $\rho - value > 0.05$, H_0 is rejected. The main goal of Grubbs's test is to identify the homogeneity of DMUs.

RESULTS

This section is dedicated to presenting and discussing the results. Thus, we have opted to divide it into two blocks. *A priori* we present a brief report of the variables – the information – used in this study. The second block is dedicated to the estimated results for this model and its approaches.

DESCRIPTION OF THE DATA

The database refers to the period from 2008 to 2012 and the nine states that make up the Northeast. After determining the tests and selection criteria for the variables to find the best fit and best discrimination, essentially due to a reduced number of DMUs, we opted to use four variables. The group of variables is denoted in Text Table 1. The data for the outputs – violence – was collected from the Brazilian Yearbook of Public Safety. In terms of the inputs – investment in public safety – they were collected from the national treasury's website on the Brazilian Finance platform.

TEXT TABLE 1

Description of the Study Variables

Variables	Description
Public Safety	Average per capita investment in public safety
Murders/Firearms	Murder rate by firearms (100,000 inhabitants) – inverse.
Robbery Leading to Murder	Robbery leading to Murder Rate (100,000 inhabitants) – inverse.
Rape	Rape rate (100,000 inhabitants) – inverse.

Source: Prepared by the authors.

ARTIGO

Public spending versus criminality: Northeastern Brazil
Lauro César Bezerra Nogueira, Carlos Rangel Pereira Vieira,
Bianca Alencar Vieira and Adriano David Monteiro

The inputs refer to the average per capita investments in public safety. The outputs are represented by the inverse of the murder rate by firearms, robbery leading to murder and the rape rate per 100,000 inhabitants.

The information exhibited in Figure 3 raises some important questions. For example, the data inform us that the state of Alagoas stands out in terms of the violence indicators during this period, especially murder by firearms. There is also an intriguing relationship between investment and violence in Ceará.
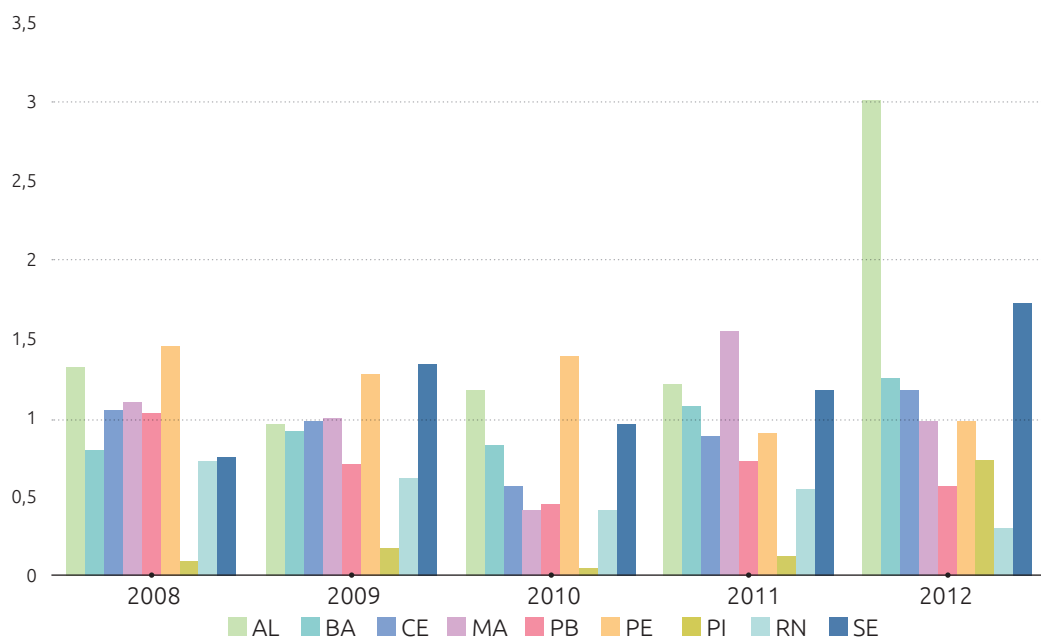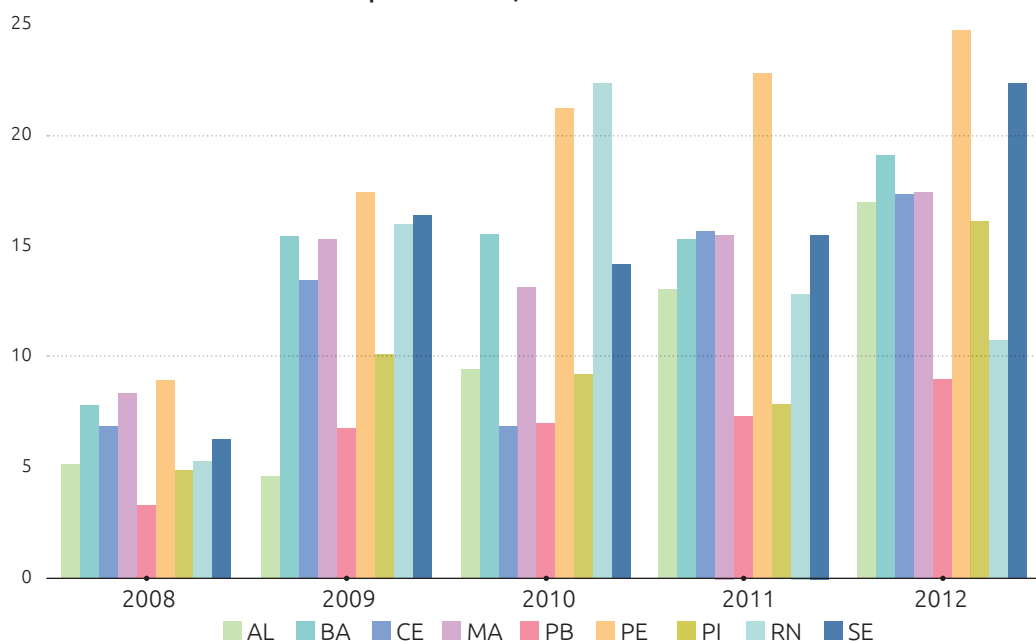
FIGURE 3

Investments in Public Safety versus Urban Violence
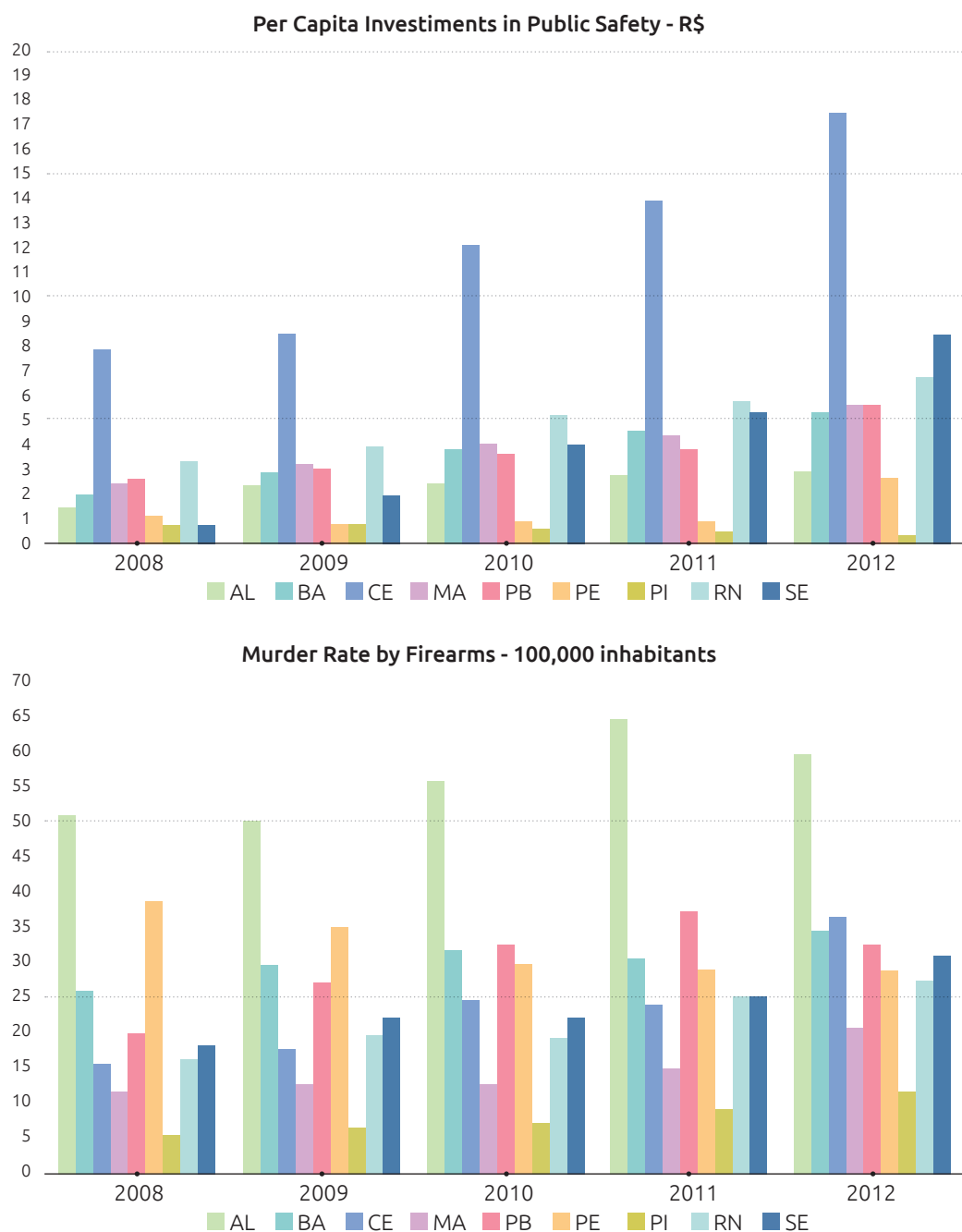
Per Capita Investiments in Public Safety - R$

Murder Rate by Firearms - 100,000 inhabitants

Robbery Leading to Murder Rate - 100,000 inhabitants

Rape Rate - 100,000 inhabitants

Source: Prepared by the authors.

Thus, even though the state has invested more and more in public safety, the violence indicators have not accompanied this trend. We can observe that the number of murders by firearms in Ceará has more than doubled during the period analyzed. Only in 2010 and 2011 was there any stability, even though the numbers were much higher than in previous periods.

ARTIGO

Public spending versus criminality: Northeastern Brazil
Lauro César Bezerra Nogueira, Carlos Rangel Pereira Vieira,
Bianca Alencar Vieira and Adriano David Monteiro

In terms of violence as characterized by cases of robbery leading to murder and cases of rape, Ceará managed to reduce such occurrences between 2009 and 2010. At the beginning of the following year, however, these indices began to increase again and became greater than those of the initial period.

The behavior in the state of Piauí is also interesting. First of all, it is by far the state that invests least in public safety. Paradoxically it has the lowest murder rates by firearms. On the other hand, cases of robbery leading to murder and cases of rape increased markedly during the period analyzed. In numbers, robbery leading to murder grew 225.31%. During the same period, rapes increased by 636%. It should be emphasized that the information used corresponds to the number of occurrences registered with the police. It therefore does not necessarily indicate the number of victims involved.

Rio Grande do Norte is another state that merits attention, albeit for negative reasons because even though it increased its investment in public safety during the period, its violence figures increased in an extreme fashion, with the exception of robberies leading to murder which fell by 57% during this period. Specifically, murders by firearm increased approximately 71%, while rapes increased 107%.

Another interesting characteristic provided by the data has to do with the behavior of violence in the state of Pernambuco. Even though the state does not invest heavily in public safety, the murder and robbery leading to murder rates have plummeted. At the same time, however, the incidence of rape has soared by 176.8%.

On the other hand, during the analyzed period Bahians managed to reduce the murder rate by firearms and cases of robbery leading to murder. However, the number of rapes has grown. Even so, this reduction is less than that intended by the investment made in public safety, because per capita investment in public safety almost tripled during this period. The problem in Maranhão is much more accentuated. Even though investment in public safety increased by almost 130%, the violence indicators did not diminish. On the contrary, the number of homicides by firearm increased by 68.9%. The number of rapes grew by 97.8%; in other words, it practically doubled. It should be emphasized that the increase in the number of rapes in general could be linked to more frequent reporting of this type of violence.

The data for Paraíba follows the regional pattern; that is, even though investment in public safety has more than doubled, the violence indicators have grown worse across the board, with the exception of robbery leading to murder, which fell by 44% during this period. The respective figures for murder by firearm and rape grew by 64.8% and 175.4%, respectively. In Sergipe, all of the indicators analyzed increased substantially. Specifically, the number of fatal victims of firearms grew by 75%. The occurrences of robbery leading to murder increased by 140%, while in terms of rapes reported to the police authorities, the growth observed in 2012 was 3.5 times greater than in 2008.

The graphs in Figure 2 reveal interesting characteristics. We observe a pattern of considerable growth in public safety spending. In some cases, this spending more than doubled, as in the state of Ceará. However, there was no significant decrease in the indices of criminality in the Northeast. Most of the indicators displayed an aggravation of the violence. This graph leads us to suppose that the evolution of public safety spending consists of therapies and remedies for the problem, but not real planning to combat violence.

ESTIMATES OF THE DEA MODEL

The results of the estimates of the DEA Model – BCC/output-oriented – illustrated in Table 1 inform us that only the states of Paraíba and Piauí applied the resources allocated to public safety in an efficient manner.

The state of Pernambuco is the one that presents the least efficient pattern. According to the findings, more than half the investments in public safety were poorly applied. In Bahia and Sergipe, respectively, low productive efficiency was also observed in the fight against criminality and violence. The efficiency figure for Bahia was 0.51 and for Sergipe the figure was 0.52. These numbers are even more serious when we observe the inverted and composite figures.

TABLE 1

Productive Efficiency

UF	Productive Efficiency – Outputs			
	Standard	**Inverted**	**Composite**	**Normalized**
Alagoas	0.79	1.00	0.39	0.53
Bahia	0.51	0.97	0.27	0.36
Ceará	0.62	1.00	0.31	0.41
Maranhão	0.63	0.87	0.38	0.51
Paraíba	1.00	0.66	0.67	0.90
Pernambuco	0.46	1.00	0.23	0.31
Piauí	1.00	0.50	0.75	1.00
Rio Grande do Norte	0.60	0.85	0.38	0.50
Sergipe	0.52	1.00	0.26	0.35
Average Efficiency	**0.62**	**0.97**	**0.38**	**0.50**

Source: Prepared by the authors.

In Ceará, Maranhão and Rio Grande do Norte, even though there was an improvement in the allocation of roughly 20% of the resources dedicated to public safety compared to those cited above, the results are still far below the desired optimal numbers. Specifically, when we evaluate the state of Ceará we observe that the total of underutilized inputs is very expressive, given that the state invested approximately R$ 150.5 million in public safety just in 2012. The spending on public safety in the states of Rio Grande do Norte and Maranhão was R$ 20.4 million and R$ 31.5 million respectively.

On the other hand, the state of Alagoas, even though it has high indices of violence, had an efficiency of 0.79. In other words, 21% of the state's resources in this area were spent in an inadequate manner. It should be noted that this result usually occurs due to a state investing little in public safety.

This characterization – investing little – seems to clarify the efficiency found, given that the state of Piauí is the only efficient state in all of the approaches adopted and is the one that allocates the least investment to public safety, according to the data[2]. The efficiency of the state of Paraíba is also standard. However, when the composite and normalized efficiency are estimated, the results suggest that 10% of the resources are wasted.

As may be observed, there is a standard average waste of 38% of the money invested in public safety in the Northeast. This result becomes of even greater concern when we restrict the model to normalized composite efficiency and make multiple comparisons between the states; the comparisons suggest there is an underutilization of half of the resources. The results presented up to this point enable two

---

2   *It should be pointed out that the state of Piauí is considered to be one of the states with the greatest problems in terms of information, according to the National Secretariat of Public Safety – SINESP.*

ARTIGO

Public spending versus criminality: Northeastern Brazil
Lauro César Bezerra Nogueira, Carlos Rangel Pereira Vieira,
Bianca Alencar Vieira and Adriano David Monteiro

inferences to be drawn. First, most of the states in the Northeast invest little in public safety. Second, just increasing spending does not seem to be the solution, because Ceará, according to the data, invested more than double the amount that Bahia invested in 2012 and approximately 7.5 times that of RN, yet the violence indicators are roughly similar and, in some cases, worse. In Table 2, we present the values for the reference units.

TABLE 2

Benchmarks – Reference Units

UF	Paraíba	Piauí
Alagoas	0.56	0.44
Bahia	0.68	0.32
Ceará	0.63	0.37
Maranhão	0.19	0.81
Paraíba	1.00	0.00
Pernambuco	0.21	0.79
Piauí	0.00	1.00
Rio Grande do Norte	0.40	0.60
Sergipe	0.52	0.48

Source: Prepared by the authors

The states of Paraíba and Piauí are not false efficient units, because they serve as references for all of the states considered to be inefficient in the management of public safety resources.

We can also perceive that the preponderance of actions pursued by the units considered to be inefficient is practically divided between the states of Paraíba and Piauí. It should be emphasized that efficiency analysis is a relative comparative technique and not an absolute one, because it compares production in relation to the resources employed. Thus, it calculates by comparing with other perspectives – production/investments – what was not produced by the same total amount of resources.

FINAL CONSIDERATIONS

As may be observed, the relationship between investments in public safety and violence indicators is much more complex than might be imagined. Based on a model of efficiency – DEA – the main objective of this study is to measure the efficiency of the application of public resources in public safety in the states of northeastern Brazil. The results demonstrate that just the states of Paraíba and Piauí were efficient in comparison with the other states in Northeast Brazil during the evaluation period.

Other interesting aspects were also detected, including the fact that the state of Piauí is the state that applied the fewest resources to public safety. In turn, none of the states saw an accentuated fall in violence due to greater investment in public safety. The total magnitude of investments in public safety do not necessarily result in a reduction in the violence that afflicts this region, as we can observe in Ceará, for example.

It is important to consider important factors such as the role of criminal factions in the Northeast and the process known as the interiorization of crime, which have not been directly addressed by this methodology.

According to the 2018 Atlas of Violence, there are countless problems that drive criminality and violence in Brazil, which accentuate economic and social inequality, the inefficiency of the public safety system, the strong presence in illicit markets, criminal factions, and the elevated number of firearms, especially illegal ones. Together these factors create an enormous challenge to society, given that they contribute in a determinant manner to the high level of violence in the North and the Northeast.

In light of this, at least two facts appear to be clear. First, it is not possible to reduce violence simply by spending more money on public safety; that is, it appears that spending grows in a substantial manner not because investments are being made in public safety, but rather because money is being spent to provide remedies for and/or to reduce the growth of violence. Second, there is a clear lack of public policies for combatting violence, especially related to young people.

There are also interesting international experiences to consider. For example, Steve Aos *et al.* (2001) and Drake *et al* (2009) analyze the cost-benefits of given programs implemented in North America, especially the United States. The main results demonstrate that programs such as: multisystem therapy, functional family therapy, and coordinated services have obtained significant effects in terms of the criminal justice system. According to these studies, these programs are good investments for lowering criminality in terms of reducing the net costs of crime for their perpetrators and victims. For every dollar invested, there was a return of twenty dollars to the contributor.

In Brazil, there is a clear absence of public policies oriented towards preventing the precocious entry into a life of crime, as well as preventing the recurrence of crime. It is hoped that this study will contribute to advances related to this subject, especially in the formulation of policies designed to prevent crime, especially those dedicated to the young population.

However, we should point out some limitations to this study that can be investigated in the future. First of all, some states do not provide proper data to the Brazilian Yearbook of Public Safety, such as the state of Piauí. Second, there are factors that affect violence that are not considered by this methodology, such as investment in education. It should be emphasized that investment in education was tested as an input in the variable selection process and was rejected. Given this, various prospects for future research on this subject arise. For example, there are other possibilities in terms of source databases, and it would also be interesting to adopt a two stage DEA model which considers the biases of the omitted variables that affect violence.

REFERENCES

AOS, Steve et al. **The Comparative Costs and Benefits of Programs To Reduce Crime**. Version 4.0. 2001.

AOS, Steve et al. **Benefits and costs of prevention and early intervention programs for youth**. 2004.

ARAÚJO, C. E. M.; **O duplo cativeiro: escravidão urbana e sistema prisional no Rio de Janeiro**, 1790-1821. In: MAIA, C. N. et al (Org.). História das prisões no Brasil. Rio de Janeiro: Rocco, 2009. v. 1, p.217-248.

BANKER, Rajiv D.; CHARNES, Abraham; COOPER, William Wager. **Some models for estimating technical and scale inefficiencies in data envelopment analysis. Management science**, v. 30, n. 9, p. 1078-1092, 1984.

BATELLA, Wagner Barbosa; DINIZ, Alexandre Magno Alves. **Análise espacial dos condicionantes da criminalidade violenta no estado de Minas Gerais. Sociedade & Natureza**, v. 22, n. 1, 2010.

CÂNDIDO JÚNIOR, José Oswaldo. **Os gastos públicos no Brasil são produtivos?.** Planejamento e políticas públicas, n. 23, 2009.

CHARNES, Abraham; COOPER, William W.; RHODES, Edwardo. **Measuring the efficiency of decision making units. European journal of operational research**, v. 2, n. 6, p. 429-444, 1978.

CUNHA, Bruno Tonioni; SOARES DE MELLO, J. C. C. B.; ANGULO-MEZA, L. **Implementação computacional de seleção de variáveis em DEA: um estudo de caso em avaliação educacional**. In: CLAIO-Congreso Latino-Iberoamericano de Investigación Operativa. 2006.

DE ALMEIDA, Aléssio Tony Cavalcanti; GASPARINI, Carlos Eduardo. **Gastos públicos municipais e educação fundamental na Paraíba: uma avaliação usando DEA. Revista Econômica do Nordeste**, v. 42, n. 3, p. 621-640, 2016.

DE ANDRADE, Ueliton Santos; FERREIRA, Fábio Félix. **Crise no sistema penitenciário brasileiro: capitalismo, desigualdade social e prisão. Revista Psicologia, Diversidade e Saúde**, v. 4, n. 1, 2016.

DRAKE, Elizabeth K.; AOS, Steve; MILLER, Marna G. **Evidence-based public policy options to reduce crime and criminal justice costs: Implications in Washington State**. Victims and offenders, v. 4, n. 2, p. 170-196, 2009.

DUENHAS, Rogério Allon; DE OLIVEIRA GONÇALVES, Flávio; JÚNIOR, Eduardo Gelinski. **Educação, segurança pública e violência nos municípios brasileiros: uma análise de painel dinâmico de dados**. Doi: 10.5212/PublicatioCi. Soc. v. 22i2. 0005. Publicatio UEPG: Ciências Sociais Aplicadas, v. 22, n. 2, p. 179-191, 2014.

GRUBBS, Frank E. **Procedures for detecting outlying observations in samples**. Technometrics, v. 11, n. 1, p. 1-21, 1969.

MARANHÃO, Ana Paula Barradas, AGUIAR, Sylvana Maria Brandão. **Introdução ao sistema prisional e a patrimonialização da Casa de Detenção do Recife: da tortura à cultura**. Museologia e Patrimônio, Rio de Janeiro, v. 9, n. 1, p. 78 - 90, 2016.

MELLO, J. C. S.; MEZA L. A.; GOMES E. G.; NETO L. B. 2005. **Análise Envoltória De Dados (DEA)**, XXXVII Simpósio Brasileiro de Pesquisa Operacional, Gramado-RS.

MEZA, Lidia Angulo et al. **SIAD–Sistema Integrado de Apoio à Decisão: uma implementação computacional de modelos de análise de envoltória de dados**. Simpósio de pesquisa operacional da marinha, v. 6, p. 2003, 2003.

MONTEIRO, Felipe Mattos; CARDOSO, Gabriela Ribeiro. **A seletividade do sistema prisional brasileiro e o perfil da população carcerária: um debate oportuno**. Civitas - Revista de Ciências Sociais, v. 13, n. 1, p. 93-117, 2013.

MOURA, Tatiana Whately de; RIBEIRO, Natália Caruso Theodoro. **Levantamento Nacional de Informações Penitenciárias – INFOPEN**: junho de 2014. Brasília: Ministério da Justiça, p. 105-128, 2015.

PERROT, Michelle. **Os excluídos da História: operários, mulheres, prisioneiros.** Editora: Paz e Terra, 2017.

PINO, Angel. **Violência, educação e sociedade: um olhar sobre o Brasil contemporâneo**. Educação & Sociedade, Campinas, v. 28, n. 100, p.763-785, out. 2007. Disponível em: <http://www.redalyc.org/html/873/87313704007/>. Acesso em: 19 jul. 2017.

REZENDE, Amaury José; SLOMSKI, Valmor; CORRAR, Luiz João. **A gestão pública municipal e a eficiência dos gastos públicos: uma investigação empírica entre as políticas públicas e o índice de desenvolvimento humano (IDH) dos municípios do estado de São Paulo.** Revista Universo Contábil, v. 1, n. 1, p. 24-40, 2005.

RIBEIRO, Márcio Bruno. **Desempenho e eficiência do gasto público: uma análise comparativa entre o Brasil e um conjunto de países da América Latina**. 2008.

SCHERER, Zeyne Alves Pires et al. **Perfil sociodemográfico e história penal da população encarcerada de uma penitenciária feminina do interior do estado de São Paulo. SMAD**. Revista eletrônina saúde mental álcool e drogas, v. 7, n. 2, p. 55-62, 2011.

WELSH, Brandon C.; FARRINGTON, David P. **The benefits and costs of early prevention compared with imprisonment: Toward evidence-based policy**. The Prison Journal, v. 91, n. 3_suppl, p. 120S-137S, 2011.

REVISTA
BRASILEIRA
DE **SEGURANÇA PÚBLICA**