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Crime and Government Expenditure in Brazil

Estimating the Impact of Government Security Spending on Homicide Rates

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Abstract

Despite the widespread debate about crime in Brazil and the alarming increase in homicides in recent years, few studies have analyzed or exposed evidence of the impact of public security spending on deterring violence in the country. This may be due to issues of endogeneity when estimating the relationship between security spending and the rate of homicides. The primary innovation presented in this paper is the use of a Bartik-inspired instrument to address the simultaneity issue. It measures government security spending in a two-stage least squares estimation, obtaining outcomes that are not only statistically but also practically significant. Results indicate that an increase of R$10 per capita in annual security expenditure leads to a decrease of 0.6 per 100,000 people in the number of homicides.

JEL Codes: H59, H72, H76, K00, O12
Keywords: Brazil, citizen security, crime, crime prevention, homicides, public expenditure

1. Introduction and Context

In the state of Espírito Santo, Brazil, a serious public security crisis in February 2017 led to the death of 127 people in six days. This number represents a 408 percent increase in the state's already high homicide rate compared to the same period a year previously (Machado, 2017). Far from being an exception, cases of public security system failure and widespread violent crime since the 1980s have filled newspaper headlines, reflecting the country's alarming increase in the rate of homicides. In 2016, the national rate reached a record 30.3 deaths per 100,000 people, representing a toll of 62,517 human lives (Cerqueira et al., 2018).

When placed in perspective, these numbers are even more appalling: with less than 3 percent of the world's population, homicides in Brazil in 2016 represented 13 percent of homicides across the world. In this same year, among the 50 most homicidal cities on the planet, 25 are located in Brazil (Muggah and Aguirre Tobón, 2018). According to Murray, Cerqueira, and Kahn (2013), between 1980 and 2010 there were one million homicides in Brazil. Despite the substantial economic and social costs stemming from high violent crime rates in Brazil, few empirical studies have neither explored the determinants of criminal activity nor analyzed the effectiveness of efforts to control it.

Following the seminal work of Becker (1968), classic economic theory on criminal activity has focused on rational choice and individual maximization of utility. According to this approach, the individual decision to commit a crime is based on the consideration of potential gain from illegal activities, opportunity costs, severity of punishment, and probability of conviction. Deterrent effects on the topic are the focus of most empirical studies, and are essentially defined by public policy choice. While multiple papers focus on the impact of the number of police officers in decreasing crime (Cornwell and Trumbull, 1994; Levitt, 1997), few center on the deterrent effects of sentence severity (Ehrlich, 1975) and government security spending (Gould, Weinberg, and Mustard, 2002).

This study focuses on the impact of government security expenditure on homicide rates. Security spending by the public sector is an important indicator of the magnitude of the police force and, hence, a relevant measure of probability of punishment as a deterrent factor for illegal activities. More importantly, public spending in security is the most direct and available mechanism to governments making an effort to control rising crime rates. Although the literature points to the large and significant effects of labor markets, income dynamics, and education on crime, public authorities have limited instruments to reduce unemployment and inequality and increase education levels in the short term. A focus on security spending would offer the opportunity also to analyze the effectiveness of government efforts to reduce crime and improve the welfare of citizens. The hypothesis being tested by this study is that an increase in the level of security expenditure in Brazil will have a negative and significant impact on crime.

The process by which security expenditure is expected to impact crime dictates that increases in spending lead to increased police capacity to prevent and combat crime. More resources would be available to hire police officers, invest in equipment, and finance operations. The assumption of this paper is that improved capacity would cause crimes to decrease by increasing the detention of criminals that will no longer be involved in illegal activities and by heightening the probability of detention, thus discouraging choices in favor of criminal behavior.

Estimates of the magnitude of the deterrent effect vary in the literature, but most studies—mainly undertaken in the United States—suggest increases of 1 percent on the probability of punishment would lead to reductions in crime ranging from 0.2 percent to 1.1 percent. Not many studies in Brazil have focused on the impact of security expenditure on crime, and the few that have done so have been unable to find statistically significant coefficients or they have presented mixed results in terms of the sign of their relationship, possibly due to endogeneity problems.

At the root of the endogeneity issue is the fact that higher crime rates are likely to increase the marginal productivity of security spending. It follows that regions with a higher

number of crimes will spend more resources on security with the expectation of reducing the crime rate. What normally will be seen, therefore, is an increase in security spending in response to a rise in crime, a factor that could prompt studies to find a positive correlation between spending and crime (Levitt, 1997), when estimating this relationship.

In order to address the simultaneity between spending and crime, many authors apply instrumental variables. Ideally, a valid instrument would be uncorrelated with crime, except through the spending variable. Some authors have found results, significant and negative, from the application of revenue values; the effectiveness of such instruments, however, can be put into question, since revenue and past crime can impact crime in multiple ways. Revenue can be spent in other areas that affect crime, such as education and cash transfers (which impact inequality), or it can reflect a generally better economic context and lower unemployment rates, thus decreasing incentives to commit crime.

In one of few recent papers addressing the relationship between public spending and crime in Brazil, Loureiro and Carvalho-Júnior (2007) attempted to address the endogeneity issue by using lagged values of government revenue and security spending as instrumental variables. They were able to estimate a significant and negative impact of -0.25 percent on the number of homicides per 100,000 people as a result of a one-percent increase in security expenditure. This estimated effect, although obtained by means of a different methodology, is in line with the one obtained by the model developed in this paper.

The primary innovation of this paper is the approach used to address the inherited endogeneity issue in the analysis of public spending and crime. To identify the effect of security expenditure on crime—and more specifically on homicides—the paper employs a Bartik-inspired instrument. Mostly applied in the field of labor economics, the Bartik instrument is used to separate the effects of demand and supply shocks of labor on wages.

Bartik (1991) uses the average national employment growth to create a measure of local labor demand that is unrelated to local changes in labor supply. He then analyzes how this local

demand impacts wages. Analogously, this paper applies the average national security expenditure growth to produce a measure of local public expenditure in security that is unrelated to local homicide levels. It further analyzes how this expenditure impacts homicides. The advantage of doing so is to potentially address the endogeneity between local crime levels and security spending, stemming from the fact that regions with a higher number of crimes will spend more resources on security with the aim of reducing their crime rate.

The study examines a panel of 26 Brazilian states over the period 2002−14, although not all states have data available as early as 2002. It estimates the impact of security spending per capita on the homicide rate at the state level while controlling for variables that are widely viewed as key determinants of homicides: unemployment rate, Gini coefficient, and average household income. The instrumental variable is calculated as a growth prediction of local government expenditure, based on the national growth of expenditure in security. The instrument is then used to estimate a fixed effects model.

In line with previous studies (Gould, Weinberg, and Mustard, 2002), the first results demonstrate that an Ordinary Least Squares (OLS) estimation leads to a positive and significant correlation between security spending and homicide rate. The estimation of the same model, including time and state fixed effects, leads to a negative albeit small coefficient for security expenditure. The same relationship was evaluated through a Two-Stage Least Squares with the Bartik-inspired IV at the initial stage. A significant and negative coefficient was obtained, indicating that a one-unit increase in spending per capita leads to a decrease of 0.06 in the number of homicides per 100,000 people. The methodology is further discussed in Section 3. While the findings do not diverge notably from the expected effect size gleaned from other studies, the paper substantially contributes, nevertheless, to the literature by providing an innovative application of the Bartik instrument, as well as significant results to add to the literature focusing on the experience of Brazil.

2. The Data

2.1 Government Expenditure Data

The dataset used for the study provides information relating to 26 Brazilian states from 2002 to 2014. Since not all states have the necessary information for every year, an unbalanced panel is being used. The option to focus on security expenditure at the state level, however, is not without merit. In Brazil, state governments are entities that are constitutionally responsible for public security policies and their execution. Municipalities do not maintain armed forces, and those of the central government are dedicated to border protection and cross-border crime along state lines. Approximately 80 percent of public expenditure in security, therefore, is carried out by Brazil's state governments. The country has 26 states and a federal district. While all states are represented in the sample, the federal district is excluded from the analysis, given the specificities of its public security system, which is directly linked to that of the central government.

In 2014, the average spending on security by the 26 states was R$2.5 billion, although expenditure varied greatly from state to state. The state of Roraima spent less, dedicating R$54 million to security in comparison with São Paulo at almost R$12 billion within the same year. Taking into account the population of each state, Piauí allocated less to security, at only R$18 per capita compared to that of Acre, which reflected the highest per capita spending of R$614. On average, states allocated 9 percent of their total budget to security, mostly on personnel at 73 percent. States dedicated a mean of only 5 percent of their public security budget to investments.

Data on government security expenditure at the state level was obtained from a novel dataset put together by the author of this paper for the Inter-American Development Bank (to be published), which is based on the annual expenditure reports provided by Brazil's 26 states and those of the country's National Treasury Secretariat (Secretaria do Tesouro Nacional). All levels

of government in Brazil are required to classify each expenditure item according to six economic categories and 28 functions of government, among other classifiers. The six economic categories include (a) Personnel and Special Charges, (b) Debt Interest and Charges, (c) Other Current Expenditures, (d) Investment (gross fixed capital formation), (e) Financial Investments, and (f) External Debt Amortization. Functions of government include classifiers for Education, Health, Housing, and Public Security. Although each expenditure item is identified according to economic and functional classifications, subnational institutions are required only to provide expenditure information aggregated in one or the other classification. Consequently, there is no systematic dataset with information that is aggregated based on the economic categories and public functions at the state level. This implies that the government does not hold or publish data on how much state security expenditure, for example, is dedicated to investment or personnel.

In order to obtain information on the economic categories and functions of government at the central and state levels, contact was made individually with each state, the federal district, and those central government institutions responsible for public finance. Institutions responded by submitting disaggregated data on their spending, which were ultimately aggregated according to the classifiers of interest. Values are expressed in current local currency (reals) and the dataset covers the period 2000−14. Values prior to 2002 were excluded from this study, because a major change in the reporting guidelines for expenditures in 2001 resulted in many values before 2002 being inconsistent with the rest of the data.

For this paper, expenditure data was aggregated and used to calculate, by year and by state, total government and security expenditure and total categories of security spend. Only three categories were considered for this model: expenditures relating to personnel, investment (understood as gross fixed capital formation), and other current expenditures (rents, utilities, and other operational costs). Other categories represented less than 2 percent of security expenditure.

Other methodological considerations with regard to expenditure data were as follows:

- Only direct application of resources by the states were considered for the measure of security expenditure (the study excludes transfers from the federal government and to municipalities).
- It is assumed that all states abide by national accounting guidelines for the reporting of public expenditures, although it is likely that there is significant variation in terms of how each state assigns accounting classifiers for expenses reported (especially regarding police pensions).

Appendix Figure 3 displays spending per economic category as a share of annual security expenditure. Aggregated at the national level, the graph appears to show low variance of spend per category (i.e., personnel, general current spend, and investment). Appendix Table 1, however, displays the considerable variability within states (across time) and across states.

2.2 Other Data

Data at the state level on homicides were obtained from the Ministry of Health's Mortality Database (Sistema de Informação sobre Mortalidade, SIM/DATASUS). The database comprises Brazil's death certificate records, issued by its public health authorities. The cause of death on certificates follows the International Statistical Classification of Diseases and Related Health Problems. Deaths considered homicide for this study were classified under this code as mortality as a result of assault (Codes X85-Y09).

The total of homicides per state was divided by an estimation of state population, provided by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, IBGE) in order to calculate the homicide rate per 100,000 people for each state. The variable was used as the dependent variable for all estimated models.

Data for the control variables were obtained from the IPEADATA database—managed by the Institute of Applied Economic Research (Instituto de Pesquisa Econômica Aplicada,

IPEA)—and based on Brazil's annual household survey, PNAD (Pesquisa Nacional de Amostra de Domicílios). There was no data for 2010, a time when the survey was not carried out. In order not to disregard one year of homicide and expenditure data, a linear interpolation was used to obtain predicted values for 2010. Based on the literature discussed previously, three control variables were included in the study for each state and year: (a) Unemployment rate, (b) Gini coefficient, and (c) household income per capita.[1]

Table 1 in the Appendix displays the summary statistics of the main variables used in the study, including the standard deviation within and across states. In general, values vary considerably within as well as across states. For most values, a within variation is considerably higher than a cross variation, providing credence that there is sufficient variation to identify a significant impact of security spending on homicide. Essential to the choice of instrument—detailed in the next section—was the greater variation of subcategories of spending in comparison to total spending.

Appendix Figure 1 demonstrates the time trends for homicides and security expenditure at the national level in Brazil. It reveals the tragic increase in homicide rates in the past years, previously mentioned in the Introduction, indicating how closely security expenditure has tracked the rise in homicides. Appendix Figure 2 shows the same trends, albeit for individual states. The image clearly displays how heterogeneous homicide rates as well as expenditure trends are across states.

3. Empirical Methodology

A clear and successful identification of causation many times is only possible under controlled experiments whereby treatment and control status are randomly assigned and information is gathered prior to and following the uptake of treatment by the observation units. Such an

[1] Although measures of poverty and education had been considered, they were excluded after first regressions demonstrated high levels of multicollinearity..

experiment would be impossible to carry out in the real world, however, when government decisions on security expenditure are under consideration. First, it would not be morally acceptable or feasible to randomize resources to fight and prevent crime. Second, a start date for treatment cannot be identified in the case of governments dedicating resources to security since inception.

The challenge of identification that stems from the absence of a randomized assignment of treatment should not discourage an analysis of the effects of public spending choices relating to crime. The relevance of such public spending in the presence of tragically growing rates of homicide is high, and the available econometric methods will be able to provide effective alternatives for an identification strategy.

Before tackling more complex identification strategies, this study introduces a simple linear model of the impact of per capita expenditure in security on homicides, controlling for unemployment rate, inequality, and household income. Equation (1) expresses the model mathematically.

$$Homicide_{st} = \beta X_{st} + \delta E_{st} + \epsilon_{st} \ , \tag{1}$$

where $Homicide_{st}$ refers to the homicide rate measured at state *s* and time *t*; X_{st} refers to the controls included at the state level at time *t*; E_{st}refers to the total public expenditure on security per capita at state *s* at time *t*; and ϵ_{st} represents an error term that includes state unobserved effects and an idiosyncratic error. If higher levels of homicide tend to generate more expenditure in security, without controlling for state fixed effects, it is likely that a positive and significant coefficient on spending will be estimated. The same holds true if crime and spending follow a similar trend through time.

The second model includes state and time fixed effects, a powerful technique for achieving causal identification, based on the valuation of within estimators that contribute to control for unobserved heterogeneity. Equation (2) expresses the second model mathematically.

$$Homicide_{st} = \alpha_s + \lambda_t + \beta X_{st} + \delta E_{st} + u_{st}, \tag{2}$$

where α_s represents the state-level fixed effects and λ_t year fixed effects. The model would provide unbiased and efficient estimates in the absence of a strong endogeneity problem, among other assumptions. Even controlling for the fact that states with higher crime levels spend more on security, what is left is the issue that every state is likely to increase its security spending in a reaction to a local positive shock in crime.[2]

To address the endogeneity characteristic of studies on security expenditure and crime, a Bartik-inspired instrumental variable is introduced in the first stage of the two-phase least squares process to estimate the impact of security spending on homicides in Brazil. The essence of the Bartik instrument, developed for the study of employment and wages, is to use an average national employment growth to produce a measure of local labor demand that is isolated from local supply shifts that also impact wages. Bartik instruments are generally constructed as growth predictions for the dependent variable at a subnational level, based on national trends.

This study adapts the classic instrumental variable from labor economics to isolate the shifts in security spending that respond to local shocks in the rate of homicides. The instrument in this paper is based on national public spending trends in security that can be understood as exogenous to local homicide rates and policy decisions. These shifts are calculated as the predicted expenditure that would have been observed at the state-level had states increased (decreased) their spend at the rate of national increase (decrease) from a base year.

Instead of using the national changes in total security expenditure to compute this instrument, this study employs the three distinct categories that add up to the total security spend at the national level to construct a prediction of local expenditure that serves as an exogenous variation in the model. This means that the local estimation of expenditure will

[2] An additional issue would be the presence of time-variant, unobserved effects and measurement errors. Attenuation bias is not a significant concern, given the large within variation present in the dataset. Appendix Table 1 shows that for most variables, within standard errors are larger than cross-sectional.

depend on the local share of security spend in each category at the base year and on the average variation in each category at the national level.

Mathematically, this instrument was constructed according to equation (3):

$$Z_{s(t)} = \sum_c E_{cs(b)} * \frac{E_{cn(t)} - E_{cn(t-1)}}{E_{cn(b)}}, \quad (3)$$

where $Z_{s(t)}$ is the instrument for state *s* at time *t*; $E_{cs(b)}$ is the security expenditure in category *c* of state *s* at a base year (here the first year of available data); and $\frac{E_{cn(t)} - E_{cn(t-1)}}{E_{cn(b)}}$ is the overall national growth of expenditure category c as a percentage of the base year category total. Thus, the instrumental variable is the sum of the predicted growth (in units of expenditure) of each category of security expenditure (personnel spending, general current spending, and investment), providing the overall response one would expect in state-level spending if states had followed the same spend patterns observed at the national level.

One important reason supporting the selection of expenditure categories is to establish the spending prediction, instead of simply using the national security expenditure changes: the three categories respond differently to economic cycles, overall criminal activity, and other factors, with the personnel expenditure category being more rigid than the other categories due to recruitment and termination processes. Thus, applying the same national variation to states with small and high fractions of personnel spending could be misleading when calculating the instrumental variable.

As with other instrumental variables, the application of the Bartik instrument requires a strong first stage and the validity of the exclusion restriction. Estimates will show that the Bartik IV instrument performs well at the first stage of estimation. The exclusion restriction requires the IV to be uncorrelated with the outcome variable conditional on the components of expenditure, explained by national trends. This will be guaranteed if national variations in security spending per category are not significantly explained by variations in a state. The data shows it is not.

After a first estimation, based on national variations, the model is re-estimated by applying "almost national" measures and the significant results are obtained.

In the main estimation, almost national measures were constructed for each state, based on expenditure trends observed in all other states of the country but the one being considered. By doing so, it guarantees that the exclusion restriction is imbedded in the instrument, since an omission of a state effect in the calculation of national rates will create predicted expenditure measures that, by design, exclude the state in question.

4. Results and Robustness Checks

Estimations of the models described are shown in Appendix Table 2. The results of the first model, summarized by equation (1), indicate the endogenous direction: a positive and significant relationship between security spending and homicides. Estimates show the inadequacy of using a simple linear model and suggest a strong endogeneity problem. Variance inflection factors show average years of education to be significantly collinear with average household income, leading one to estimate all models without the education variable. Due to heteroscedasticity, the first model also was estimated with robust standard errors.

In a first attempt to address the simultaneity between security spending and crime, the second model was evaluated, a two-way fixed effects estimation of the relationship of interest. Results show a negative and significant coefficient for public spending in security, although it is believed that its magnitude is too small due to endogeneity issues that were not able to be dealt with by using a simple fixed effects model.

The model was estimated by using a two-stage least squared method, in which the spending variable, security expenditure per capita, is instrumented using the Bartik-inspired IV instrument at the first stage. First, an instrument was used based on national measures of expenditure that take into account all states and which also estimate that an increase of R$10 in the security expenditure per capita leads to a decrease of 0.4 on the homicide rate. By

estimating the model with an instrument based on “almost national” variations, the impact of increasing spending in security becomes bigger, indicating a decrease in homicide rates of 0.6. For both methods, results are significant at a 5 percent confidence level.

As Appendix Table 2 shows, the IV performs well on the first stage, enabling the rejection of the Anderson LM test for underidentification. The impact of average household income was found not to be statistically different from zero. The unemployment rate and Gini coefficient are statistically significant and have the expected signs. Results indicate that increases in unemployment and inequality lead to a significant rise in the number of homicides.

The study tested for heteroskedasticity, using the Breusch-Pagan test. Results indicate that the null hypothesis of homoscedasticity was rejected. A re-estimation of the model was carried out, using robust standard errors. The standard errors of expenditure per capita increased for all specifications, but coefficients were still significant. The study tested for autocorrelation, using the Cumby-Huizinga test with five lagged variables, and results did not show significant autocorrelation processes.

As a robustness check, a third approach to the IV method was developed, using the variation in security spending by the central government to construct the Bartik-inspired instrument. Security spending at the central level does not include defense expenditure and is not directly related to budget decisions at the state level. The estimation of the model based on this version of the instrument revealed results that were consistent across specifications, although the coefficient for security spending was slightly lower than that obtained from other models. According to this approach, adding R$10 to the security expenditure per capita would decrease homicide rates by 0.34. The impact of the other variables is also comparable, despite being somewhat lower, and results are statistically significant at a 10 percent confidence level.

5. Conclusions

5.1 Evaluation of Effect, Size, and Limitation of Results

As the discussion of results points out, the number of homicides per 100,000 is expected to decrease by 0.6 for every R$10 increase in per capita spending at the state level. Considering an average security spend of R$196 per capita in the panel analysis and an average homicide rate of 29 among states, these estimates suggest that a 1 percent increase in security spending leads to an approximate 0.4 percent decrease in homicides in Brazil.

This effect is within the range indicated by the literature, although it is on the lower range of values found by other studies. Possible limitations influencing these results stem from the data obtained and the econometric model used to estimate the results. In terms of the data, a major concern is the existence of time-variant measurement errors. Because a new system of public expenditure reporting was implemented in 2002, it is possible that measurement errors are concentrated in earlier years, potentially biasing the results. The option to include the earlier years, nonetheless, was based on having had a short panel, already limited to evaluate the relationship of interest.

With regard to the econometric models applied in this paper, a main concern is the use of such a short and unbalanced panel. Due to the limited number of observations, estimates appear more sensitive to specification differences. The statistical significance of results, however, is encouraging and demonstrates a nontrivial impact of security spending on homicides. Ultimately, the study represents a meaningful contribution to the literature by applying the Bartik instrument in an innovative way and by obtaining estimates that are meaningful and credible.

5.2 Cost-Benefit Analysis

An elasticity of 0.4 percent in the relationship between security spending and homicides may appear almost practically insignificant. Since the estimated coefficients are placed in perspective, however, the meaningful results from the models are evident.

Carvalho et al (2007), through nonparametric estimations of the foregone production due to death, estimated an average cost per victim of R$189,500 in 2006. Considering a population of 181 million that year, increasing expenditure in security by R$1 per capita would imply 109 less deaths by homicide in 2006 and approximately R$21 million gained from saved lives. Given that the cost of scaling up security spending would be R$181 million, this simple cost-benefit analysis would not justify the increase in state-level security expenditure. One should keep in mind, nonetheless, that this is an extremely conservative estimate of costs per homicide—based only on the present value of estimated future earnings—that does not take into account other private and public costs brought about by homicide.

Cerqueira et al. (2007) developed one of the most substantive assessments of homicide costs in Brazil. By introducing an accounting approach that considers private costs (i.e., human capital loss, insurance) and public costs (i.e., health spending, security spending), the authors estimated an average cost from violence of R$519.40 per capita in 2004. Taking into account an average homicide rate of 25 percent, the 0.06 negative impact of increasing the per capita expenditure by R$1 would mean a decrease of 0.2 percent on the rate of homicides. If it is considered that violence, in general, would follow this decrease, spending an additional R$1 per capita in security would lead to more than a R$10 saving for every real spent.

5.3 Policy Implication

The implications of the estimates in this paper, combined with rough cost-benefit calculations, provide a strong indication of the effectiveness of security expenditure and the influence an expansion of government spend can have on preventing violent crimes. Further research should

aim to examine more comprehensive estimates for each state and compare the outcomes against existing studies that measure the cost of homicides and violent crimes by individual state. Future studies also should elucidate which of the three categories of spending (i.e., investment, personnel spending, general spending) is more effective in controlling the rise in the rate of homicides. In the event that an increase in public spending is an issue due to budget limitations, proving which type of spending is more effective will provide key information to resolve the issue of public security in Brazil.

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Appendix. Tables and Figures

Table 1. Summary Statistics

Variable	Mean	Standard Deviation		Minimum	Maximum
		Within states	Across states		
Homicides per 100,000 people (average of state rate)	29.16	7.06	9.76	10.16	68.91
Total expenditure (per capita)	2270.53	932.82	880.51	550.38	7740.15
Total security expenditure (per capita)	195.90	90.85	74.21	18.35	614.46
Total security spending with investment (per capita)	7.54	5.68	3.38	0.37	49.86
Total security spending with general activities (per capita)	38.29	17.25	20.07	5.85	161.37
Total security spending with personnel (per capita)	150.05	76.44	58.17	0.00	489.64
Security spending (proportion of total expenditure)	0.09	0.02	0.02	0.01	0.15
Investment spending (proportion of security expenditure)	0.05	0.04	0.03	0.00	0.42
General current spending (proportion of security expenditure)	0.21	0.08	0.07	0.07	0.79
Personnel spending (proportion of security expenditure)	0.75	0.10	0.09	0.00	0.91
Average years of education	6.53	0.57	0.93	3.98	8.95
Unemployment rate	8.49	1.45	2.00	3.13	16.89
Gini coefficient	0.53	0.03	0.03	0.42	0.63
Household income	746.17	137.06	224.11	314.28	1503.33

* All expenditure values in current Brazilian reales.

Figure 1

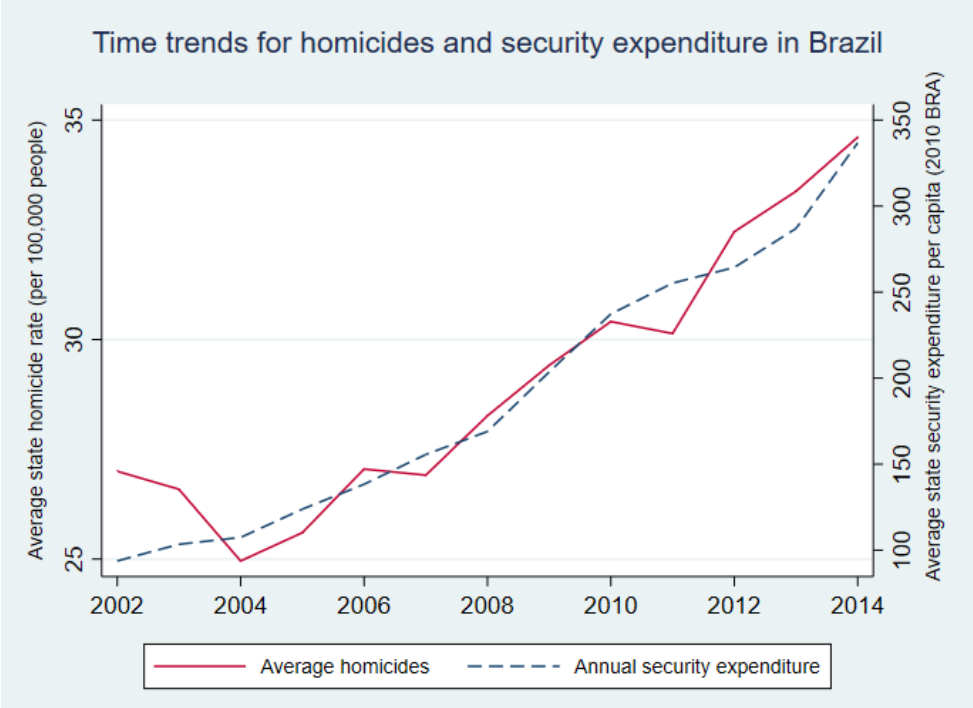

Figure 2

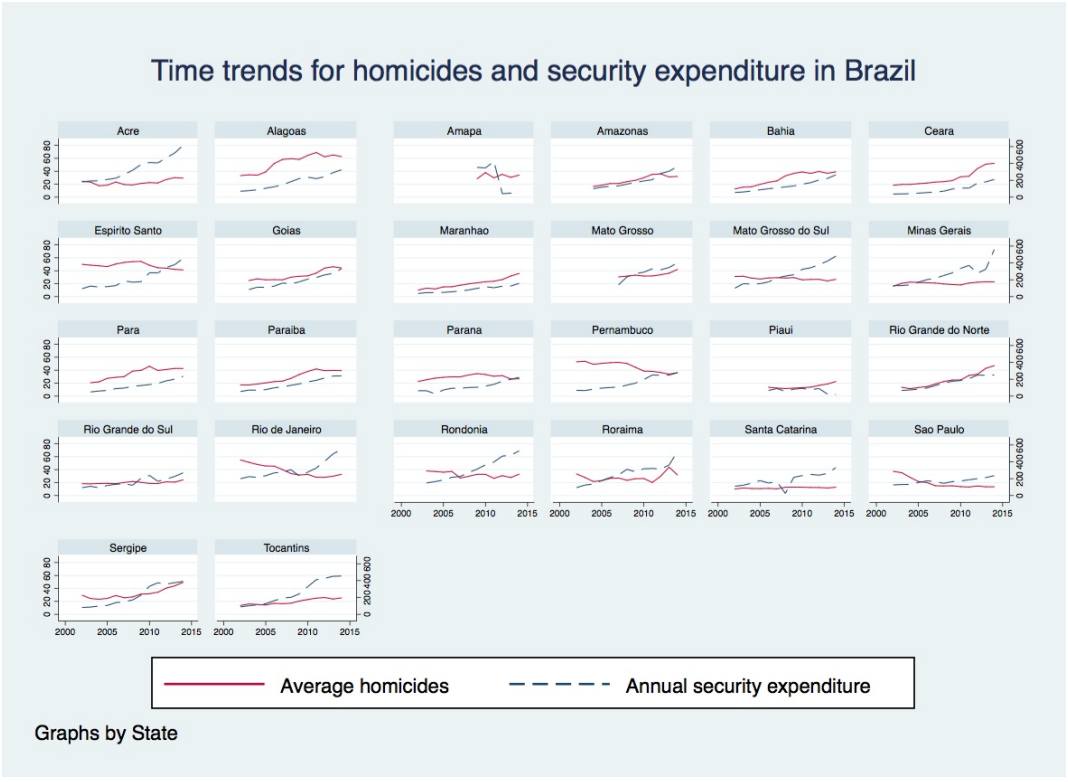

Figure 3

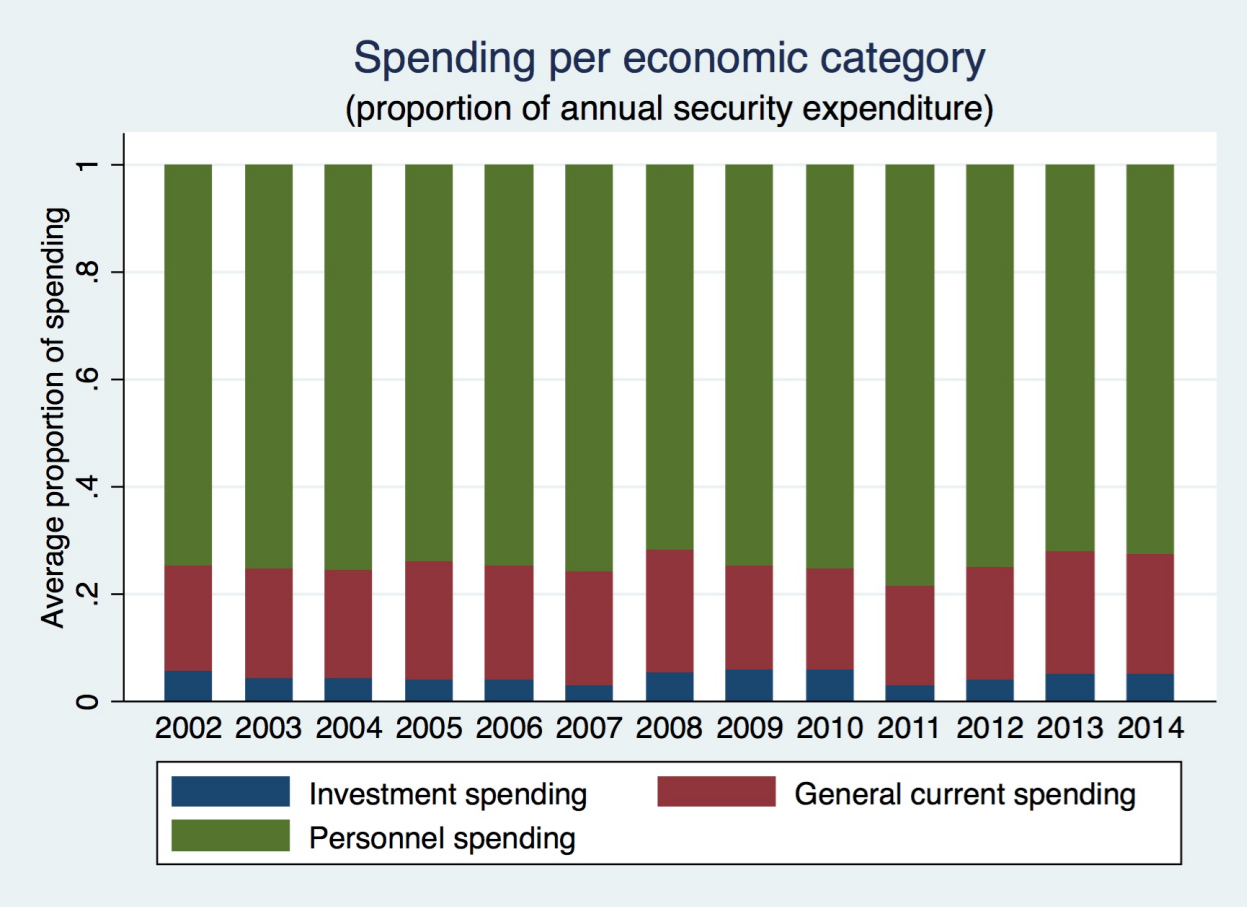
Spending per economic category
(proportion of annual security expenditure)
Average proportion of spending
0
.2
.4
.6
.8
1
2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Investment spending
General current spending
Personnel spending

Table 2. Estimates of the Impact of Security Spending on Homicides

Dependent variable:	**(1)**	**(2)**	**(4)**	**(6)**	**(8)**
Homicides per 100,000 people	**OLS**	**OLS Fixed Effects**	**IV - National**	**IV – Almost National**	**IV - Central Govt.**
	Robust SE	**Robust SE**	**Robust SE**	**Robust SE**	**Robust SE**
Security expenditure per capita (current BRA)	0.0269***	-0.0131**	-0.0401**	-0.0568**	-0.0340*
	(0.00542)	(0.00629)	(0.0202)	(0.0270)	(0.0206)
Unemployment rate	2.005***	1.775***	2.319***	2.376***	2.298***
	(0.334)	(0.455)	(0.373)	(0.392)	(0.369)
Gini coefficient	-1.873	57.17***	47.76*	56.91*	44.38
	(25.14)	(21.18)	(29.02)	(32.27)	(28.62)
Average household income	-0.000460	-0.0206**	0.00521	0.00793	0.00420
	(0.00342)	(0.00987)	(0.00529)	(0.00609)	(0.00533)
Time fixed effects	No	Yes	Yes	Yes	Yes
State fixed effects	No	Yes	No	No	No
Constant	8.192	-15.47	-20.49	-25.96	-18.47
	(13.76)	(14.28)	(17.03)	(18.80)	(16.85)
Observations	316	316	290	290	290
R-squared	0.191	0.773	0.152	0.055	0.181
First stage					
Instrument			0.6437**	0.5282**	0.6461***
F statistics			6.23	5.69	6.70
Prob > F			0.0131	0.0178	0.0102
Kleibergen-Paap Wald F Statistic			6.23	5.69	6.70
Cragg-Donald Wald F Statistic			51.61	36.51	45.61

Notes: OLS = Ordinary Least Squares
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1