The "São Paulo Mystery": The role of the criminal organization PCC in reducing the homicide in 2000s

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Abstract

We move forward in identifying the causes of the marked and systematic reduction in the homicide rate in São Paulo state in the 2000s. Its main objective was that of investigating the role of the criminal organization PCC in this process. We constructed a first-difference fixed effects model with a spatial structure where we controlled for various socioeconomic and demographic measures and for the presence of firearms and law-enforcement, among other measures. Our results do not support the PCC hypothesis at the level of the state of São Paulo.

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1. Introduction

After 1999, there was a decrease in the homicide rate in the state of São Paulo. This decrease occurred in about 500 out of a total of 645 municipalities. Until 2015, the decrease had reached 80.9% and constituted one of the most important *cases* of crime reduction worldwide. However, the reasons that contributed to this notable performance are not completely understood and still remain somewhat of a Mystery, above all because the 2000s were prodigal of transformations in politics, economy, society, and legislation.

Indeed, there were countless changes not only nationally, but also regionally. Nationally, the debate about public security policies deepened and widened in scope. The Federal Government took on part of the responsibility for this issue, launching the 1st National Public Security Plan before the date scheduled for its launch in response to the death of

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the teacher Geisa in the famous "Bus 174" incident in July 2000, which caused a national uproar. Also for the first time, the issue of public security took center stage in the debate around the municipal elections that were held in that same year. Since then, the number of municipal guards has increased significantly throughout the country. Social conditions improved systematically: there were gradual increases in per capita income, the unemployment rate dropped, income inequality decreased, and school coverage and attendance rates went up. In legislative terms, the Disarmament Statute was enacted at the end of 2003, putting a brake on the true arms race observed in previous decades. Finally, during that decade, the country witnessed the beginning of a deep change in the demographic regime, made possible by an increase in life expectancy and a substantial reduction in fertility rates, which meant that the proportion of young people began to decrease in some regions.

At the state level, São Paulo was one of the few federative units that achieved continuity in governmental management, with the same party[1] at the head of the state government since 1995. During that period, many innovations were made in the area of public security, which included more intensive use of technology and managerial reorganization, engendering a substantial increase in incarceration rates. At the same time, some municipalities started taking a more active role in public security, when they adopted the alcohol prohibition policy (*dry law*) in the wake of good results achieved in the city of Diadema.

Last but not least was the growth of the prison population, which facilitated the luring of prisoners to join the *Primeiro Comando da Capital (PCC)*, a criminal organization that was born within the prison system and became nationally known after orchestrating and perpetrating hundreds of attacks in May 2006. The cartelization of the retail drug market under the leadership of the PCC would therefore be one of many hypotheses used to explain the Mystery of the reduction in homicides in São Paulo.

In this complex context, the main objective of this paper is to apply an empirical methodology to test the hypothesis that the PCC cartel had a significant influence on the drop in the homicide rate in the state of São Paulo in the 2000s.

This study contributes to the literature that attempts to explain the decline in homicide rates in São Paulo during the 2000s, and to the literature on criminal organizations and their impact on criminal behavior. Specifically, we focus on the behavior of the PCC cartel. While previous work has focused on this criminal organization, we provide a more standard econometric approach to thinking about the effect of this organization on the "Mystery" of the decline in homicide rates in São Paulo.

This paper is structured as follows. In Section 2, we present the study area, the "São Paulo Mystery" and quantitative and qualitative studies that looked into the possible causes of homicide reduction in São Paulo. In this section we also discuss the economic context of organized crime and pay special attention to the so-called "PCC hypothesis". In Section 3, we briefly discuss the *proxy* variable we use for the presence and power of the PCC in the state of São Paulo, our empirical model, identification strategy, and the data sources that were used. Section 4 shows results. In the Section 5 we presents five facts inconsistent with the PCC hypothesis. We conclude the article in Section 6, where we presents the limitations of inferences.

2. Background and previous studies

2.1. The "São Paulo Mystery"

According to data from the Public Security Secretariat of the State São Paulo (*Secretaria de Segurança Pública, SSP-SP*) and from the Brazilian Institute for Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística, IBGE*), the state of São Paulo had a rate of 44 homicides per 100,000 population in 1999, while the national average was 26.2. This placed the state of São Paulo among the most violent regions of the world United Nations Office on drugs and crime, 2006. In 2012, the rate fell to 11.5, below the regional average in the Americas (28.5) but still above the world average (6.7) (World Health Organization, 2014). Following this trend, in 2015 the rate was 8.4 (SSP-SP, 2016). The "São Paulo Mystery" resulted from this gradual and uninterrupted drop in the homicide rate (Fig. 1). As in the case of New York (see Levitt, 2004), scholars are intent on understanding the causes of this Mystery for the state of São Paulo.

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[1] Except for the period between March 31, 2006 and January 1, 2007, when Vice Governor Claudio Lembo assumed the government after the resignation of Governor Geraldo Alkmin.
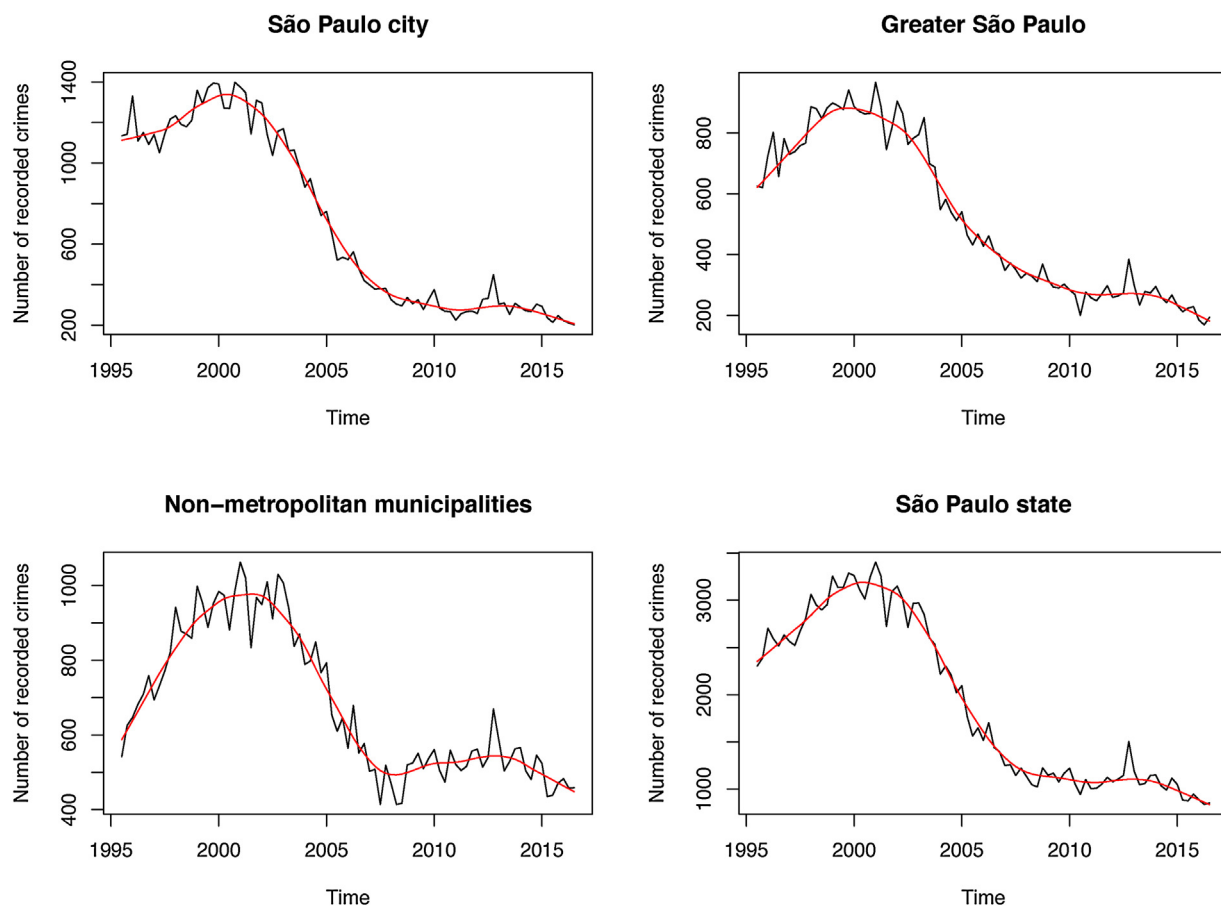
Fig. 1. Number of homicides reported by quarter from 1995*Q*3 to 2016*Q*3.

Source: prepared by the authors.

2.2. Organized crime and PCC hypothesis

The PCC is the largest and most famous criminal organization in Brazil. It was initially established in the prison system of the state of São Paulo and gradually took command of all prisons in the country due to the lack of presence of the state and for the purpose of ensuring better incarceration conditions for inmates (Biondi, 2009). In 1993, one of the founders of the organization drafted a statute for the union of the detainees with the aim of avoiding mistreatment and of regulating what inmates could do or not (Biondi, 2009).

The existence of the PCC was only officially recognized in 2000, based on an investigation carried out by the Secretariat for Penitentiary Administration. From that time onward, the transfer of its main leaders to other prisons outside the state only helped to spread the principles of the organization throughout the country (Biondi, 2009). The first display of power of the organization occurred in 2001, when rebellions took place in 29 prisons in the state of São Paulo. The wide coverage of the mass media and the success of the rebellions strengthened the PCC culture in urban areas as well (Biondi, 2009). It was in May 2006, after 765 prisoners were transferred to a maximum security unit, including the PCC leader, that the organization carried out its most calamitous action. According to Cano and Alvadia (2008), there were 84 rebellions in prisons throughout Brazil, 74 of which in the state of São Paulo, as well as 300 attacks on public facilities, 84 buses set on fire, 17 attacks on bank branches, and more than 500 dead among civilians and the military. The PCC is present in all the national territory and in some countries in Latin America, acting in robberies, bank robberies, and arms and drug trafficking. The Brazilian Public Prosecutor's Office estimates that the organization's monthly revenue in 2015 amounted to 16 million reais.

For more details on the PCC's expansion and consolidation process in the São Paulo prison system and the social role it established in that system as a result of monopolizing opportunities for increasing its power, see Dias (2011).

According to McCarthy (2013), it is difficult to determine a general theory for organized crime. In Lampe (2016), for example, we find 180 definitions of "organized crime" in the world. Their origins, structures, and modus operandi differ significantly. The only certainty we have is that they are organized and that their business is based on an illegal activity of what kind or another.

Their origin lies fundamentally in the state's lack of power to guarantee law enforcement and criminal justice (Fiorentini and Peltzman, 1997; Skaperdas, 2001; McCarthy, 2013). Bandiera (2003) mentions that the Sicilian mafia emerged from the Italian agrarian reform to guarantee protection and property rights to the population. In another way, the presence of the state can also contribute to the development of criminal organizations by prohibiting the production and distribution of certain high-demand goods and services with attractive profitability (Kumar and Skaperdas, 2008).

Criminal organizations are actually corporations working rationally with a wide variety of businesses ranging from micro-trafficking and theft to highly complex transnational crime organizations engaged in activities such as money laundering, drug trafficking, and corruption. Their predominant structure is hierarchical (Levitt and Venkatesh, 2000; McCarthy, 2013). Like any organization, the principles of loyalty, motivation, and profit-making are desirable requirements. However, there is no way to turn to the police or legal system in the face of contractual or financial conflicts in their business chain (Kumar and Skaperdas, 2008). Despite this, the validity of contracts can be much more effective, since penalties tend to be more severe and often carried out through violence.

Just as in the legal market, we can expect new players to join in if illegal activities generate profit. According to economic theory, breaking a monopoly or increasing competition leads to greater efficiency. However, this peaceful balance may not occur, given the culture of using violence against rival organizations (Kumar and Skaperdas, 2008). In Mexico, for example, the homicide rate grew by about 1.000% between 2006 and 2010. The main explanation lies in the war for territory between the Juarez and Sinaloa cartels (Dudley, 2014). According to Bouchard and Wilkins (2010), the Nash equilibrium for these conflicts would occur in a structure similar to monopolistic competition, with each group acting in specific regions. The distribution of Colombian cocaine in cities in the United States, for example, was divided by agreements between the Cali and Medellin cartels that remained in force for a certain period (Clawson and Lee, 1996).

The same holds true when dealing with legal authorities such as law enforcement and the judiciary. If they are not in the way of their business, by accepting bribes, there is balance without violence. Otherwise, Daniele and Marani (2011) point out that there is a trend of more active corruption or even bomb attacks and arson, with the aim of drawing the attention of political agents.

If there is balance, the culture of criminal organizations of using violence differs according to their characteristics, to the environment, and also to the type of crime. The Medellín Cartel, for example, was led by Pablo Escobar, who employed plenty of violence to achieve his goals. The Cali Cartel, which succeeded the Medellín Cartel, employed virtually no violence as a strategy so as not to draw the attention of the authorities (McCarthy, 2013). In addition to these examples, consolidating a criminal organization into a multi-gang environment can also lead to order, as a result of regulating property rights and security services. This can be verified in Biondi (2014), who observes the benefits cited by the residents of the presence of organized crime in favelas in the city of São Paulo, Brazil. Specific crimes such as violence against women and rape are also expected to decrease, since the principle of respect for women is observed by many of these organizations (McCarthy, 2013). Given this diversity, it is difficult to determine a general pattern, resulting in the need to analyze violence and its consequences on a case-by-case basis.

The relationship between organized crime and homicides is ambiguous. There is evidence that organized crime can contribute to both increasing and decreasing homicide rates at a given location and time. The conjecture is that the more organized crime is, the lower the need and rationality of acting with violence. The typical model is that of the Italian Mafia or of the Yakusa, which prefer to bribe and co-opt public agents and share their business rather than exchange shots with authorities or engage in armed disputes with rival groups. In Brazil, a classic example is that of the so-called Animal Lottery, which is a much older and more organized illegal activity than drug trafficking and doesn't involve violence. In this context, a criminal organization has little influence on homicide rates and may even contribute to reducing homicides if it was in conflict with authorities or competing groups in a previous period.

A high number of deaths in clashes with police or between members of rival groups, as seen in Rio de Janeiro, can be an indicator of organizational gaps. Exchanging shots with police and rival groups is bad for business, while joining interests through agreements seems to be the most effective strategy.

Recently, analysts began to refer to the drop seen in homicide rates in Medellín and El Salvador as an example of how homicides can decrease when organized crime stops resorting to violence while government takes more efficient actions and improves social and economic conditions for the population. In Medellin, homicide rates dropped abruptly in 2003, when the Bloque Cacique Nutibara (BCN) was demobilized, and began to rise again in 2008 after its local leader was extradited, giving rise to a dispute between criminal factions over drug trafficking. After this outbreak of violence was over, homicide rates took a downturn once again in 2009 (Garzón-Vergara, 2016; Lessing, 2016). In El Salvador, a truce between the government and two criminal factions in 2012 may have contributed to a two-year decline in homicide rates, which began to rise again after the agreement fell apart in 2013. A new strategy of confronting gangs adopted in 2014 may have led homicide rates to rise from then on.

No empirical study has been carried out in connection with any of these cases to measure this impact on homicides controlling for other determinants of violence. Sudden declines in homicide rates roughly coinciding with truce agreements between governments and gangs are the only clues.

The relationship between organized crime and homicides is complex and determined by the amount of firearms available, territorial control by factions, the prosecuting capacity of the state, and greater or lesser emphasis on a direct confrontation strategy, among many other factors (Garzón-Vergara, 2016; Lessing, 2016). What was seen in São Paulo, on the other hand, was a gradual and constant decline in homicides as of 2000 and not abrupt declines followed by increases, as in the cases of Medellin and El Salvador. Unlike what happened in Rio de Janeiro and in those cities, controlling territories for drug trafficking purposes – where police are received with gunfire – is a much less adopted practice. There are no areas in the state of São Paulo ostensibly controlled by armed drug dealers where police are not allowed to enter peacefully. Penitentiaries are an exception, as these are clearly controlled by the PCC gang. São Paulo is also one of the Brazilian states with the highest homicide resolution and conviction rates. It should be noted that, unlike the cases of Medellin and El Salvador, there has never been an explicit pact or agreement between the government of São Paulo and organized crime to reduce violence.

The case of Rio de Janeiro deserves mention in this context. There is a fierce dispute between different and heavily armed factions over drug outlets and these factions ostensibly control the communities where they operate. It is a well-known fact that the capacity of the Rio de Janeiro Police Department to investigate and arrest the leaders of these gangs is clearly far from ideal. No agreement has been entered into to demobilize or reduce violence between the government of Rio de Janeiro and criminals. However, homicide rates in Rio de Janeiro fell uninterruptedly for a decade, between 2003 and 2013. It can be speculated that the decrease in homicide rates in Rio is due to factors such as a reduction in the number of firearms in circulation, improvements in the economic situation, and law-enforcement leadership and innovations (such as setting up Pacifying Police Units – UPPs – in slums), as observed in São Paulo. Neither the decrease nor the increase in homicide rates seen in Rio after 2014 seem to be related to the capacity of organized crime to regulate violence in the territories in which it operates.

Thus, arguments according to which the variations observed in homicide rates in Medellín and El Salvador are predominantly due to variations in the capacity of organized crime to regulate violence are fragile. These variations may be more indicative of the intensity of confrontational policies adopted by public authorities than of the regulating capacity or organized crime. It is also not appropriate to compare the decline in homicides in São Paulo with the above-mentioned examples due to the very different characteristics of the local contexts: gradual and widespread decline throughout the state, even in hundreds of municipalities where organized crime is not present. It is possible that organized crime has an effect of some kind on reducing homicides, but it is limited to some slums in São Paulo city.

The field of empirical research in criminology is eminently multidisciplinary, and one in which different traditions, methods, and approaches, both quantitative and qualitative, coexist. As Weber said, no methodology is a priori better than another. Different methods can and should be recommended for different analyses, depending on the goal of the research, as well as on the constraints involved in obtaining information. Nevertheless, the approaches can be compared with regard to the criteria of internal and external validation of a hypothesis that one wishes to put to the test.

Research with high internal validation will be able to refute alternative hypotheses, avoiding spurious correlations that concur to a mistaken understanding of a given phenomenon. On the other hand, external validation offers greater guarantee that the results obtained can be generalized to a population and are not dependent on a sample or particular situation.

In an ethnographic research, Biondi (2009) provides evidence that the transformations brought about by the PCC were very beneficial to detainees, as the creation of order avoided physical assaults and sexual violence and ensured

respect for the material goods of each of its members. In addition to the fact that it created internal order, the PCC hypothesis is substantiated by the idea that many murders that took place in territories competed for and other criminal acts committed for revenge, settling of scores, etc., would no longer be accepted by the central command of the organization without prior and categorical authorization. A single paper (Biderman et al., 2015) employing a quantitative approach measured the alleged impact of the PCC. These authors found that the power of this criminal organization accounted for approximately 7% of the decrease in homicides in the slums in the capital of São Paulo state controlled by the PCC. On the other hand, numerous ethnographic studies concluded that there was a notable effect of the actions of the PCC as a leading actor in reducing homicides in São Paulo. Ethnographic analysis and interviews with the actors involved were the empirical basis of those studies. Despite the richness of details and the deeper understanding of the social connections involved in the phenomenon that those studies provided, there are intrinsic limits to the ethnographic method in terms of extrapolating conclusions to show generalized causal effects. We are not disqualifying this research, let alone saying that the group had no bearing on the reduction in homicides. We only argue that this influence and its real weight have not been confirmed. It is possible that the role played by the PCC in the imagination of people living in suburbs, journalists, and researchers is much greater than its actual role in explaining the phenomenon.

The most incisive defense of the PCC hypothesis is one made by Willis (2013), an anthropologist who studied homicides in São Paulo between 2009 and 2012, following the work of DHPP policemen and interviewing residents from the outskirts of the capital. Although very rich in the description of the faction's functioning and of the moral arguments constructed by the actors involved to justify who can kill and who must die, that study puts forward a weak argument when it tries to argue that the decrease in homicides in São Paulo was mainly due to the PCC and that law enforcement, known for its inefficiency, would have little relation with the phenomenon.

It should be noted, however, that the author carried out his research only in the city of São Paulo, specifically in some favelas in the capital where the PCC was active, and as we have seen, the decrease in homicides was widespread in the state, occurring in most of its municipalities. The author assumes that most homicides are premeditated and that the faction can therefore avoid them. It is also assumed that the faction exerts its influence not only among the members of the group and in communities, but also in all other contexts. This approach holds the erroneous assumption that the only way that authorities can affect the homicide rate is through investigations carried out by the DHPP. This agency deals only with homicides by unknown criminals that occurred in the city of São Paulo, which causes bias in the research. The decrease in other types of crime in the state over the same period, such as vehicle robbery/theft and robbery followed by homicide, is not considered and cannot sufficiently explain the decrease in interpersonal homicides. The author still does not acknowledge the influence of the power of the state in the process, even though there is empirical evidence that public security policy has also played a major role in reducing homicides.

Some quantitative studies were developed to test various hypotheses with the aim of explaining the cause of the decrease in homicides in São Paulo. Table 1 summarizes some of those studies.

It is worth mentioning that, whereas quantitative methods are generally useful for testing hypotheses, having as their ultimate methodological concern the principles of simplicity and internal and external validation, qualitative methods, and ethnographic work in particular, seek to obtain a deeper understanding about, and a detailed description of, certain social relations; and about values and beliefs that guide the actions of individuals. On the other hand, the very nature of qualitative research does not lend itself to the objective of internal and external validation of hypotheses, also because the individuals observed are part of a particular social context and their beliefs and values are limited to their set of information and experiences.

In the quantitative studies listed here, the authors confirmed hypotheses about the importance of certain factors that contributed to the general decrease in homicides in São Paulo. These include: the disarmament policy, improvements in socio-economic conditions, increased school attendance among young people, a decrease in the proportion of young people in the population, technological and organizational innovations in public security management (such as the Infocrim system), and a decline in the crack epidemic cycle. At the same time, De Mello and Schneider (2010) found local effects of the implementation of the alcohol prohibition policy (*dry law*) in some municipalities.

Cerqueira (2014) shows that the Disarmament Statute was effective in reducing the homicide rate in the state of São Paulo, and that a decrease of 1% in guns in the hands of citizens reduced the homicide rate by approximately 2%. The evidence found by Justus and Kassouf (2013) reveal that the Disarmament Statute reduced the rate of lethal crimes (homicide and robbery followed by homicide) in the capital, reinforcing the findings of that study. They also highlighted the role of improved economic conditions leading to better law enforcement performance in reducing the rate of lethal crimes in the capital of São Paulo state. Cabral (2016) found a strong effect of the adoption of new public

Table 1
Empirical previous studies on alleged causes of the homicides rate reduction in São Paulo.

Hypothesis	Authors	Methodology	Spatial dimension	Time dimension
PCC participation	Biderman et al. (2015)	Panel data analysis	Slums (Favelas) of São Paulo city	2005–2009
Disarmament	Hartung (2009)	Time series analysis	State of São Paulo	2001–2007
	Cerqueira (2014)	Panel data analysis (painel IV)	Municipalities of São Paulo	2001–2007
	Justus and Kassouf (2013)	Time series analysis (cointegration analysis)	São Paulo city	1997–2010
	Cerqueira and De Mello (2013)	Panel data analysis (painel IV)	Municipalities of São Paulo	2001–2007
Family structure	Hartung (2009)	Panel data analysis	Municipalities of São Paulo	1997–2007
Dry law	Biderman et al. (2010)	Panel data analysis	Greater São Paulo	2001–2004
Demography	De Mello and Schneider (2010)	Panel data analysis	Municipalities of São Paulo	1992–2005
	Cerqueira and Moura (2014)	Panel data analysis	Brazilian municipalities	1991, 2000 and 2010
Labor market	Dix Carneiro et al. (2016)	Panel data analysis (painel IV)	Brazilian municipalities	1991, 2000 and 2010
	Cerqueira and Moura (2015)	Panel data analysis (painel IV)	Brazilian municipalities	1980, 1991, 2000 and 2010
	Justus and Kassouf (2013)	Time series analysis (cointegration analysis)	São Paulo city	1997 and 2010
Social programs	Chioda et al. (2015)	Panel data analysis (painel IV)	São Paulo city	2006 and 2009
Police intelligence (Infocrim)	Cabral (2016)	Panel data analysis (spatial painel model)	Municipalities of São Paulo	2000 and 2010
Drugs	De Mello (2015)	Panel data analysis	Greater São Paulo	1984–2005

Source: prepared by the authors.

Fig. 2. The State of São Paulo: São Paulo city, Greater São Paulo and non-metropolitan municipalities.
Source: prepared by the authors.

security technologies in the state of São Paulo in her evaluation of the impact of the Infocrim system. The author argues that this police information system was responsible for an average reduction of 8.4 in the homicide rate per one hundred thousand population, avoiding 3472 homicides from its implementation in 2003–2010.

3. Method

3.1. The study area

Fig. 2 shows the study area within Brazil: the state of São Paulo. It is located in Brazil's southeast region and consists of 645 municipalities, 39 of which are located in the metropolitan area called Greater São Paulo, and the capital city of São Paulo. The state has a population of 44 million and generates about a third of all the wealth produced in the Brazilian economy. The city of São Paulo has a population of 11.2 million and accounts for about 12% of Brazil's GDP and for 36% of all the goods and services produced in the state. The metropolitan region of São Paulo constitutes one of the 10 largest metropolises in the world.

3.2. Proxy for the PCC's power

Some variables can be measured directly, such as the existence of a civil guard corps or the implementation of alcohol prohibition measures in the municipality. Others, however, are either non-observable (treated here as fixed effects) or are only observable through *proxy* variables. This is the case, for example, of the prevalence of firearms and the power of the PCC.

In the case of firearms, the recent literature has used the proportion of suicides committed with firearms as *proxy* variables. This indicator has been shown to be related to the possession of weapons at home reported in victim surveys and other indicators related to weapons (see Cerqueira, 2014).

In the case of the PCC, we cannot even count its members in the municipality or measure its intensity of membership. Therefore, to measure the mobilizing power of the PCC in a municipality, we used the number of attacks perpetrated in May 2006. Although the faction had been born earlier, it was only during those events that it really showed its power outside the walls of prisons and became nationally known and feared. In those weeks, the organization's leaders overtly requested its members from outside prisons to organize attacks on police, even threatening to death those who did not comply.

Although it is not possible to directly observe the power of the PCC within a municipality, since the events of May 2006 were the largest display of the power of the PCC in the state of São Paulo, we assume that the number of attacks

is a good indirect indicator of the mobilizing capacity of the group in those municipalities. In short, it is an indirect measure of where the group is more or less active.

As it was an extreme moment when, in theory, all the resources of the faction were deployed, we argue that the number of attacks can somehow capture the mobilizing capacity of the PCC in a municipality. So, if the PCC plays a role in pushing the homicide rate down in the state of São Paulo, we expect this decrease be more pronounced in municipalities where the faction has shown that it can actually act in practice.

We point out that the *proxy* variable applied to measuring the power of the PCC was validated externally by another indirect indicator of the faction's power: the number of drug trafficking events reported to the *Disque Denúncia* (Crime Hotline). Using data from municipal police records in that same year (2006), we found a very high correlation – greater than 0.9 – between the number of attacks and the number of reports.[2]

3.3. Empirical strategy

Let y and $\mathbf{x} \equiv (x_1, x_2, \ldots, x_k)$ be the observable random variables, and let α be an unobservable random variable. We can observe y and $\mathbf{x}$ in two periods t before and after the attacks of the PCC, respectively period 1 and period 2. We assume that α is constant in time, i.e. that it has a fixed unobservable effect.

We used the *number of attacks per one hundred thousand population* perpetrated in May 2006 (`PCC/population`) as a *proxy* variable for the power of the PCC in municipalities in São Paulo. This variable, along with the other control variables, are contained in vector $\mathbf{x}$. Alternatively, we checked the stability of the results by replacing this measure with another one in which the denominator is *population density* (total population divided by total area).

Response variable is the *homicide rate per one hundred thousand population* (`homicide`). We measured this rate from the average of the previous four years (2002–2005) and then (from 2007 to 2010) from the wave of PCC attacks in 2006. The intention is to reduce the influence of exogenous shocks that may have affected the rate in some of the state's municipalities. In the initial period, no city was attacked. In the second period, however, 16.3% of the cities within the state were attacked (109 cities).

Assuming a linear model in the form of error, with α entering additionally along with x_j, we have:

$$homicide_t = \beta_0 + \mathbf{x}\boldsymbol{\beta} + \alpha + \varepsilon_t \tag{1}$$

where the interest lies in vector $K \times 1$, and by definition, $\mathrm{E}(\varepsilon_t | \mathbf{x}_t, \alpha) = 0$ for $t = 1, 2$.

We assume $\mathrm{E}(\mathbf{x}_t' \varepsilon_t) \neq \mathbf{0}$ for $t = 1, 2$. However, with $T = 2$, Eq. (1) can be differentiated to eliminate the non-observable time-constant variable, α. So $\Delta homicide = homicide_2 - homicide_1$, $\Delta \mathbf{x} = \mathbf{x}_2 - \mathbf{x}_1$ and $\Delta \varepsilon = \varepsilon_2 - \varepsilon_1$. Therefore, Eq. (1) is just a standard linear cross-sectional equation in the first difference of all variables. The intercept is excluded, but we included an intercept in the equation in differences, δ, to control for the time trend (in the original model), since $\delta t - \delta(t - 1) = \delta$. Hence the estimable model is:

$$\Delta homicide = \delta + \Delta \mathbf{x}\boldsymbol{\beta} + \Delta \varepsilon \tag{2}$$

Therefore, the so-called first-difference estimator (FD) is an MQO estimator of the Δy_i regression over $\Delta \mathbf{x}_i$ for $i = 1, 2, \ldots, N$, where i is the number of municipalities in the state of São Paulo.

According to Becker (1968), any individual can be a potential criminal. The rational choice will depend on the individual's characteristics related to the expectation of returns from criminal activity, his or her degree of risk aversion, and also the opportunity cost represented by the returns in the legal market. The exogenous variables are related to the severity of punishment and to the probability of failure in the activity. In other words, the individual compares the returns from illegal activity with those obtained in the legal market, given the variables of law enforcement and criminal justice. Ehrlich's (1973) extension of Becker's model includes the decision of temporal allocation of criminal activity, so that the decision between the legal and illegal markets is not exclusive.

Law enforcement and criminal justice were controlled for by: the existence of a municipal police force (`municipal guards`), expressed by a binary variable that takes the value of 1 if the municipality possesses a municipal guard corps and 0 if it does not; number of penal institution (`prisons`); the passage of the alcohol prohibition law (`dry law`), with a binary variable that takes the value of 1 if the municipality adopted the law and 0 for those that did not,

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[2] The data are from an internal survey done at the time by the Public Security Secretariat of São Paulo based on data from the Crime Hotline.

and the establishment of the Infocrim system (`infocrim`), with a binary variable that takes the value of 1 in the municipalities where the system was set up between 1999 and 2010 and 0 for the others. According to Becker's model, we expected enhanced law enforcement and criminal justice as represented by these variables to reduce benefits and incentives for criminal behavior.

Household income per capita (`household income`) was used as a measure of return from criminal activity. For the opportunity cost, we included two socioeconomic conditions: percentage of the economically active population aged 18 years or more that was unemployed[3] (`unemployment`); the ratio between the number of people in the age group from 6 to 17 years attending basic education (primary school and high school – regular or serial); and the total population in that same age bracket multiplied by 100 (`school attendance`).[4] In addition, we controlled for the demographic conditions that potentially influence homicide rates in municipalities: the ratio between the number of males in the 15–29 age group and the total population multiplied by 100 (`young men`) and the percentage of the population living in urban areas (`urban`).

In addition, two variables were included in the empirical model in order to control for exogenous changes that are part of the "São Paulo Mystery" and had a bearing on the decrease in the homicide rate and, as a result, on the rational decision of agents to commit crimes. The *proxy* for alcohol consumption follows the same strategy adopted by various authors, such as Pridemore (2004), Stickley and Carlson (2005) and Razvodovsky (2008), among others. This variable was calculated by the ration between the number of people who were killed by alcohol poisoning and the population of the municipality multiplied by 100,000. It is, therefore, the rate of deaths caused by alcohol consumption for every 100,000 population (`alcohol`). The *proxy* used for firearms was the proportion of suicides with guns to total suicides (`guns`). There is a profusion of international evidence that validates this *proxy* and indicates that it is so far the best indirect measure for the prevalence of firearms in the analyzed locations (see Kleck, 2004; Killias, 1993; Briggs and Tabarrok, 2014, and others).

3.4. Data

The data for the number of PCC attacks carried out in May 2006 come from an internal survey done at the time by the Public Security Secretariat of the State of São Paulo (SSP-SP) based on police records. The data about the establishment of the Infocrim system were also provided by that Secretariat.

Data about homicides, suicide by firearms, and alcohol poisoning[5] were obtained from the *Mortality Information System* of the Ministry of Health, which follows the 10th revision of the International Classification of Diseases.

Data about municipalities where the alcohol prohibition law was adopted are from the Metropolitan Forum on Public Security. Data about the number of prisons are from the Secretariat for Penitentiary Administration of the State of São Paulo. For the other variables we used the 2000 and 2010 demographic censuses carried out by the IBGE.

4. Results

Table 2 shows three different specifications for first difference estimates, without (columns 1–3) and with spatially-lagged homicide rate (columns 4–6).

The first specification, shown in column 1, has neither the *proxy* for the presence and power of the PCC nor the other variables, for which we cannot guarantee strict exogeneity. The next specification, shown in column 2, contains the variable of interest in this study: number of attacks per one hundred thousand population perpetrated in May 2006, that is, the variable labeled as `PCC/population`. It is clear that the results of the model of column 1 are stable even after that variable is included, which indicates that they are robust with respect to this issue. However, we don't see any statistical significance in the *proxy* for the criminal organization within the state of São Paulo. The next step, as shown in column 3 was to include *proxies* to control for the role of firearms diffusion, the workings of public security forces, and the socioeconomic and demographic conditions that hypothetically affect the homicide rate. It is worth

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[3] I.e. that was not employed one week before the interview, but had looked for a job during the previous month.

[4] People from 6 to 17 years old attending preschool have been considered as if they were in the first grade of primary school. People from 6 to 17 years old attending the third grade of high school have been considered to have completed that level.

[5] In this set, the following subcategories of cause of death were included, according to ICD-10: E244; F04; F100 to F109; G312; K852; K860; P043; R780; T519; X450 to X459; X650 to X659; Y150 to Y159; Y909 to Y919 e Z721.

Table 2

Results of the first difference (FD) estimates without and with spatially-lagged homicide rate, and conventional standard errors.

	FD estimates			FD estimates with spatially-lagged		
	(1)	(2)	(3)	(4)	(5)	(6)
Whomicide				2.1367***	2.1250***	1.4754***
				(0.212)	(0.214)	(0.279)
household income	0.7929*	0.7648*	1.4372***	0.6000	0.5926	1.3499***
	(0.451)	(0.451)	(0.536)	(0.420)	(0.420)	(0.519)
young men	0.5108**	0.5075**	0.3744	0.3719*	0.3717*	0.3087
	(0.214)	(0.214)	(0.263)	(0.199)	(0.199)	(0.255)
urban	0.2576***	0.2572***	0.1087	0.2235***	0.2236***	0.1414*
	(0.0717)	(0.0716)	(0.0810)	(0.0667)	(0.0668)	(0.0787)
school attendance	−0.2064***	−0.2103***	−0.2466**	−0.1700**	−0.1713**	−0.1982**
	(0.0795)	(0.0795)	(0.0997)	(0.0740)	(0.0741)	(0.0970)
unemployment	0.5846***	0.5837***	0.4150***	0.3049***	0.3061***	0.3830**
	(0.114)	(0.114)	(0.155)	(0.109)	(0.109)	(0.151)
PCC/population		−0.2862	−0.1104		−0.0864	0.0044
		(0.190)	(0.208)		(0.178)	(0.202)
alcohol			−1.3132			−1.3611
			(1.222)			(1.183)
guns			0.0186			0.0182
			(0.0149)			(0.0144)
prisons			−0.9889***			−0.1714
			(0.344)			(0.367)
infocrim			−5.8835***			−2.9234*
			(1.675)			(1.715)
dry law			−10.5511***			−7.8491***
			(2.835)			(2.792)
municipal guards			−4.3742***			−2.9950***
			(0.948)			(0.954)
trend	−3.1186***	−2.9365***	−1.5191	−1.8778*	−1.8295*	−0.9600
	(1.077)	(1.083)	(1.329)	(1.009)	(1.014)	(1.291)
Observations	644	644	413	644	644	413
R^2	0.088	0.092	0.342	0.214	0.214	0.385

Note: The values within parentheses are conventional standard errors.

* * $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$; for sources of the data see Section 3.4.

remembering that these regressors were not included in the two previous specifications because we cannot guarantee the strict exogeneity of these regressors. Nevertheless, in addition to a change in the magnitude of the coefficients, we show that urbanization is the only factor that ceases to have a statistically significant effect on the homicide rate with the inclusion of these controls. We found no statistically significant effect of PCC attacks.

We found an additional difficulty in empirical modeling when we placed on a map of São Paulo the spatial distribution of several factors that may be related to the reduction in homicides. In addition to temporal synchronicity, the maps suggested that there is also a spatial overlapping of several variables.

The decrease in homicides was more pronounced in municipalities located in the metropolitan regions of São Paulo state, Campinas and Santos, being smaller in the interior of the state. A Local Indicator of Spatial Analysis (LISA), reinforced by the *I*-Moran indicator, clearly suggested that there is spatial contiguity among municipalities with the highest reductions as well as among those with the lowest reductions. It became clear – and was corroborated by many previous studies on spatial effects on crime – that it is necessary to control for spatial dependence in the identification of the alleged determinants of the homicide rate.

The alcohol prohibition law, known as *dry law*, was adopted only in some municipalities located in the metropolitan region of São Paulo. There is a large concentration of prisons in those areas, which are also the most urbanized and wealthiest in the state. There was also more crime in those metropolitan regions, and municipalities that set up civil

guard corps are also concentrated in them. The Infocrim system and several other management systems and practices were adopted earlier in those regions and much of the PCC mobilization in 2006 occurred in the same municipalities.

In addition to the overlapping of and interactions among factors, it is quite likely that there will be spillover or contagion effects. A municipality that sets up a civil guard corps or adopts the alcohol prohibition law probably affects not only its own territory, but also those of neighboring cities. The same can be said of the Infocrim system and other innovations. And these effects can be negative (when they simply transfer crime from one place to another) or positive (when they contribute to deterrence of, and decrease in, crime in contiguous areas). Just as the temporal correlation between two events does not imply causation, neither does spatial coincidence.

In this scenario, to circumvent problems of spatial correlations, we control for the spatial lag of the homicide rate by applying a *rook* space contiguity matrix. In fact, when applying spatial autocorrelation tests to both the error term and the dependent variable, we diagnosed the presence of spatial dependence in the dependent variable ($p = 0.035$ in the LM test). Therefore, the spatially-lagged homicide rate (`Whomicide`) was included in all three previously estimated models. Table 2 provides the results in the columns 4–6.

In short, we observed a moderate reduction in the magnitude of the effects of the control variables and the significance of the *proxy* for the spread of firearms, with the expected positive sign based on the cited literature. And, once again, no statistically significant effect was found for both measures used for the attacks.

Our main result is that the proxy for the PCC gang is not statistically significant at conventional levels. Notwithstanding, this result crucially depends on the "correct" (in terms of measurement) estimation of standard errors. We therefore expanded the analysis for robustness by estimating the variance-covariance matrix of the estimators in different ways. In other words, to go beyond these estimates, whose relationship between reductions in homicides and the presence of the PCC was not found, the standard errors of the coefficients in the most complete models shown in column 3 and 6 of Table 2 were estimated in an alternative way, with standard errors robust to heteroskedasticity, and by cluster-robust. The results of this robustness exercise are shown in Table 3.

It should be emphasized that heteroskedasticity robust standard errors show in the columns 1 and 5 can be used to make a valid statistical inference about our coefficients, even though our data are not identically distributed. We relax the assumption of independence of the observations by using the cluster-robust variance estimator. For the homicide data, it is difficult to believe that the models for various cities are independent. This fact was partially controlled for by performing estimates with spatially lagged variables. Nevertheless, we consider that the errors remain correlated even after controlling for the spatial lag. The cluster-robust estimator relaxes the independence assumption and only requires that the observations be independent across the clusters. We consider clusters of three types for the data on homicides: sixty-three microregions as defined by IBGE (columns 2 and 6), fifteen mesoregions as defined by IBGE (columns 3 and 7), and twelve police divisions (columns 4 and 8) based on the classification used by the Public Security Department of São Paulo State (capital, Greater São Paulo excluding São Paulo city, and ten judicial police departments in non-metropolitan regions of São Paulo).

It can be seen that, regardless of how the standard errors are obtained, the coefficient of the proxy measure for the presence of the PCC remain statistically non-significant, corroborating the results presented in Table 2.

Finally, for socioeconomic variables all results are in line with Becker's (1968) theoretical model. The crime rate varies positively with the number of young people, since these individuals have a low opportunity cost when compared to others. This is due to inexperience and low schooling, since they are still in a period of accumulation of human capital. There is also a positive relation with the level of unemployment, since the opportunity cost increases for individuals with no income from work. The proportion of children aged between 6 and 17 attending school reduces the occurrence of crimes, corroborating the positive effect of education (see Lochner and Moretti, 2004). Household income was included as a *proxy* to represent the expected return on criminal activity and, as expected, increased income makes the decision to commit a crime less attractive. Regarding the variables for law enforcement and criminal justice, represented by the presence of municipal guards, the alcohol prohibition law and the existence of prisons, all estimated coefficients were statistically significant, raising the cost of committing crimes and, consequently, inhibiting such practices. For the control variables entered according to the "São Paulo Mystery", we corroborated the evidence of the relationship between more weapons and crimes established by Justus and Kassouf (2013), Cerqueira and De Mello (2013) and Cerqueira (2014), besides the importance of using new technologies in the state of São Paulo (Infocrim), as found by Cabral (2016).

Table 3

Robust and cluster-robust standard errors from models 3 and 6 (see Table 2), without and with spatially-lagged homicide rate, and *p*-values (in parentheses).

	FD estimates				FD estimates with spatially-lagged			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Whomicide					0.3616	0.3168	0.3747	0.4110
					(0.0001)	(0.0000)	(0.0015)	(0.0042)
household income	0.4946	0.6301	0.6867	0.8565	0.4681	0.5588	0.5883	0.7501
	(0.0039)	(0.0261)	(0.0550)	(0.1215)	(0.0041)	(0.0187)	(0.0377)	(0.0994)
young men	0.2114	0.2624	0.3009	0.3274	0.2030	0.2258	0.2414	0.2639
	(0.0774)	(0.1587)	(0.2339)	(0.2771)	(0.1292)	(0.1767)	(0.2217)	(0.2669)
urban	0.1061	0.1096	0.1199	0.1224	0.1130	0.1146	0.1192	0.1279
	(0.3063)	(0.3253)	(0.3799)	(0.3937)	(0.2118)	(0.2221)	(0.2553)	(0.2928)
school attendance	0.0962	0.1091	0.1160	0.1151	0.0929	0.0956	0.0963	0.0895
	(0.0108)	(0.0273)	(0.0518)	(0.0553)	(0.0334)	(0.0424)	(0.0586)	(0.0488)
unemployment	0.1796	0.1823	0.2387	0.1615	0.1766	0.1724	0.2446	0.1629
	(0.0214)	(0.0264)	(0.1040)	(0.0260)	(0.0307)	(0.0301)	(0.1396)	(0.0384)
PCC/population	0.2440	0.3208	0.3363	0.3580	0.2456	0.3193	0.3226	0.3479
	(0.6511)	(0.7318)	(0.7475)	(0.7635)	(0.9856)	(0.9889)	(0.9892)	(0.9900)
alcohol	1.0565	0.9922	1.5014	1.4890	1.1012	1.0660	1.6839	1.5613
	(0.2146)	(0.1906)	(0.3965)	(0.3967)	(0.2172)	(0.2065)	(0.4324)	(0.4020)
guns	0.0132	0.0116	0.0095	0.0111	0.0133	0.0123	0.0097	0.0118
	(0.1604)	(0.1155)	(0.0713)	(0.1215)	(0.1725)	(0.1439)	(0.0808)	(0.1518)
prisons	0.2418	0.2292	0.2255	0.2278	0.4179	0.3258	0.2524	0.5065
	(0.0001)	(0.0001)	(0.0006)	(0.0012)	(0.6819)	(0.6008)	(0.5081)	(0.7415)
infocrim	2.0078	1.6673	1.2901	1.3370	1.9236	1.7414	1.7209	1.7824
	(0.0036)	(0.0008)	(0.0004)	(0.0011)	(0.1294)	(0.0983)	(0.1115)	(0.1292)
dry law	3.8527	2.3413	1.9200	1.7094	4.3697	2.2795	1.2695	1.2946
	(0.0064)	(0.0000)	(0.0001)	(0.0001)	(0.0732)	(0.0010)	(0.0000)	(0.0001)
municipal guards	0.9274	0.8729	1.0130	1.0182	0.9824	0.8066	0.8862	0.8744
	(0.0000)	(0.0000)	(0.0007)	(0.0013)	(0.0025)	(0.0004)	(0.0045)	(0.0057)
trend	1.3877	1.5187	1.9954	2.0088	1.3433	1.3895	1.7281	1.7491
	(0.2743)	(0.3211)	(0.4591)	(0.4654)	(0.4752)	(0.4922)	(0.5873)	(0.5941)

Note: In (1) and (5), the standard errors are robust to heteroskedasticity; in (2)–(4) and (6)–(8), the standard errors are cluster-robust for microregions, mesoregions, and police divisions, respectively.

5. Facts inconsistent with the PCC hypothesis

There are five stylized facts about homicide reduction in São Paulo that, even if they are not inconsistent with the idea that the PCC cartel played a leading role in explaining the phenomenon, at least cast doubt on its importance.

The first aspect, as pointed out above, is that the decrease in homicides in the state of São Paulo occurred in 500 of the 645 of the state's municipalities, as highlighted in Fig. 3, when we compare the average rates from 2002 to 2005 – before the wave of PCC attacks – with the 2007–2010 average after the attacks in 2006. The homicide rate dropped much beyond the municipalities where the PCC is supposed to have minimal organization, as the map of PCC attacks carried out in May 2006 shows (Fig. 4).

Another point, perhaps the central one, as shown in Fig. 5, is that the homicide rate began to fall in the state of São Paulo and in the state capital in 1999, many years before the importance of the criminal organization, which became nationally known after the 2006 attacks, was recognized.

Third, homicides were not the only crimes to fall in the period. Since 1999, there has been a sharp decline in rates of crime against property that are the least likely to be left unreported, such as robbery followed by homicide and robbery or theft of vehicles (Fig. 5). Is the reduction in these crimes of strictly economic motivation also due to the PCC? This hypothesis is obviously untenable. This in a way weakens the PCC hypothesis and strengthens the hypotheses of the efficiency and effectiveness of public security policies.
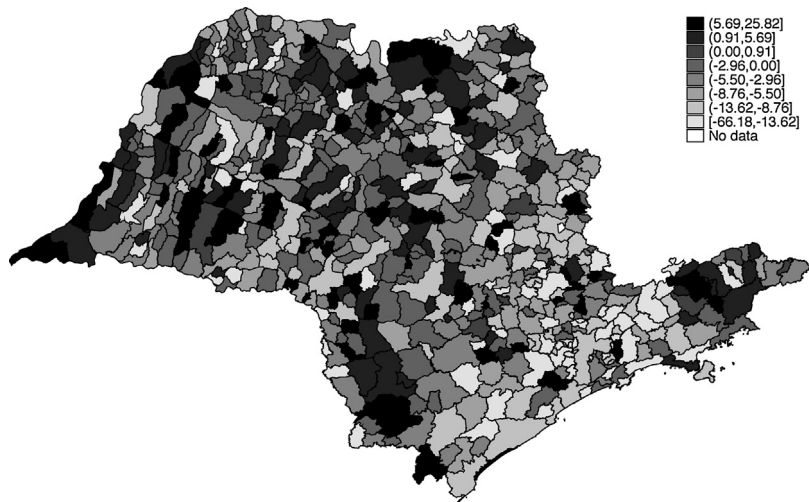
Fig. 3. Variation in the homicide rate per one hundred thousand population from 2002–2005 to 2006–2010.
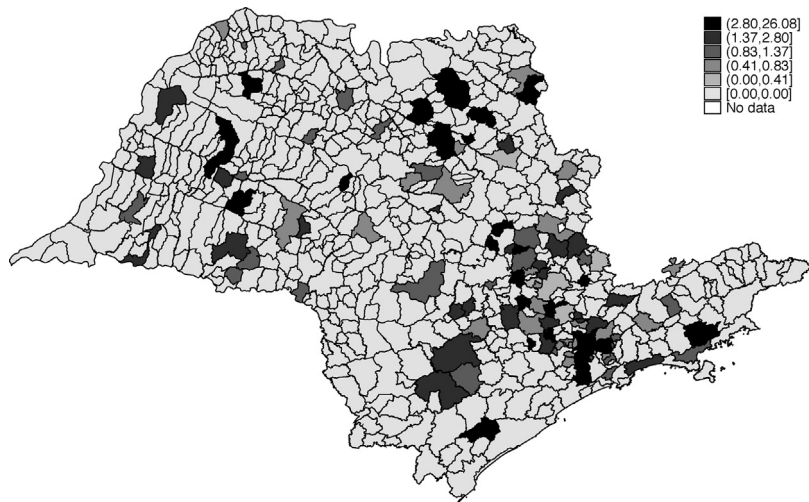Source: prepared by the authors.

Fig. 4. Number of PCC attacks carried out in May 2006 per one hundred thousand population.
Source: prepared by the authors.

The fourth fact concerns data on the characteristics of victims. Their analysis showed that violent deaths decreased not only among young, low-schooled men living in suburbs – a profile similar to those involved in crimes – but also in populations with very different profiles.

Finally, the fifth fact is that a considerable proportion of homicides have elements that associate incidents with causes of an interpersonal nature, as suggested by the significant presence of alcohol in the blood of the victims and the concentration of cases in the early hours of the morning on weekends (see Gawryszewski et al., 2005).

Even with these obvious facts, the ethnographic literature suggests a possible influence of the PCC "courts" on homicides, which must be expressly authorized by its central command. One would expect the control of deaths by organized crime to be felt more intensely in the mid-2000s, when the first signs that the organization was growing appeared, culminating in the display of its full power in the events of May 2006. However, as we have emphasized here, the decrease in homicides in São Paulo started back in the 1990s, spreading virtually to the whole state, and the profile and contextual elements of the lives that were not lost differ from what would be expected from homicides associated
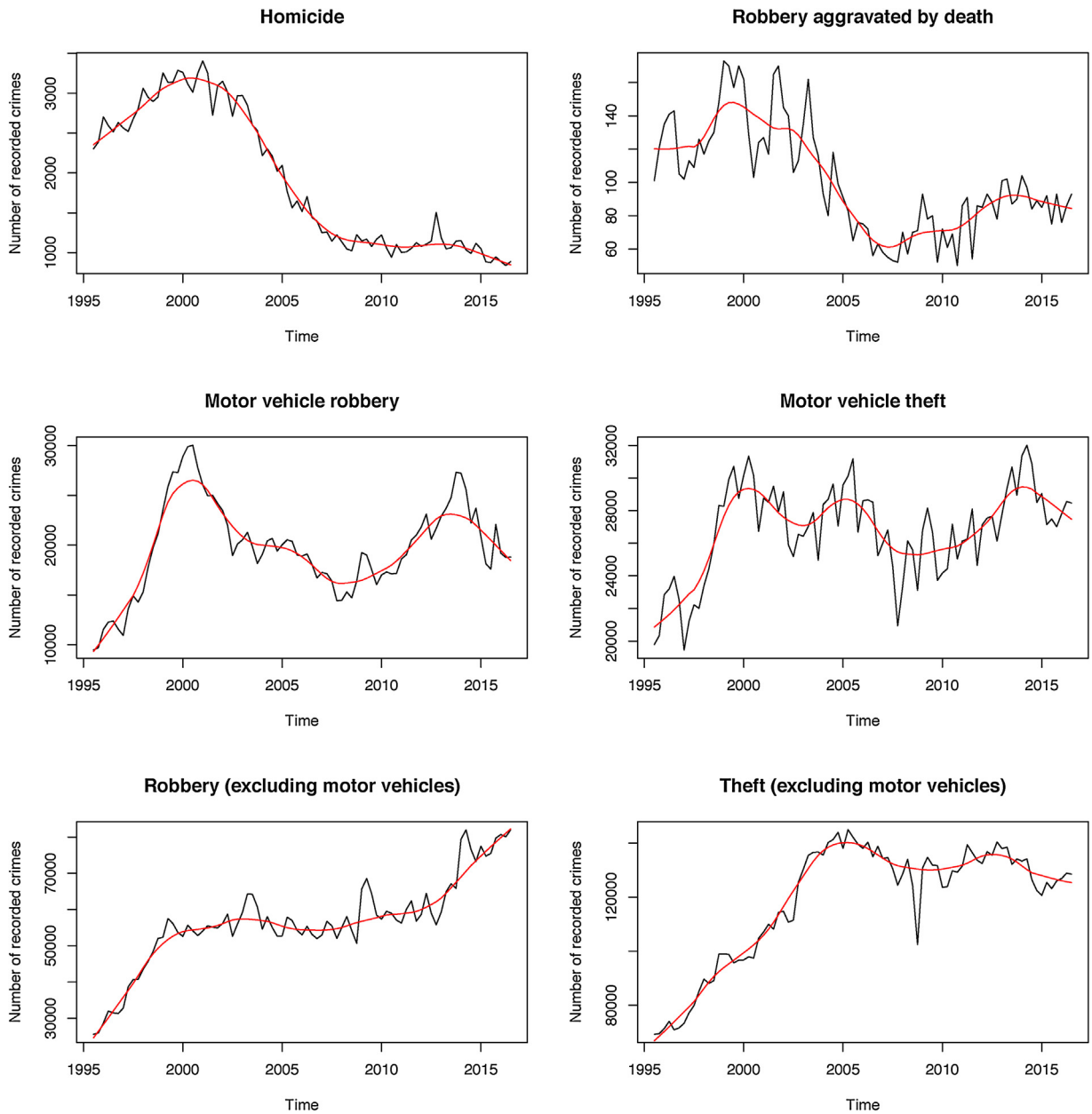
Homicide

Robbery aggravated by death

Motor vehicle robbery

Motor vehicle theft

Robbery (excluding motor vehicles)

Theft (excluding motor vehicles)

Fig. 5. Number of reports for six types of crimes in the state of São Paulo by quarter from 1995*Q*3 to 2016*Q*3.
Source: prepared by the author.

to drug trafficking. On the other hand, references in qualitative studies have not made any mention to crimes or events linked to property, which underwent a concomitant decrease.

It is clear that such stylized facts do not constitute any evidence that the PCC courts have not had a role in reducing homicides in São Paulo. On the other hand, such a framework contradicts the idea that the decrease in homicides in both the capital and in the state as a whole can be mainly attributed to the PCC. In order to test the hypothesis that the PCC cartel had a significant influence on the aggregate homicide rate in the state of São Paulo, we produced the model shown in the next section, in which we include controls for many of the elements mentioned in the literature and that may have played a role in reducing violent deaths.

6. Concluding remarks

The mystery about the causes that explain the substantial decline in the homicide rate in São Paulo in the 2000s continues to attract the attention of scholars and policy makers. In this article, we sought to improve our understanding of the phenomenon.

We reviewed some non-exclusive hypotheses discussed in qualitative and quantitative studies, which highlight: (i) increased efficiency of police work; (ii) better social and economic conditions; (iii) strong disarmament policy implemented by the state and above all reinforced by the intervention of the Disarmament Statute in December 2003; (iv) substantial demographic change through the reduction in the proportion of young people in the population, so that less potential victims and potential criminals move throughout the state; (v) increase in the rate of school attendance of children and young people; (vi) implementation of new technologies, such as the Infocrim system, Copon-online and *Disque Denúncia* (Crime Hotline); (vii) strong action by the PCC criminal organization as a violence-moderating agent. It was on this last hypothesis that we based the evidence we present in this paper.

In this context, we believe that we have made progress in identifying the causes of the marked and uninterrupted decline in homicides in the state of São Paulo in the 2000s, seeking to empirically estimate the role of the PCC, as was done by Biderman et al. (2015).

We found no statistical evidence that the presence and power of the PCC played any role in the variation in the homicide rate recorded during the period in question. Our results do not support the PCC hypothesis at the level of the state of São Paulo. They corroborate, however, the results of previous empirical studies on the role of labor market conditions (Justus and Kassouf, 2013; Cerqueira and Moura, 2015; Dix Carneiro et al., 2016); demographic change (De Mello and Schneider, 2010; Cerqueira and Moura, 2014); Infocrim (Cabral, 2016); increased school attendance rate (Chioda et al., 2015; Cerqueira and Moura, 2015); and the alcohol prohibition law (Biderman et al., 2010).

It is worth emphasizing some aspects related to other results found in this study. First, municipalities began to act more intensely in public security in the last decade, when they created the municipal guard corps. The increase in the number of municipal guards not only allowed for a large contingent of the Military Police to be displaced from activities such as those related to the preservation of public property and the ordering of vehicle traffic, but reflects, above all, a greater concern with public security on the part of municipalities. Apparently, the indicator for the presence of municipal guards was able to capture some partial effect of this variable in determining the homicide rate. Nevertheless, more in-depth analysis of the subject is needed. Second, Infocrim is a criminal georeferencing system with *Business Intelligence* (BI) features inspired by the New York's Compstat system. More than a computer program, it launched a new form of management and allocation of police resources based on statistical information for operational and strategic purposes. The existence of an epidemiological system for georeferencing homicides is one of the factors identified in the literature in all the notorious cases of homicide reduction.

Needless to say, our results are valid only under the hypotheses we assumed in the empirical model. The main limitation is the possibility of endogeneity of PCC attacks. Those attacks provoked a very strong response from law enforcement, which prompted the investigation, imprisonment, and clamping down on the organization in the municipalities in which the attacks occurred. Therefore, it is possible that the supposed PCC effect was neutralized by the efficient action of public security institutions. In other words, even if a negative effect had been found, it would not be possible to tell if it reflects PCC influence on homicides or the influence of police action in those municipalities after the attacks.

We also point out possible biases in the estimation resulting from the definition applied to construct the *proxy* for the presence and power of the PCC. By definition, there is an attenuation bias because we assumed that this variable would be zero before the wave of attacks carried out in 2006. The same was assumed for the binary variables (prisons, Infocrim, etc.), because without temporal variability they could not enter the specification in first difference. Nevertheless, the significance of these binary variables – all of which have a negative sign – indicates that the treatment that was applied at least did not deny the role played by these variables in defining the homicide rate. Unfortunately, we cannot say the same for the PCC measure. On the one hand, if this criminal organization operated in the municipality before the wave of attacks, the number of homicides could be smaller already – according to the PCC hypothesis. This fact would justify the non-significance of this variable in the estimated models. On the other hand, in cases where a cell of the faction already existed somewhere without the central command exerting its power and applying the cartel rule yet (or if the structure of the drug market was competitive) and the regime only became a cartel half way through the decade,

then for practical purposes there is no mitigation bias in its effect on the homicide rate. If this is true, then what matters is not whether this criminal organization operated in the municipality in the past or not, but rather whether the market regime changed. Future studies should try to answer this question.

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