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PAX MONOPOLISTA AND CRIME: THE CASE OF THE EMERGENCE OF THE PRIMEIRO COMANDO DA CAPITAL IN SÃO PAULO

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ABSTRACT

This paper documents a rare phenomenon: the consequence of the dominance of a single criminal gang in the city of São Paulo, the Primeiro Comando da Capital (PCC). Using unique data to identify entry in geographically well-delimited areas – the Favelas - we explore the timing of the expansion of geographical dominance to estimate the causal impact of its dominance on property and violent crime. Pax Monopolista caused a reduction in violent crime but no impact on property crime.

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CAF – Documento de trabajo N°2014/03
15/07/2014

RESUMEN

Este documento de investigación documenta un fenómeno extraordinario: el dominio de una sola banda criminal (Primeiro Comando da Capital (PCC)) sobre la ciudad de São Paulo. Usando datos para identificar la entrada a áreas geográficamente bien delimitadas – las favelas – se exploró el ritmo de expansión del dominio territorial para estimar el impacto causal de este dominio sobre el crimen violento y el robo a las propiedades. El programa Pax Monopolista causó una reducción en el crimen violento pero no tuvo impacto sobre el crimen a las propiedades.

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Pax Monopolista and Crime: the Case of the Emergence of the *Primeiro Comando da Capital* in São Paulo[1]

Ciro Biderman, Renato Sergio De Lima, João Manoel Pinho De Mello, Alexandre Schneider

"When I was twenty-five, having studied economics for six years, I grasped suddenly that prices are for allocation not fairness. When I was twenty-eight, …, I grasped that prices are only one possible system for allocation (*violence* and queuing are others), but socially the cheapest."[2]

"It was the *Primeiro Comando da Capital* (PCC) that reduced crime."[3] Marco Williams Herbas Camacho, a.k.a. *Marcola*, alleged PCC supreme commander, cell phone wiretap.

Abstract

This paper documents a rare phenomenon: the consequence of the dominance of a single criminal gang in the city of São Paulo, the *Primeiro Comando da Capital* (PCC). Using unique data to identify entry in geographically well-delimited areas – the *Favelas* - we explore the timing of the expansion of geographical dominance to estimate the causal impact of its dominance on property and violent crime. *Pax Monopolista* caused a reduction in violent crime but no impact on property crime.

[1] Biderman: SPtrans. Bueno: Fundação Getúlio Vargas . De Lima: Forum Brasileiro de Segurança Pública. João De Mello: Insper, CNPq, FAPERJ and Academia Brasileira de Ciências. Schneider: Fundação Getúlio Vargas. We are very thankful for the generous financial support by the Corporación Andina de Fomento (CAF).
[2] McKloskey (1992), The Natural, *Other Things Equal, Eastern Economic Journal*, Spring 1992, Vol. 18., No
[3] "Foi o PCC quem reduziu a criminalidade," *Estado de São Paulo*, 10/11/2013

INTRODUCTION

Criminal activity trivially begets crime. Nevertheless, it is conceivable that strong dominance by a single criminal gang works towards pacification for two related yet different reasons: the *enforcement hypothesis*, i.e., a monopolist gang may have sufficient stake on pacification and power to enforce "justice"; and the *competition hypothesis*, i.e. the monopolization of drug markets reduces disputes for territory among rival gangs. In this paper we document the impact of the emergence on violent and property crime of the *Primeiro Comando da Capital* (henceforth PCC) as the dominant criminal gang in São Paulo.

A long held conjecture to explain the sharp decline in the 2000s is the pacification of the *Favelas* due to the domination of the drug business by the PCC, a prison gang turned major criminal group (Feltran, 2010 e 2011; Telles and Hirata, 2007 e 2010; Biondi, 2009). The reasons behind the decline in violence are disputed (see Peres et alli, 2011), and the decline predates the PCC (De Mello and Schneider, 2010), but it is conceivable that it was a contributing factor.

The *competition hypothesis* is rather interesting for several fields of social science. Consider the Industrial Organization of Drug Markets: does competition beget violence in illegal markets? If violence is one of the systems for allocation, as the quote by McKloskey suggests, then yes. However, the impact of competition on violence is ambiguous theoretically for at least three reasons. When markets are not contestable, monopolies would reduce violence insofar as violence is used to acquire market share, a reasonable assumption in illegal markets. However, with contestable markets it is not clear whether monopolies generate peace. It maybe optimal for a monopolistic incumbent to keep prices high and compete with violence when faced with entry. In this case is not clear whether violence is lower under a monopolistic structure, with occasional entry and bursts of violence, or under a stable oligopolistic structure, with constant but possibly lower violence and no entry. Second, the nature of distribution matters. For retail, which is the case of PCC, open street drug markets tend to be criminogenic. The popular image is a few kids in a street corner, showing off guns. Because drug dealers tend to carry cash, they are primary

targets of robbery. Thus, they tend to carry weapons, a great recipe for violence. Indoors discreet transactions are less prone to violence.

The last reason is law enforcement. Interventions aimed at repressing the most violent criminals, as drug policy specialist Mark Kleiman proposes, may reduce the level of violence involved in the illegal drug trade (CITE MARK HERE). On the other hand, law enforcement repression of incumbents may turn a non-contestable market into a contestable one, possibly increasing violence induced by competition. Aggressive enforcement, such as the case of Mexico, cause turnover of upper management, opening the space for power disputes, increasing intra-gang violence. In addition, tacit collusion among sellers may depend on longer-term personal relationship, which are destroyed by killing or (less likely) arresting upper managers. Enforcement interventions also may change the nature of retail and wholesale distribution. Forcing retail open drug markets indoors, which is normally less prone to violence.

Beyond theory, it is just an empirical fact that not all illegal markets are violent (Reuter, 2014). Prostitution smuggled cigarettes, for example, are largely peaceful businesses. Estimates suggest that drug consumption in the US has not decreased since the late 1980, but violence dropped sharply. Retail distribution of methamphetamine is not particularly violent.

In this context, the PCC case is particularly interesting. Similarly to the retail drug markets in American cities, retail market in São Paulo had open street market characteristics, with many transactions taking place in specific locations within *favelas* (the so-called *bocas de fumo*). Thus, dominance by single criminal group could have an impact on violence through the inter-gang (competition) channel. In addition, PCC is supposed to have a hierarchical structure and a motivation technology in the threat of retaliation if the criminal goes to prison. Thus, PCC's dominance could reduce intra-gang violence.

The *enforcement hypothesis* is related to the Goldstein's systemic channel (Goldstein, 1985). Illegal markets beget violence because of the absence of the legal judicial system to settle disputes. A modified version of the systemic channel could be operative when a single criminal group dominates a geographical region. A sufficiently powerful group, with a large enough stake on pacification may be able to enforce "justice". In the case of PCC, ethnographic evidence suggests that PCC has administrated justice in areas known for social fragility and absence of the

state, the *Favelas* (slums). See Feltran, 2010 e 2011; Telles and Hirata, 2007 e 2010. *Favelas* are well-delimited areas normally characterized by the following features: 1) absence of property titles; 2) poor socio-economic indicators; 3) lack of basic urban infrastructure (lack of sewage, proliferation of illegal cabling of electrical power and cable TV, among others; 4) high crime.

PCC's origin and its main source of power stem from its dominance of the prison system. Lessing (2010, 2012) argued that prison gangs exert power from a distance through the threat of retaliation when criminals go inside, *propagating* their power from within the prison system outward. Qualitative evidence supports the "propagation hypothesis". Lessing (2010) studies several cases of prison gangs that extended their dominance outward, including the PCC. From prison, PCC extended its territorial dominance to *Favelas*, spots for retail open drug markets.

The year 2006 is a turning point in PCC's history. In May, through an orchestrated series of attacks on public security forces, PCC consolidated its dominance in the *favelas* of São Paulo. This so-called *Levante* was major challenge to the state's monopoly of power. Over 150 deaths are directly attributed to the *Levante* and the subsequent police retaliation. Allegedly, the attacks were motivated by the state prison authority's decision to move some of the PCC commanders to a maximum-security facility. But their timing coincides strongly with PCC dominating local distribution channels in *Favelas*, as we show in section 3.[4] PCC's dominance represents, as of 2009, some 7% of the territory in the city of São Paulo (see Maps 1 and 2).

Favelas are geographically well delimitated areas of precarious urban dwellings normally – but not always – characterized by the lack of formal property rights over real estate, absence of basic public infrastructure such as sewage and garbage collection, and, more generally, lack of the state presence. Not surprisingly, *Favelas* have always been prime spots for street drug markets in Brazil, as well as a safe haven for drug dealing gangs.

Ethnographic evidence suggests that PCC dominated the wholesale drug distribution of illegal drugs into the city of São Paulo during the second half of the 2000s. From this vantage position, it established exclusive deals with local retail distributors located at *favelas*, who later became PCC operatives. But PCC extended its dominance beyond merely selling drugs to

[4] For an anecdotal account of the events, see Violence in Brazil, *The Economist*, 05.17.2006, available at http://www.economist.com/node/6939676.

downstream distributors. Evidence suggests that it imposed local monopolies in retailing and exerted "justice" at the *favelas* – the so-called "julgamento". It imposed a set of rules ("proceder", how to proceed) to establish the co-existence, the "convívio" (see Marques, 2007). These set of rules regulate the resolution of everyday conflicts between *favelas* dwellers, as well as the rules of engagement for drug retailing. In particular, killing was prohibited without the explicit authorization (the "aval") of the PCC, normally issued from prison. Another important feature of the PCC verticalization procedure is that they imposed one single retailer per *favela* – i.e., they suppressed competition within *favelas* - and regulated competition between *favelas* (Marques, 2010; Dias, 2011).

In summary, it is conceivable that the rise of PCC to dominance contributed to the pacification in São Paulo's *Favelas*. Ethnographic evidence suggests the mechanisms: meditation of conflict and monopolization of the drug trade. A growing body of literature has been documenting quantitative empirical evidence on the links between product illegality and violence through the competition channel. Dell (2012) finds that a PAN victory at the local level spurs violence, suggesting that the crackdown policy induces violence. However, PAN's victory is followed by violence only when it wins in city whose neighbor drug traffic is controlled by a rival firm. Thus, the competition channel has to be operative for crackdowns to induce violence. Castillo et alli (2014) reach a similar conclusion. They study how temporary negative shocks to cocaine exports from Colombia induce violence in Mexico, which they interpret as the scarcity increasing rents when demand is inelastic, and rents are competed away through violence. After shocks to Colombian supply, homicides in Mexico increase in places that are valuable to the traffic distribution, i.e., cities close to the US border, and, quite interestingly, when there is more than one cartel present in the city. Thus, the competition channel has to be operative. Chimel and Soares (2013) find that the prohibition of mahogany trade in the Brazilian Amazon caused a spike in violence. The authors interpret the result as illegality creating a substitute system of enforcement, which is violence inducing. Equally plausible, the spike in violence may come from the increased use of violence for market share acquisition. Arguably, violence as a means of market share acquisition becomes relatively cheaper after prohibition. Idrobo et alli (2013) find that disputes for market share in illegal mining in Colombia induced violence.

Our paper contributes to this growing literature on competition in illegal markets by investigating the impact on crime of the PCC's territorial dominance in the São Paulo. Our empirical setting is different from the aforementioned work. Dell (2010) and Castillo et alli (2013) document the impact of some shock interacted with some measure of market structure. In contrast, we study the impact of the event of entry by a strong competitor. Idrobo et alli (2013) and Chimeli and Soares (2010) both estimate the impact of illegality on crime, a more reduced-form object. We estimate the direct impact of entry on crime.

In addition, the case of PCC is particularly interesting because ethnographic evidence suggests that it involves the informal enforcement of "justice" in places characterized by the lack of state presence, the *enforcement hypothesis*. In this sense, we also relate to the large literature on state capacity.[5] One paper relates A few papers are more directly related to our application. Ferraz and Otoni (2014) show how occupation by the state presence of the *Favelas* in Rio – the UPPs – helped to reduce crime in the *Favelas*. Ironically, our result is both compatible with and opposite to their results. PCC arousal is a symptom of lack of state capacity. But, in the absence of the state, a strong enough criminal groups, with sufficient stake in the pacification of the drug trade, may replace the state as law enforcer, as the ethnographic evidence suggests.

Finally, we relate to the somewhat larger literature on prison gangs. Lessing (2010) provides a very good summary of the role of prison gangs in out-of-prison crime in several cities.

This paper has five sections besides this introduction. Section 2 describes the unique dataset we construct to associate PCC presence with crime; we will emphasize the method to measure the first time the PCC dominated a well-delimitated geographical area (a *favela*). Section 3 outlines the identification strategy. Section 5 presents the results. We interpret results and conclude in section 6.

[5] It is beyond our scope to review the large literature on state capacity. Besley and Persson (2009) provide an introduction to the topic.

DATA

We built a unique dataset merging three other unique datasets: 1) the INFOCRIM database, a COMPSTAT-like geo-referenced reported crime data from the *Secretaria de Segurança Pública do Estado de São Paulo*, the state law enforcement agency; 2) the Disque-Denúncia database, a crime hotline database which contains geo-referenced anonymous citzen crime report; 3) a geo-referenced geographical data of the borders of all the *Favelas* in São Paulo.

The INFOCRIM unit of analysis is the police report. We observe all that is included in the report: the exact or estimated place of the crime (latitude and longitude), type of crime[6], exact or estimated time of occurrence, and, when applicable, characteristics of the suspect when applicable (e.g., age and gender). We have a complete set of INFOCRIM data from January 2005 through October 2009.

The *Favela* database identifies the geographical borders of more than 1,400 *Favelas* in the city of São Paulo. The borders are geo-references, which allows us to determine whether a crime occurred within the *Favela*, or close to its boundaries.

We determine whether the PCC had presence in a given *Favela* using the hotline data. The "Disque-Denúncia" is a hotline service used by the population of the State of São Paulo to report crimes to the enforcement agencies. The service is run by a non-governmental organization called "Instituto São Paulo contra a Violência" (São Paulo Against Crime Institute) through an agreement with the state-level enforcement agency (the *Secretaria de Segurança Pública*). The *Instituto São Paulo contra a Violência* is an NGO established in 1997 with the support of the biggest Brazilian media group and other important private sector partners[7]. The organization is responsible for running the call center infrastructure. The phone operators receive special training for dealing with public safety and human rights issues normally denounced by

[6] Thefts and robberies are defined in the usual way (burglaries are subsumed within both categories, according to the use of force). The other categories include the following definitions of crimes from the police records (our translation): (i) violent crimes include assaults, attempted homicides, attempted rapes, homicides, rapes, random acts of violence, and threats; (ii) drug-related crimes include association with/for drug-trafficking, drug-trafficking (sale), manufacturing of drugs, possession of drugs, and use of drugs; and (iii) vandalism includes cruelty to animals, damage to property, obscene writing, disturbance of the public order, causing turmoil, and vagrancy.

[7] Globo Television Channel and various entities that comprised private federations, foundations and associations, financial institutions, corporations, etc.

the population, such as drug trafficking, gambling and domestic violence. Following a script, the attendants receive the calls and record all the information using proprietary software developed for the service. Once registered, the information is sent through the software to the Criminal Analysis Centre of both the judiciary and the police forces, which are located in the same building of the call center. After verifying if the demands are under their jurisdiction, the police analysts classify the crime situation and send the information to their peers at local unities according to the address informed.[8] Local unities are responsible for following up. They must any action taken within 30 to 90 days, using the same proprietary software. Citizens can call back the service to verify what has been done.[9] The hotline operates 24h per day, 7 days per week, and it covers all the cities of the State of São Paulo. The service is free of charge and incoming calls can be made using landlines and cell phones[10].

Based on the *Disque Denúncia* calls we built a database to identify the first time PCC appears in a given *Favela*. The data contain the following information: the full address of the occurrences[11], date and time of the occurrences[12], the physical characteristics of both the suspects and the victims. Quite important for our purposes, operators have an open-ended field where they briefly describes the situation related.

We have data from 2000 through 2010 using transcripts from calls. Because the software does not contain a specific field for registering the involvement of PCC members in the complaints, the methodology used by the *Instituto São Paulo contra a Violência* for finding the necessary information consisted on the search for the term PCC in the open-ended field. We

[8]Police stations, for example.

[9] In order to maintain anonymity, the user is asked for an alphanumeric code provided at the first call when calling back for follow up.

[10]The number "181" is assigned by the Agência Nacional de Telecomunicações – ANATEL (National Telecommunications agency) for all the Brazilian hot lines of this nature, which operates differently in each State. Being considered a "public utility service" there are no costs involved it the use of this line.

[11]The address can refer to the exact local of the event, to the place where the suspects of the crime can be found, or to both situations.

[12]Similarly, the date and time can refer to the fact reported or to the period within which the suspect can be found at the informed address.

consider that the PCC entered a *Favela* the first time we identify a call containing the term PCC made from inside the Favela.

We start with 1504 *favelas* in our sample. In 996 *favelas*, we either did not find any mention to PCC any time before 2009, or PCC was already there before 2005. Our identification strategy – which hinges on *favela* fixed-effects – implies that these 996 *favelas* do not contribute to estimate the main coefficient of interest. Thus, we have a sample of 510 where PCC entered between February 2005 and September 2009.

Figure 1 depicts the trajectory of the entry of PCC in the 510 *favelas* in our sample. The pattern is striking. PCC presence in *favelas* was increasing steadily before May 2006, the month of the *levante.* All the sudden, PCC's presence jumps from 46% to 74% in a little less than 2 months. Subsequently the presence returns to a steady increase.

[FIGURE 1 HERE]

It is important to keep some *caveats* in mind when using the *Disque Denuncia* data. First, self-reported data refers to the perception of the population about specific crimes and situations may or may be accurate. Second, acquaintance with the service depends on access to information; effective ability to use the service depends on access to telephony; finally, the level of trust in the service significantly affects the volume of calls, and the type of situations related. Finally, the media is known to play a major role in spreading information about specific crimes or violent situations, which in turn has an impact on the volume of reports. For our purposes, these *caveats* matter only insofar as they influence the propensity to report the presence of PCC in a *Favela*. We cannot see any systematic relationship between reporting PCC and the propensity to report, but we cannot exclude the possibility. Part of our identification strategy hinges on the assumption that a user's decision to mention PCC in the *Disque Denúncia* hot line is driven that how frequently issues related to the PCC happened in the *Favela*.

THE EMPIRICAL STRATEGY

We measure the impact of the PCC's entry on crime by comparing *Favelas* with and without the PCC. Define a dummy variable d_{ft} assuming value 1 if PCC is in the Favela f on month t and zero otherwise. We estimate the following model:

$$y_{ft} = \alpha + \delta d_{ft} + \boldsymbol{\beta} \boldsymbol{X}_{ft} + \phi d_{ft} \boldsymbol{Z}_{ft} + \mathbf{F}_f + \mathrm{Y}_t + u_{ft} \quad (1)$$

where y_{ft} is the number of crimes[13] in *favela f* in month *t*, $\boldsymbol{X}_{ft}$ is a vector of covariates (admittedly very few of them); $\boldsymbol{Z}_{ft}$ is a subset of $\boldsymbol{X}_{ft}$ for variables that we want to interact with the dummy variable in order to find heterogeneity or indirect impacts of PCC on homicides. $\mathbf{F}_f$ is a full set of year *favela* dummies. u_{ft} is a shock that contain all time-varying unobserved heterogeneity across *favelas*. The main coefficient of interest is δ. In all estimation procedures we correct for the fact that u_{ft} may be correlated within *favelas*.

Inclusion of Favela fixed-effects implies that identification comes from comparing the dynamics of crime in *favelas* where PCC entered early and late in the sample period. In fact, the main source of identifying variation will be whether the crime increased (or dropped) *before* in *favelas* where the PCC entered early. The sample effectively consists of *favelas* where PCC entered between February 2006 and September 2009. All units are "treated", but at different points in time.

We observe crime at a quite disaggregate level, the *favela*, and use a relatively high frequency data as far as crime is concerned: monthly. It is important that we take data to the very local level, where ethnographic evidence finds evidence of PCC's territorial dominance. High frequency is also valuable because PCC's dominance may be established in less than a year and using annual data would dispense valuable variation. At the monthly frequency and at the *favela* level, criminal events are rare even in high crime environments. The modal figure for violent

[13] We will not specify the crime in this specification. Our hypothesis is that PCC would reduce homicides but we will not take a stance about other types of crimes. For instance, we may notice an increase in drug related crimes. We will estimate this specification for different types of crimes separately.

crime is zero. Figures 2 and 3 show the histogram of violent and property crime, respectively. Panel A shows un-weighted numbers, and in Panel B we weight by baseline crime (2005), the idea being that there is less noise where crime is more frequent.

[FIGURES 2 AND 3 HERE]

The rare occurrence feature of the data led us to two empirical decisions. First, we resort to aggregation at another dimension, and we look only at aggregate crime categories: violence and property crime. Second, we need to take into account the counting nature of the data, the clear over-dispersion of the data – especially when data are weighted, and the clear mass at zero. Thus, the main results are from estimating equation (1) using a zero-inflated negative binomial model. The probability of zero crime in month-*favela* pair is modeled as a logistic function of the average crime in 2005, which we use as baseline crime (violent or property depending on which type is the dependent variable). As expected, baseline crime strongly explains the chances of observing zero crime in month-*favela* pair. The negative binomial is more adequate than a straight poisson because the variance of violence crime is much larger than the mean (some 60% larger, see Table 1).

Identification

PCC's decision to enter a given *Favela* and, more importantly, the timing of entry, is not randomly determined, which poses a significant challenge to identification. It could be that PCC decided to enter disputed territories, where it would face a divided opposition. In this case, the mean reversion of high level of violence in disputed territories will produce spurious evidence in favor of the *Pax Monopolista* hypothesis. Or it could be that PCC chose to enter more profitable distribution points, and profitability may be related to baseline violence.

While it is not obvious how the non-random entry will bias results, it is conceivable that the *PCC* could be related to unobserved time-varying heterogeneity across *Favelas*. We do not a clear source of exogenous variation on PCC, i.e., an instrument. We will still argue that the

strategy we postulated will recover the causal impact of PCC on violence. We will proceed in the same fashion as many recent successful papers that do not have a clear source of exogenous variation but argue nonetheless that a fixed-effects strategy works (see Galiani et alli 2005, and Biderman et alli 2010). We follow two paths.

Showing the determinants of entry quantitatively

Absent access to clearly exogenous variation, the literature has resorted to studying if and how the timing of entry is affected by observable variables. Following Galiani et alli (2005) and Biderman et alli (2010), we estimate a duration model to estimate the determinants of the timing of entry. This will inform us on two dimensions: 1) if in fact the timing of entry seems systematically related to observables (in fact, our preliminary regressions suggest that it not); 2) how threatening the non-random entry decision is.

Controlling for "pre-treatment" trends

Another common procedure is to allow different trends according to baseline differences across *Favelas*. In particular, our specification will allow for *Favelas* to have different time trends according to the following variables: 1) violence in the baseline, measured by homicides, drug-related homicides, deaths in confrontation with the police, vehicle robberies and thefts, and robberies and thefts); 2) size of the drug market measured by the total amount of drug apprehensions (cocaine and marijuana); wide range of socio-economic variables, such an income and income distribution; 4) measures of state presence and capacity, such as the presence of schools, hospitals and health clinics.

Most of the identification concerns should be mitigated by the inclusion of differential time trends according to the variables described above. Size of market, for example, is strongly related to profitability in most markets (Bresnahan and Reiss, 1991). Thus, including differential trends according to the size of the market will discard spurious variation due to the fact that profitability in the baseline will cause homicides to change differently across *Favelas* over time.

Mutatis mutandis for violence: any linear mean reversion or mean expansion will be capture by differential trends. Interacting drug-related homicides with a time trend will allow violence in *Favelas* to evolve differently according to the level of contestability in the baseline

RESULTS

Summary Statistics and Time-Series Patterns

Tables 1 and 2 contain some summary statistics for violent and property crime, respectively. We show several features of the data. Violent crime is rare event at the *favela*: less than one is reported per month; even when we weight *favelas* by the baseline crime, which will capture size and how violent *favelas* are, we find a little less than two reported violent crimes monthly. Considering that we have 510 *favelas* in our sample, which represent a little more than a third of all *favelas* in the city of São Paulo, we see that São Paulo as whole is a violent place. In the early period, for example, we have a little less than 11,000 violent crimes reported annually within 200 meters of these 510 *favelas*[14]. The actual figure was roughly 78,000 reports of violent crimes in the whole city. The *favelas* in our sample represent 14% of all violent crime in 2006, and roughly 8% of the population (data from the 2010 census), and around 7% of the area in the city of São Paulo (see Maps 1 and 2). Property crime follows a similar pattern. In the early period there were little more than 34,300 property crimes reported annually within 200 meters of these 510 *favelas*. They represent 11% of all property crime reported in the city in 2006.

Panels B show summary statistics weighted by baseline total crime in 2005, which are more representative of the whole city. We see a drop in both violent and property crime when comparing the earlier, when PCC was present in most *favelas* – with the later periods, when PCC was present in more than 70% of the *favelas* in our sample. Although we can never reject the null that crime is constant, point estimates show a 10% reduction in violent crime and a little more than a 2% reduction in property crime. Time-series patterns are indicative – but not much than that – that the PCC may have contributed to the reduction in violent crime but had no effect on

[14] 12 x 510 x 1.76 = 10,771.2

property crime. Figures 4 and 5 show the time-series patterns of violent and property crime *vis-à-vis* the penetration of PCC in *favelas*.

After the big push in PCC's emergence, violent crime drops. The sharpest drop occurs over the year following the *levante*, but it is impossible to discard that crime was dropping before that for reasons other then the PCC's presence in *favelas*, although the presence had been increasing prior to the *levante*. Throughout the sample period property crime does not follow any particular pattern, except for a marked sharp increase in 2009. In contrast to violent crime, the big surge in May 2006 did not translate into a drop in property crime, at least not visually perceptible.

Regression Results

Tables 3 and 4 shows out main results for violent and property crime, respectively. We estimate a negative binomial with zero inflated by baseline crime. Start with Table 3, column (1). Without controlling for *favela* fixed effects, we find that PCC entry causes an increase in violent crime. But this reflects only the fact that PCC entered in more violent places, which is not surprising. In column (2) we include a full set of *favela* dummies. Now PCC entry is associated with a reduction in violent crime. The coefficient – -0.163 – is a semi-elasticity. Thus, the presence of PCC is associated with a 16.3% reduction in crime, but the approximation can be very imprecise for binary variables. We compute the difference in violent crime when PCC = 1 and PCC = 0, and find a reduction of 0.136 violent crime per month and per *favela*, which represent a 16.% reduction with respect to the mean violence crime in Table 1.

PCC enters more violent *favelas*. Thus, the estimated impact of PCC maybe due to mean reversion or to other unobserved policy interventions targeted at particularly violent *favelas*. In column (3) we account for this possibility by including an interaction of baseline level of crime in 2005. Indeed, crime drops more *favelas* that were more violent in the baseline. Furthermore, as expected, the impact of PCC is now smaller: a reduction of 0.105 violent crimes per *favela* per

month, but still quite significant both statistically and practically. PCC now represent a 13% reduction in violent crime with respect to the mean in Table 1.

In column (4) we include year dummies, which is quite important because the pure time-series pattern in data maybe spurious (see Figures 2 and 3): we know that PCC dominance increased overtime when violent crime was dropping. The impact is still statistically and practically significant. We still find that the larger drops occurred in *favelas* that were more violent to begin with. The impact of PCC is now a reduction of 0.079 violent crimes per *favela* per month, which represent a 9.7% reduction in violent crime with respect to the mean in Table 1.

In column (5) we weight observations by the baseline violence in 2005. We do that for two purposes. First, we do not the *favelas* population. Because there is more crime in more populous places, weighting by baseline population approximates a little better a coefficient that is representative of the whole city. Second, violent crime is notoriously noisy, especially at the very disaggregate geographic level. Thus, weighting by baseline crime will give more weight to more informative observations. Results are similar. Now the mean reversion effect is still present but it is no longer precisely estimated. The overall impact is still precisely estimated. The magnitude of the overall effect is now a drop of 0.227 per *favela* per month, which represent a 13% reduction in in violent crime with respect to the mean in Table 1.[15]

Table 4 contains exactly the same specifications for property crime. We find no systematic impact of PCC presence. Nothing is statistically significant and for the most credible specifications (columns 3 through 5) the magnitudes are small. Overall, results suggest that PCC entry has no discernible impact on property crime.

Tables 5 and 6 show the same specification with a different functional form: the zero inflated Poisson. Inspection of Figures 2 and 3 show that overdispersion is less pronounced when observations are not weighted by the baseline crime, suggesting that Poisson may be more appropriate because of simplicity. Point estimates barely chance. Precision drops a little but, for violent crime, we still reject the null hypothesis that PCC has no impact at standard significance levels.

[15] The relevant comparison is now with the weighted mean in Table 1.

Table 7 shows other functional forms. Inspection of Figures 2 and 3 show that, when observations are weighted by the baseline crime, no significant mass appears at zero, which suggests that not inflating for zeros may be more appropriate because of simplicity. Finally we estimate the simplest possible model, a linear specification. In all cases results are similar to those in Tables 3 and 4.

In Table 7 we investigate whether the timing of entry of PCC is systematically related to violence. In spirit of Galiani et al (2005) and Biderman et al (2010), this is informative as to whether treating PCC as exogenous is reasonable. We estimate a Cox-proportional Hazard model. The failure is PCC entry.

Before proceeding to the results, consider the geographical distribution of the *favelas* in our sample. Map 2 depicts the entry of PCC in *favelas* over time. We no clear geographical pattern in the timing of entry, suggesting a certain geographical randomness in the process of PCC dominance. Incidentally, there is no clear geographical pattern when comparing *favelas* with and without PCC dominance.

A coefficient above 1 means that an increase in the variable increases the odds of PCC entry by the same percent amount at any given point in time. In column (1) we include the baseline crime (a time invariant variable) and crime (time varying). Nothing is statically significant. In terms of magnitudes, the effect is very small. The PCC has only 0.15% more chance of entering a *favela* with one standard deviation more crime in the baseline 2005. Increases in crime of a one standard deviation increase the odds of entry by 0.20%. Allowing violent and property crime to have separate impacts does not make any difference. In summary, PCC's timing of entry has no systematic relationship with violence. Although this fact by itself does not establish exogeneity, it certainly is reassuring.

CONCLUSION

We find that the PCC entry in *favelas* reduces violent crime but has no discernible impact on property crime. The *enforcement hypothesis* calls for a reduction of both violent and property

crime. On the other had, the *competition hypothesis* calls only for an impact on violent crime. Thus, the case of PCC is evidence that competition in illegal drug markets is criminogenic.

The results is this paper are in line with the small but growing literature that has been documenting the violence induced by the drug trade. In our case, differently from Castillo et alli (2014) and Dell (2012) we document violence related to the retail drug market distribution. In this sense our results have a closer dialogue with the literature on gang violence, especially the violence associated with open drug markets (Kennedy, 2011).

It is not easy to draw policy prescriptions from our results, except insofar as they are informative about the desirability of maintaining some drugs illegal. Within the prohibition framework, it is difficult and dangerous to attempt to foster monopolies in illegal markets, a risk that PCC case illustrates eloquently. PCC dominance of *favelas* did help to reduce violent crimes. But the criminal group became powerful enough to hold the city of São Paulo hostage at least twice after 2006. A strong criminal group, with large stakes in illegal markets, can bribe or threaten its way out of the reach of the judicial system, undermining state capacity.

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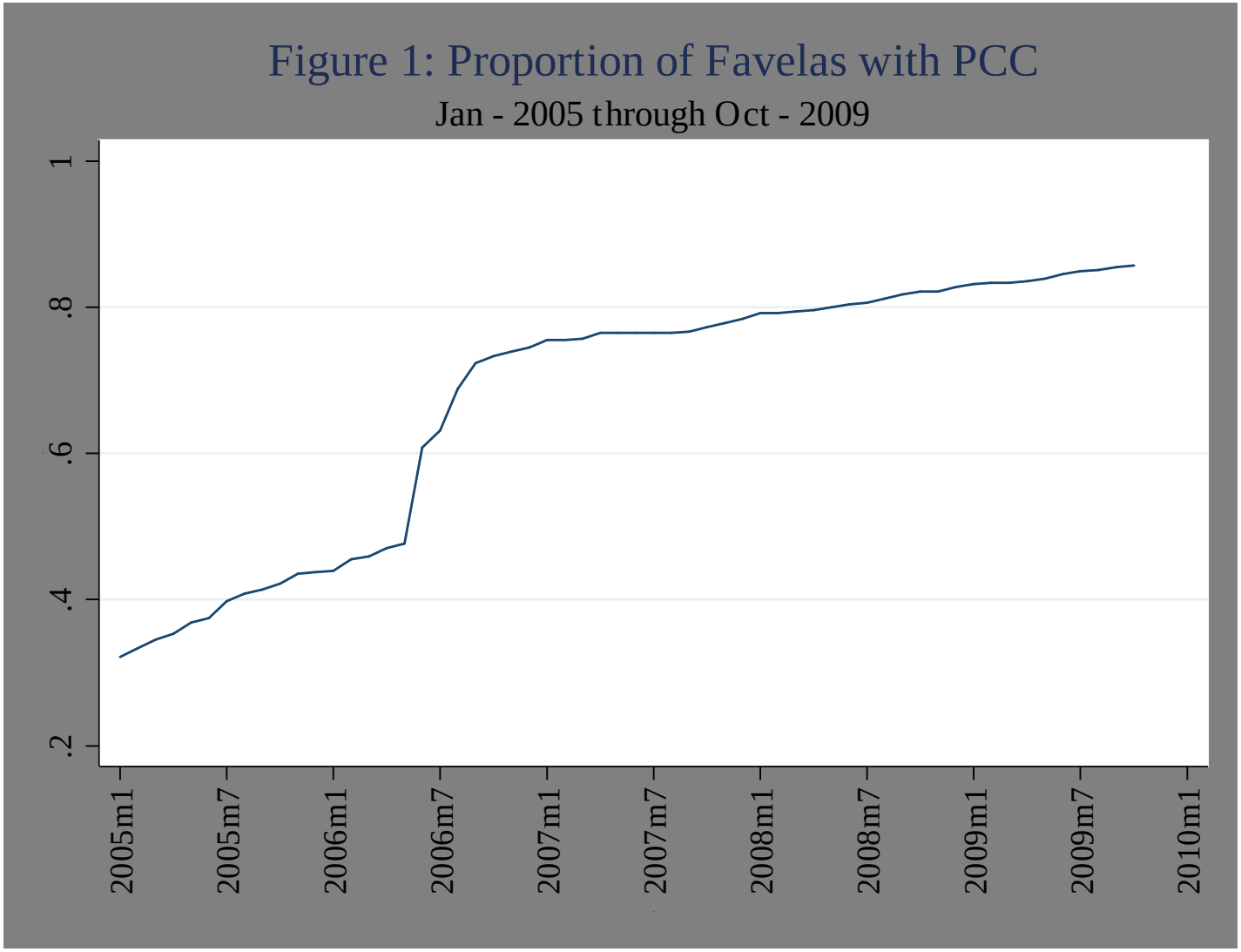


Figure 1: Proportion of Favelas with PCC
Jan - 2005 through Oct - 2009
.2
.4
.6
.8
1
2005m1
2005m7
2006m1
2006m7
2007m1
2007m7
2008m1
2008m7
2009m1
2009m7
2010m1

Figure 2: Histogram of Violent Crime

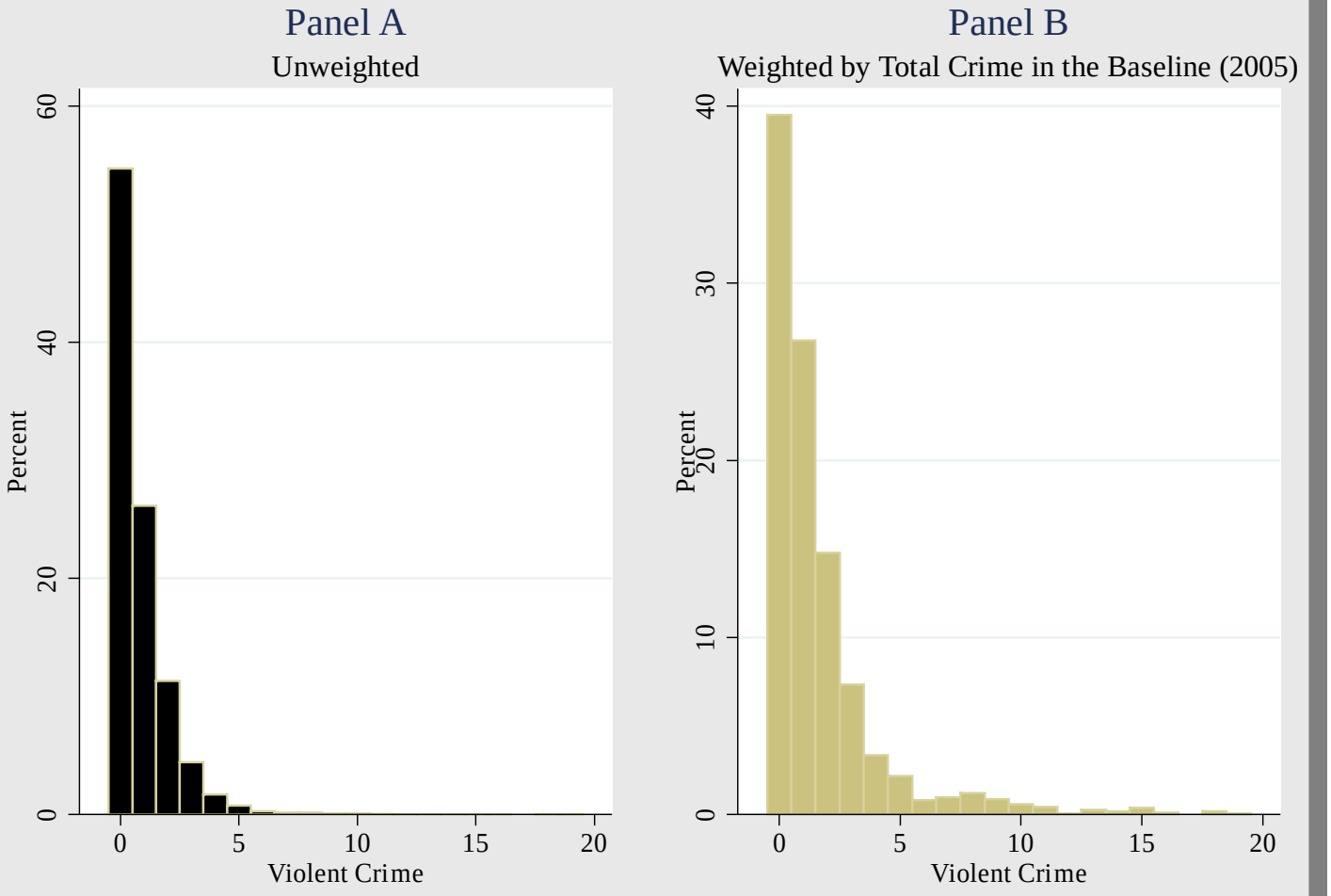
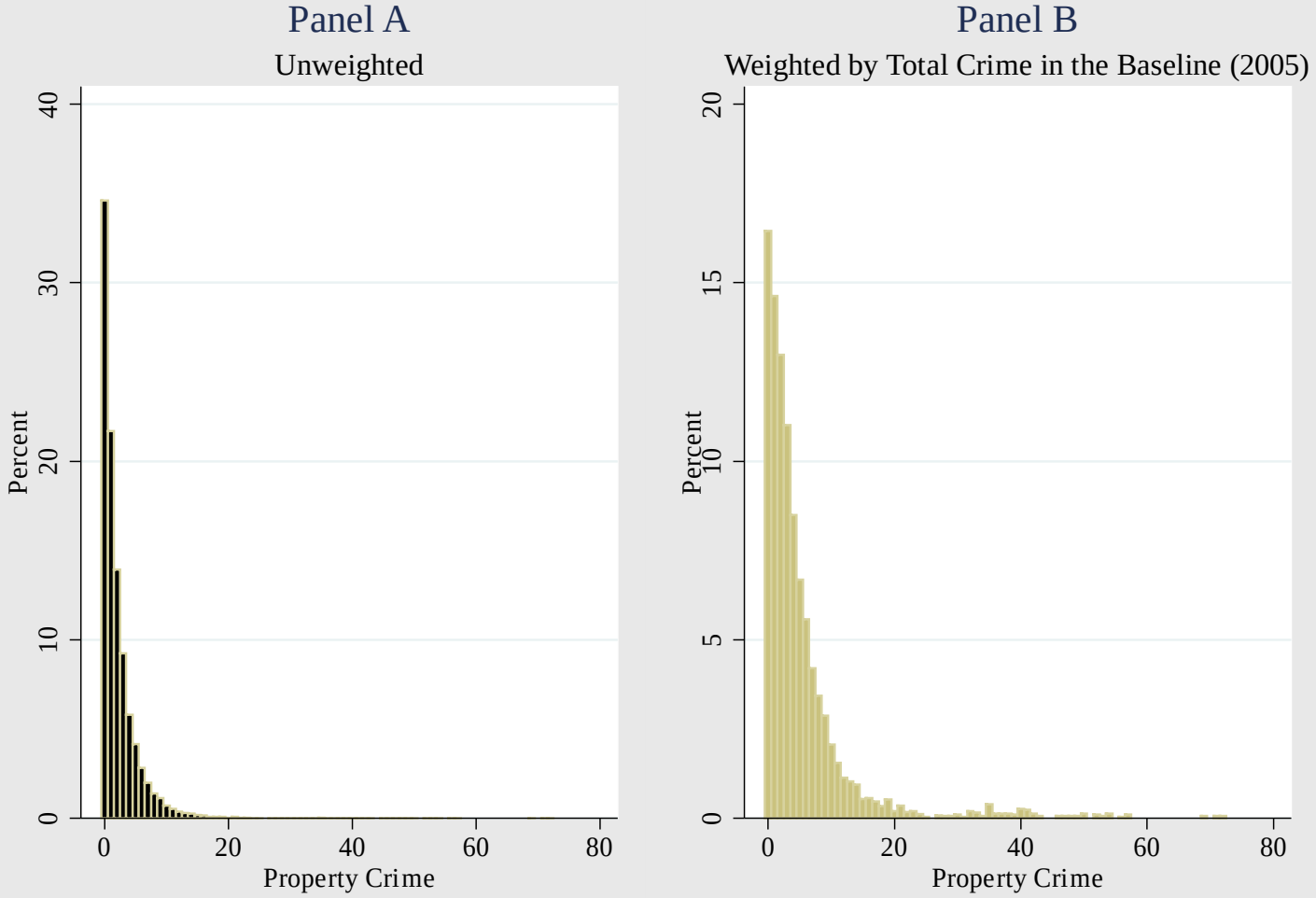


Figure 3: Histogram of Property Crime



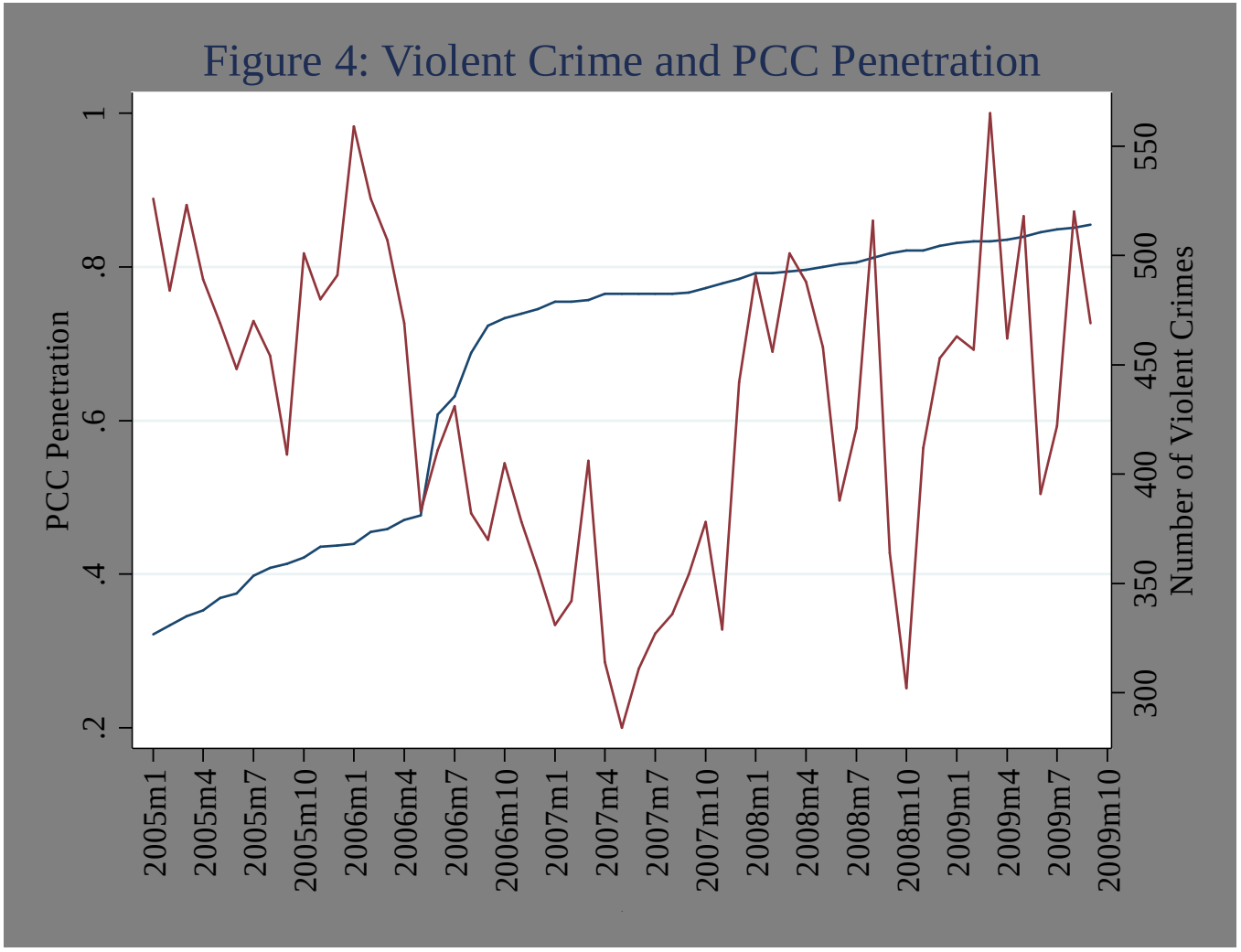


Figure 4: Violent Crime and PCC Penetration
PCC Penetration
.2
.4
.6
.8
1
Number of Violent Crimes
300
350
400
450
500
550
2005m1
2005m4
2005m7
2005m10
2006m1
2006m4
2006m7
2006m10
2007m1
2007m4
2007m7
2007m10
2008m1
2008m4
2008m7
2008m10
2009m1
2009m4
2009m7
2009m10

Figure 5: Property Crime and PCC Penetration

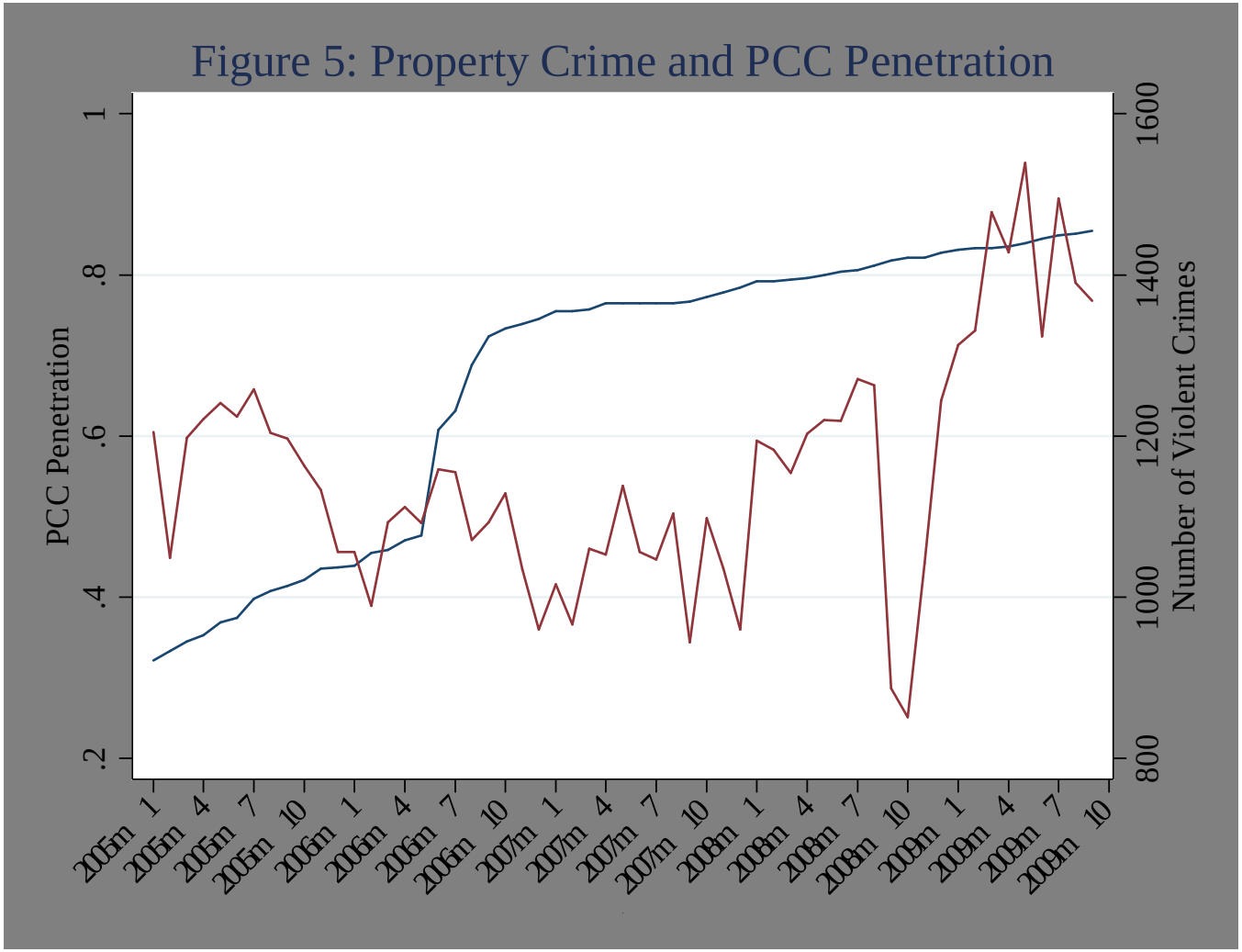


Table 1, Summary Statistics: Violent Crime			
	Mean	Standard Deviation	Observations
Panel A: Unweighted			
Early	0.85	1.37	14790
Late	0.81	1.27	14790
Total	0.83	1.32	29580
Panel B: Weighted by Total Crime in 2005			
Early	1.76	2.61	14558
Late	1.6	2.47	14558
Total	1.68	2.54	29116

Sample is between Jan 2005 and October 2009. Total of 510 favelas for the unweighted computation. Early is before June 2007.

Table 2, Summary Statistics: Property Crime			
	Mean	Standard Deviation	Observations
Panel A: Unweighted			
Early	2.29	3.47	14790
Late	2.19	3.57	14790
Total	2.24	3.52	29580
Panel B: Weighted by Total Crime in 2005			
Early	5.61	8.02	14558
Late	5.49	8.45	14558
Total	5.55	8.24	29116

Sample is between Jan 2005 and October 2009. Total of 510 favelas for the unweighted computation. Early is before June 2007.

Table 3, Dependent Variable: Violent Crime (Zero Inflated Negative Binomial)

	OLS	Favela Fixed - Effects	Including Trend times Baseline Violence	Including Year Dummies	Weighting by Baseline Crime[C]
PCC Presence[A]	0.120	-0.163	-0.126	-0.095	-0.135
	(1.86)*	(5.16)***	(3.81)***	(2.56)***	(2.65)***
Baseline Violence x Trend			-0.000895	-0.001241	-0.000508
			(3.10)***	(3.09)***	(1.08)
Crime|PCC=1 - Crime|PCC=0 [B]	0.100	-0.136	-0.105	-0.079	-0.227
	(1.78)*	(5.16)***	(3.81)***	(2.56)***	(2.65)***
N	29,580	29,580	29,580	29,580	29,580

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Zero inflated Negative Binomial model. Logit model for zeros: regressor is the baseline crime (2005).). A = coefficient if a semi-elasticity: approximate % change in due the presence of PCC. B: Coefficient is the difference in average crime when PCC = 1 and PCC = 0. Coefficients for Favela and year dummies variables not shown. Unit of analysis is a pair month-favela. C: weighted by the sum of total crime in the baseline. All estimates of standard errors take into account the possibility of within Favela correlation among error terms.

Table 4, Dependent Variable: Property Crime (Zero Inflated Negative Binomial)

	No Controls	Favela Fixed Effects	Including Trend times Baseline Crime	Including Year Dummies	Weighting by Baseline Crime[C]
PCC Presence[A]	0.097	-0.001	0.015	-0.015	-0.045
	(1.13)	(0.03)	(0.50)	(0.45)	(0.62)
Property Crime x Trend			-0.001609	-0.006024	-0.004
			(1.17)	(2.03)**	(0.28)
Crime|PCC=1 - Crime|PCC=0 [B]	0.217	-0.002	0.033	-0.035	-0.274
	(1.10)	(0.03)	(0.50)	(0.45)	(0.62)
N	29,580	29,580	29,580	29,580	29,580

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Zero Inflated Negative Binomial model. Logit model for zeros: regressor is the baseline crime (2005). A = coefficient if a semi-elasticity: approximate % change in due the presence of PCC. B: Coefficient is the difference in average crime when PCC = 1 and PCC = 0. Coefficients for Favela and year dummies variables not shown. Unit of analysis is a pair month-favela. B = weighted by the sum of property crime in the baseline (2005). All estimates of standard errors take into account the possibility of within Favela correlation among error terms..

Table 5, Dependent Variable: Violent Crime (Zero Inflated Poisson)

	No Controls	Favela Fixed Effects	Including Trend x Baseline Violence	Including Year Dummies	Weighting by Baseline Crime[C]
PCC Presence[A]	0.134	-0.162	-0.130	-0.098	-0.102
	(1.95)*	(5.07)***	(3.77)***	(2.55)**	(1.85)*
Baseline Violence x Trend			-0.000741	-0.000978	-0.000453
			(2.27)**	(2.45)**	(0.90)
Crime|PCC=1 - Crime|PCC=0 [B]	0.112	-0.135	-0.108	-0.081	-0.172
	(1.95)*	(5.07)***	(3.77)***	(2.55)**	(1.85)*
NN	29,580	29,580	29,580	29,580	29,580

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Zero inflated Poisson model. Logit model for zeros: regressor is the baseline crime (2005).). A = coefficient if a semi-elasticity: approximate % change in due the presence of PCC. B: Coefficient is the difference in average crime when PCC = 1 and PCC = 0. Coefficients for Favela and year dummies variables not shown. Unit of analysis is a pair month-favela. C: weighted by the sum of total crime in the baseline. All estimates of standard errors take into account the possibility of within Favela correlation among error terms.

Table 6, Dependent Variable: Property Crime (Zero Inflated Poisson)

	No Controls	Favela Fixed Effects	Including Trend times Baseline Violence	Including Year Dummies	Weighting by Baseline Crime[C]
PCC Presence[A]	0.094	0.023	0.024	-0.006	-0.059
	(1.14)	(0.65)	(0.72)	(0.16)	(0.69)
Baseline Property Crime x Trend			-0.000054	-0.002340	0.000173
			(0.06)	(1.26)	(0.27)
Crime|PCC=1 - Crime|PCC=0 [B]	0.209	0.052	0.053	-0.014	-0.327
	(1.14)	(0.65)	(0.72)	(0.16)	(0.69)
N	29,580	29,580	29,580	29,580	29,580

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Zero inflated Poisson model. Logit model for zeros: regressor is the baseline crime (2005).). A = coefficient if a semi-elasticity: approximate % change in due the presence of PCC. B: Coefficient is the difference in average crime when PCC = 1 and PCC = 0. Coefficients for Favela and year dummies variables not shown. Unit of analysis is a pair month-favela. C: weighted by the sum of total crime in the baseline All estimates of standard errors take into account the possibility of within Favela correlation among error terms.

Table 7: Models without Inflating for Zeros

	Poisson - Violent	Poisson - Property	Neg. Binomial - Violent	Neg. Binomial - Property	Linear - Violent	Linear - Property
PCC Presence	-0.148	-0.083	-0.134	-0.083	-0.157	-0.323
	(2.64)***	(0.80)	(2.65)***	(0.80)	(2.16)**	(0.68)
Baseline Violent Crime (05) x Trend	-0.001		-0.000512		-0.004757	
	(1.03)		(1.09)		(1.23)	
Baseline Property Crime (05) x Trend		0.000262		0.000262		0.011912
		(0.36)		(0.36)		(0.52)
N	29,116	29,116	29,116	29,116	29,116	29,116
R^2					0.66	0.80

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

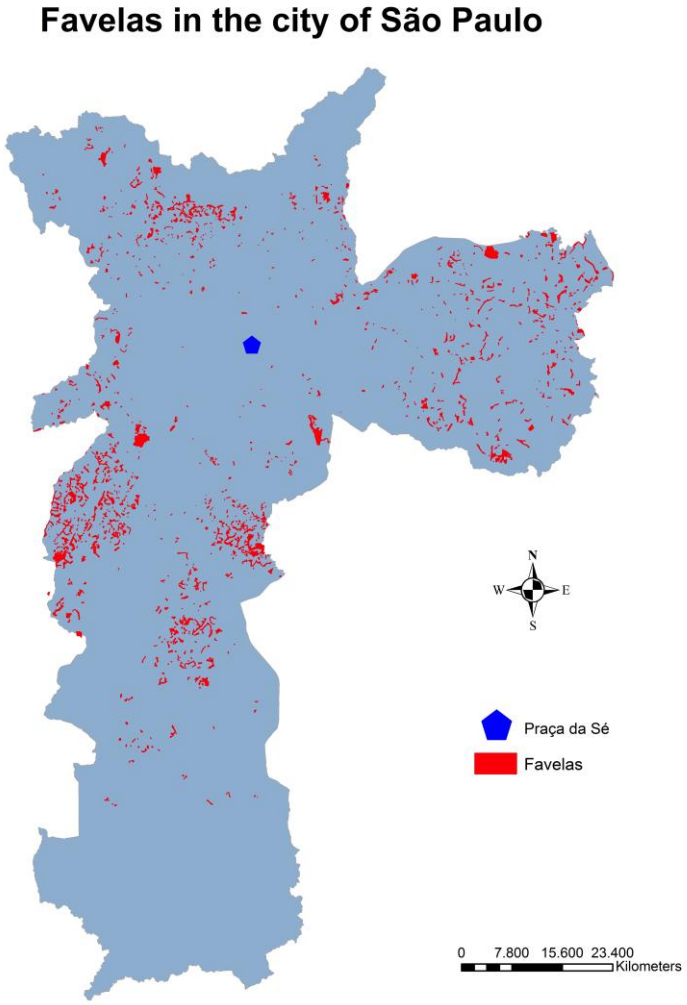
Coefficients for Favela and year dummies variables not shown. All models include year and favela fixed-effects. All estimates of standard errors take into account the possibility of within Favela correlation among error terms. In all models observations are weighted by the baseline (2005) crime

Table 8: Hazard Model to Explain PCC Entry

Failure variable is the PCC presence		**(1)**	**(2)**
Time invariant	All crime in 2005 baseline	1.0003	1.0006
		(0.0016)	(0.0016)
Time varying	All crime	1.0004	
		(0.0004)	
	Violent		1.0002
			(0.0004)
	Property		1.0008
			(0.0009)
No subjects		510	510
No failures		436	436
Time at risk		28,717	28,717
N		10,357	10,357

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Cox Proportional Hazards model. Standard Errors corrected for within Favela correlation in the error terms.


Favelas in the city of São Paulo
N
W
E
S
Praça da Sé
Favelas
0 7.800 15.600 23.400
Kilometers

1.

Map 2

Dominance of PCC in the favelas of São Paulo (2005-2009)