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The Impact of Police Presence on Drug-Trade-Related Violence

ABSTRACT Rio de Janeiro hosted two major sports events in a two-year period: the FIFA World Cup and the Summer Olympic Games. After the announcements of the city as the host of these events, the government launched the Favela Pacification Program. The program consists in the expulsion of drug-trafficking organizations from territories where they used to exert a monopoly on violence. The identification strategy used in this paper exploits the time and space variation in the deployment of police forces and the organized crime structure of criminal activity in Rio de Janeiro to evaluate the causal effect of the program on criminal activity. The results indicate that the program caused a displacement of drug-trade-related violence. We also find that the program caused a reduction in violence in pacified territories, but this result may be the consequence of contamination of the control group.

JEL Code: K42

Keywords: Police deployment effectiveness, organized crime, displacement of violence

Drug-trade-related violence has been a major issue over the last decades in some Latin American regions. Since 2007, Mexico has suffered a surge in violence linked to the struggle of drug-trafficking organizations (DTOs) to control traffic routes. Colombia has endured the violence imposed by drug cartels since the early 1980s. In Brazil, the largest cities have witnessed how DTOs can replace the state and exert a monopoly on violence in the most impoverished parts of the city. How to efficiently face DTOs is a relevant policy question for Latin American countries.

Favelas in Rio de Janeiro have been under the control of DTOs since the early 1980s, when these criminal syndicates started to use them as their headquarters for controlling and organizing drug trafficking. Economic revenues for a DTO are closely related to the amount of territory under its control,

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which has resulted in frequent gang battles to gain or secure control of a given area. Traditionally, when clashes between gangs became too violent, the security strategy employed by police forces to stop the bloodshed was to conduct temporary and violent incursions.[1] Both the gang battles and the security strategy used to deal with them have produced significant numbers of homicides and resistance cases.[2]

To fight DTO control, the government of Rio de Janeiro launched the Favela Pacification Program (FPP), which consists in the expulsion of DTOs from territories where they used to exert a monopoly on violence. The FPP pacified thirty-seven territories from November 2008 to March 2014.[3] A Pacifying Police Unit (PPU) is assigned to each pacified territory, with a police station installed to keep DTOs away from the territory.[4]

Before the FPP, the thirty-seven territories were under the control of two DTOs: Comando Vermelho (CV), Portuguese for Red Command, and Amigos dos Amigos (ADA), Portuguese for Friends of Friends. Thirty-two of the territories were controlled by the CV, the oldest DTO operating in Rio de Janeiro, and five by the ADA, a rival gang.[5] The first eleven territories pacified, which were pacified between November 2008 and September 2010, were under the control of the CV.

The quasi-experimental design of the FPP in Rio de Janeiro provides a unique setting to recover the causal effect of police presence on (1) criminal activity where the police are deployed and (2) the displacement of criminal activity to where the police are not deployed. Three elements of the quasi-experimental design used in this work are instrumental to recovering the two causal effects: space and time variation in the deployment of police forces by the FPP; the organized structure of crime in Rio de Janeiro, where each territory is ostensibly dominated by a DTO; and the fact that from November 2008 to September 2010, only territories under the control of the CV were pacified.

1. Magaloni, Franco, and Melo (2015).

2. The distinction between a homicide and a resistance case relies on who commits the murder. A homicide occurs when a civilian is murdered by another civilian. A resistance case occurs when a civilian is murdered by a police officer. In 2007, the year before the implementation of the Favela Pacification Program (FPP), the homicide rate in the areas where the program was applied was 18.9 per 100,000 inhabitants, and the resistance rate was 23.08.

3. Figure A1 in the appendix depicts the thirty-seven territories in a map of Rio de Janeiro.

4. Table A1 in the appendix shows the day on which each of the thirty-seven territories was pacified, which gang used to control the territory, the total area of the pacified territory, and the number of police officers assigned to the PPU.

5. The FPP has assigned 9,224 police officers to PPUs and covers an area equivalent to 22 percent of the city of Rio de Janeiro, where 9 percent of its population lives.

Three groups of territories can be distinguished in the sample, providing a control group and two treatment groups. Each treatment group receives a different treatment: one is treated with more police presence; the other is treated with the group's rivals' increased incentive to attack the group members and expel them from their territories. The first group is used to evaluate the causal effect of police presence on criminal activity; the second group, the effect of police presence on crime displacement in an organized crime context. The treatment group used to evaluate the causal effect of police presence on criminal activity is composed of the eleven CV territories pacified from November 2008 to September 2010, while the treatment group used to evaluate crime displacement covers the five ADA territories. The control group comprises the twenty-one CV territories pacified after September 2010.

A crucial point of the identification strategy is that the control group is not contaminated by the treatment. The pacification of the first eleven CV territories cannot provoke changes in the criminal activity of the twenty-one CV territories pacified later. This assumption is later relaxed to interpret how it affects the results.

The twelfth territory pacified, in October 2010, was controlled by the ADA. Once an ADA territory was pacified, the FPP also gave this DTO an incentive to displace violence to CV territories, so the CV territories no longer provide a good counterfactual. For this reason, the analysis is restricted to the period before October 2010.

I employ an event-study technique to evaluate the effect of the FPP. This technique specifically addresses the concern that police forces may not be allocated randomly. The results indicate that drug-trade-related violence decreases in pacified territories, in terms of both homicides and resistance cases. There is also significant displacement of drug-trade-related violence to ADA territories, only in terms of homicides. The net effect of the FPP on violence is negative: violence decreases more in pacified territories than it increases in ADA territories.

However, the possiblity that the control group is contaminated by the treatment itself cannot be fully discarded. Expelled CV criminals may take shelter in unpacified CV territories, which may increase criminal rates in the control group during the treatment period. If this is the case, the estimates are biased downward: the reduction of violence in pacified territories may be overestimated, while the increase in violence in ADA territories would be underestimated.

This is the first paper to evaluate the effect of the FPP on drug-trade-related violence taking into account the organized crime structure of criminal activity in Rio de Janeiro. The study has two findings. First, there is evidence that

the FPP displaced drug-trade-related violence, a new result in the literature. Second, I explicitly show that causal evidence that the FPP reduced violence in pacified territories should be taken with caution, as it may derive from contamination of the control group.

This paper is closely related to the work of Magaloni, Franco, and Melo, who exploit the time and space variation in the implementation of the FPP and use a difference-in-differences strategy to find causal evidence that the program decreases violence in pacified territories.[6] They find that the decrease in violence is mostly due to a decrease in resistance cases.

By considering which DTO used to control the pacified territories, I am able to capture a displacement effect of violence from pacified territories to ADA territories. Additionally, the reduction in violence found by Magaloni, Franco, and Melo may be the result of expelled CV criminals taking shelter in CV territories.[7] Overall, the results indicate that the FPP caused a significant increase in drug-trade-related violence in ADA territories, but the violence reduction in pacified territories is dubious.

This work is related to a growing literature on the effects on violence of security programs intended to fight organized crime. Dell and Calderón and others study the consequences of crackdowns on DTOs in Mexico starting in 2007, when former Mexican president Felipe Calderón launched a war on the drug trade.[8] Both works find that as a result of the weakness of the incumbent DTO and fights among new criminals to take the drug-trafficking business, violence increased where the crackdowns were carried out. Both works also find that drug-trade-related violence was displaced to alternative routes used to transport drugs to the United States. This work is also related to a literature that evaluates the causal effect of police presence on crime. The police deployment that follows a terrorist attack has been used to evaluate the effect of police on criminal activity. Draca, Machin, and Witt find a decrease in violent crime and in some types of property crime; di Tella and Schargrodsky find a decrease in car robbery.[9] Blanes and Mastrobuoni argue that the literature that uses terrorist attacks to assess the effect of police presence on criminal activity tends to find results unlikely to be found in ordinary circumstances, where police deployment is distributed more

6. Magaloni, Franco, and Melo (2015).
7. Ibid.
8. Dell (2015); Calderón and others (2015).
9. Draca, Machin, and Witt (2011); di Tella and Schargrodsky (2004). Donohue, Ho, and Leahy (2013) dispute di Tella and Schargrodsky's results, presenting evidence that there was no decrease in car robbery but a displacement of crime to adjacent areas.

smoothly than in the aftermath of a terrorist attack.[10] Exploiting a natural experiment that increased police presence in the city of Essex, England, the authors find no effect on criminal activity.

This paper is structured as follows. The next section provides some background. This is followed by a discussion of the methodology used, the data, and the results. A final section presents the conclusions.

The Favela Pacification Program

The Favela Pacification Program consists in the pacification of some favelas to recover territories under gang control. The pacification of a territory occurs in two stages. First, police forces are deployed to expel criminals, which usually results in clashes between police forces and criminals. Second, to prevent the return of the ejected criminals, a PPU is set up with jurisdiction over the pacified territory.

The FPP did not have a legal framework when it was put into practice. The only legal instrument ruling the FPP, namely, Rio de Janeiro state decree law 42,787, was passed on January 6, 2011, more than two years after the first pacification, when twenty-one territories had already been pacified. The decree law describes the necessary characteristics for a territory to be considered for pacification and the steps a pacification operation must follow. In essence, the decree law describes what was already being put into practice by the police. Specifically, a territory is "potentially able to be contemplated" for a pacification operation if it is a poor territory where heavily armed criminals represent a clear and demonstrable threat to the democratic state under the rule of law. Regarding the pacification process, the decree law establishes that the first step of a pacification is the deployment of police forces in the territory to recover state control. After a stabilization period during which additional police forces may be called in, a PPU with jurisdiction over the pacified territory is installed.

Methodology and Empirical Strategy

To recover the causal effect of police presence on drug-trade-related violence, I exploit the timing of pacifications under the FPP. The first eleven CV territories pacified are used as the treatment group to evaluate the effect of police

10. Blanes and Mastrobuoni (2018).

presence, the five ADA territories that were later pacified as a second treatment group to evaluate any displacement effect, and the last twenty-one CV territories pacified as the counterfactual for both treatment groups.

After the pacification of the eleventh CV territory on August 10, 2010, the first ADA territory was pacified, on October 14, 2010. After the first ADA pacification, the twenty-one CV territories that were subsequently pacified cannot provide a good counterfactual for the treatment groups as they may be receiving displaced drug-trade-related violence from ADA territories. Thus, September 2010 is set as the ending date of the post-treatment period.

The starting date of the pre-treatment period takes into account the fact that Rio de Janeiro was announced to host the 2014 Fédération Internationale de Football Association (FIFA) World Cup on August 17, 2007. To eliminate any announcement effect, the starting date of the pre-treatment period is set as September 2007.

For the treatment group comprising the first eleven CV territories pacified, the post-treatment date of each territory begins when the territory is pacified. For the treatment group composed of the five ADA territories, the post-treatment date begins when the FPP program was launched, in November 2008. The analysis examines whether displacement effects intensified as the number of CV territories pacified increased.

The baseline econometric specification is the following:

$$(1) \qquad Y_{im} = \sum_t \beta_t \cdot \text{PACIFIED}_{im}^t + \sum_t \gamma_t \cdot \text{ADA}_{im}^t + I_i + M_m + \varepsilon_{in},$$

where Y_{im} is a drug-trade-related violence outcome, measured at a rate per 100,000 inhabitants per month m in territory i; I_i stands for fixed effects at the territory level; M_m stands for monthly effects; and ε_{im} is the error term. PACIFIED_{im}^t is a series of dummy variables indicating when a territory is t periods away from its pacification. Formally,

$$\text{PACIFIED}_{im}^t = I\left[m - e_i = t\right],$$

where I[.] is an indicator function for the expression in brackets being true, and e_i is the month a territory was pacified.

Thus the β_t coefficients represent the time path of the drug-trade-related violence outcome relative to the date of the pacification implementation for pacified territories conditional on I_i, M_m, and ε_{im}. If pacifications were randomly assigned, the following restriction should hold:

$$\beta_t = 0 \qquad \forall t < 0.$$

This condition states that pacification operations are not, on average, preceded by drug-trade-related violence. Police deployment is not a response to relative changes in violence rates in pacified territories.

ADA_{im}^{t} is a series of dummy variables indicating when a territory is t periods away from receiving an increased incentive for CV gang members to attack them, thereby displacing drug-trade-related violence. Formally,

$$\text{ADA}_{im}^{t} = I\left[m - e_i = t\right].$$

The term e_i indicates when a territory i receives displaced drug-trade-related violence. Any of the five ADA territories may receive displaced drug-trade-related violence after the first pacifications in CV territories, in November 2008.

The following condition should hold:

$$\gamma_i = 0 \qquad \forall t < 0.$$

If it does, it means that any displacement effect was not anticipated before pacification operations, a necessary condition for γ_t for all $t \geq 0$ to capture the effect of police presence and not a spurious correlation.

The inclusion of fixed effects at the territory level plays a crucial role in our methodology. To give a causal interpretation of the effect of police presence on drug-trade-related violence, the allocation of DTOs across the city must be random, conditional on I_i, M_m, and ε_{im}. The allocation of gangs across Rio de Janeiro is unlikely to be random. It is influenced, for instance, by the location of the territory: because drug trafficking is the main activity of DTOs in Rio de Janeiro, proximity to and the accessibility of wealthy or tourist neighborhoods are crucial for the gangs. It is also affected by factors such as the roughness of the territory, to the extent that the greater the geographic challenges faced by police forces or rival gangs moving in on the territory, the safer the territory is as a headquarters for the DTO. These factors are constant over the short period conisdered in the analysis. Thus the inclusion of fixed effects at the territory level breaks down the possible endogeneity of the allocation of DTOs in a drug-trade-related violence regression.

Data

The data on offenses and police activity are gathered by the police of Rio de Janeiro. The Public Security Institute (PSI), an office of the government of Rio de Janeiro, publishes the data on its website. To provide data at the pacified territory level, the PSI locates the place where the offense or police

TABLE 1. Descriptive Statistics

	Treatment 1: First 11 CV		*Treatment 2: ADA*		*Control: Last 21 CV*	
Type of incident	*Before FPP*	*During FPP*	*Before FPP*	*During FPP*	*Before FPP*	*During FPP*
A. Crime						
Homicide	2.695	1.458	0.809	1.445	2.122	1.735
Resistance	6.320	1.013	2.113	0.877	2.563	1.316
Negligent homicide	0.290	0.170	0.369	0.225	0.203	0.221
Negligent injury	6.866	9.865	3.338	2.898	4.685	5.082
Sexual assault	1.180	3.708	1.140	1.038	1.086	1.207
B. Police activity						
Caught in the act	13.737	29.503	2.627	2.564	3.911	4.518
Arrest warrants	3.130	5.192	0.371	0.384	1.136	1.251
Drug arrest	24.472	49.472	4.854	4.928	6.348	6.142
Gun arrest	20.934	7.311	7.472	4.854	8.448	5.407
Summary statistic						
No. observations	154	253	70	115	294	483
No. territories	11	11	5	5	21	21

Notes: Rates per 100,000 inhabitants. Comando Vermelho (CV) and Amigos dos Amigos (ADA) are two drug-trafficking organizations. FPP, Favela Pacification Program; PPU, Pacifying Police Unit.

activity occurred, and if the event occurred within a territory that had been pacified, the PSI assigns the offense to that territory. The data are monthly and have been recorded and updated regularly since January 2007.

Table 1 presents mean rates of criminal and police activity per 100,000 inhabitants for the two treatment groups (namely, the first eleven CV territories pacified and the five ADA territories) and for the control group (the last twenty-one territories pacified). The magnitude of the resistance case rates in some cases is even higher than the homicide rate. It must also be noticed that ADA territories present a lower homicide and resistance case rate than CV territories, which highlights the importance of controlling for fixed effects in our empirical strategy.

Results

Equation 1 is estimated for homicides and resistance cases.[11] For $t = 0$, the event times are grouped to capture the effect of the different pacifications. For instance, the first two pacifications were in November 2008, and the next pacification did not occur until May 2009. Thus, I considered $t = 0$–6 a single

11. In the estimates, standard errors are clustered at the territory level to control for serial correllation.

time event. For $t < 0$ the estimates are restricted to include coefficients up to six months before the start of the treatment.

For the homicide model, figure 1 plots the 95 percent confidence intervals of the coefficients. To obtain a better visual representation of the evolution of the effects over time, the impact of the program is shown separately for pacified territories and ADA territories. As the figure shows, for $t < 0$ the zero is always within the 95 percent confidence interval, and the point estimates are nearly always close to zero. This suggests that the allocation of police forces was not a response to changes in homicide trends. For $t = 0$, the point estimates indicate that the program caused a reduction in homicide rates in pacified territories, an effect that is more marked by the end of the period. In ADA territories, the opposite seems to be true, as the point estimates reflect a clear increase in homicide rates during the FPP.

Figure 2 plots the coefficients for the resistance case model. The estimates presented in the figure suggest that police allocation was not driven by a previous change in resistance case rates. The point estimates indicate a remarkable decrease in these cases in the pacified territories, which, as in the homicide model, is more marked by the end of the period. In ADA territories, the program does not seem to have had an effect on resistance cases. The results depicted in figures 1 and 2 together point to a decrease in violence in pacified territories and an increase in violence in ADA territories. These results suggest that the program has been effective in stopping violence in pacified favelas, but it has displaced violence to territories dominated by rivals of the criminals expelled from their territories.[12]

A shortcoming of the estimates presented in figures 1 and 2 is the weak statistical power. To address this concern, I computed estimates of equation 1 grouping all event times when $t = 0$. For $t < 0$, I maintain the same specification, but the estimates are restricted to include coefficients up to six months before the start of the treatment. The results, presented in table 2, provide a similar picture to figures 1 and 2. In pacified territories, homicides and resistance cases decreased significantly for the post-treatment period as a whole. In ADA territories, homicides increased significantly, but no effect was captured for resistance cases.

A natural question to ask is how these trends translate into lives saved or lost. Table 3 presents the effect of the FPP in both pacified and ADA territories

12. The reduction in violence in pacified territories is robust to the exclusion of ADA territories from the sample. Table A2 presents the results of estimating equation 1 considering only CV territories and grouping all event times at $t = 0$.

FIGURE 1. Effect on Homicides

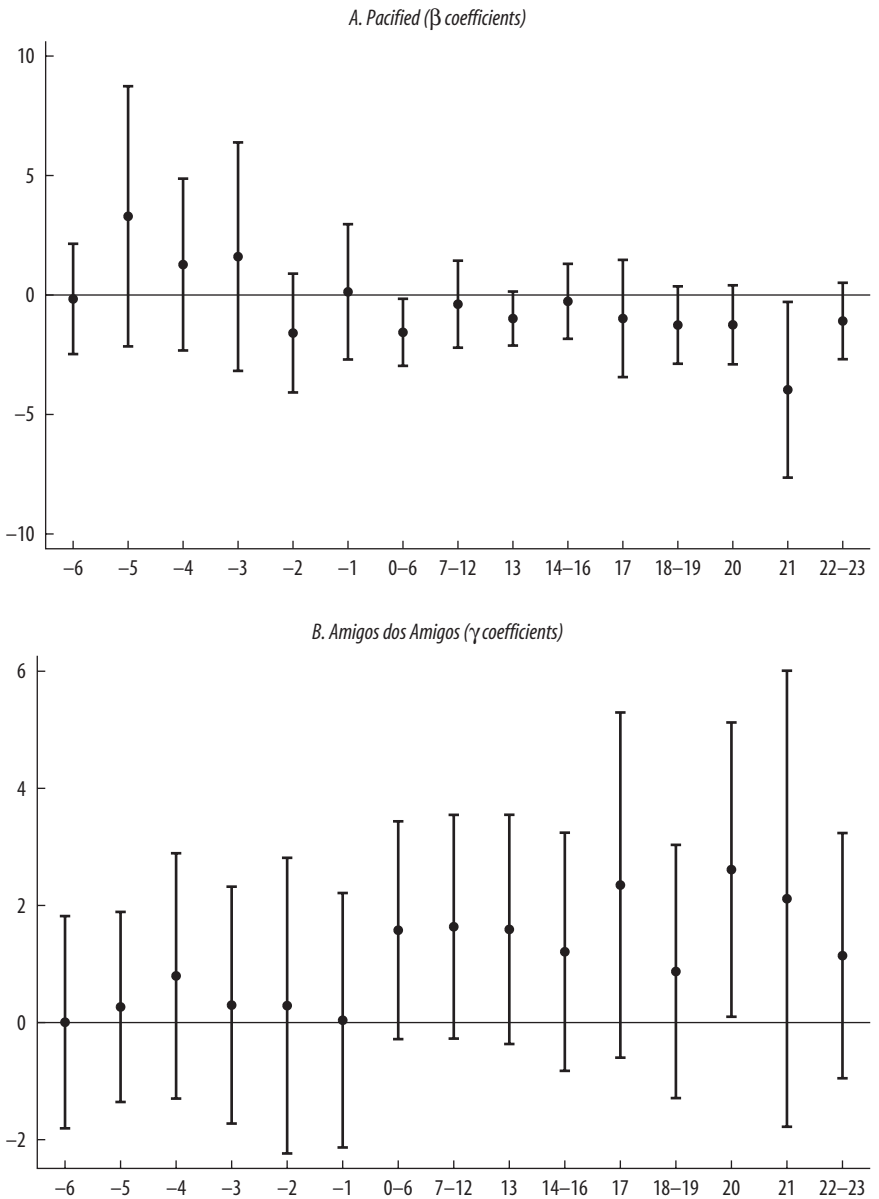


FIGURE 2. Effect on Resistance Cases

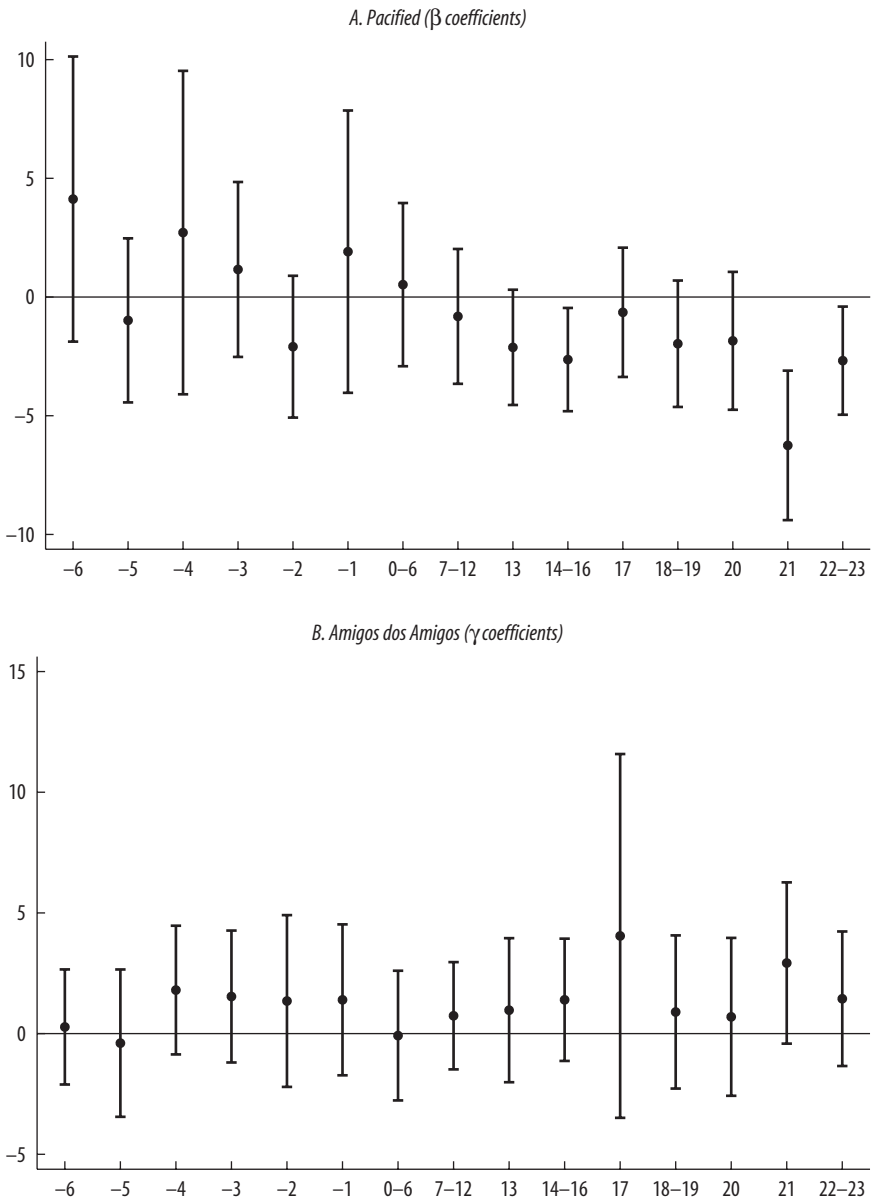


TABLE 2. Effect of the FPP on Drug-Trade-Related Violence

Explanatory variable	*Homicides*	*Resistance Cases*
Pacified [−6]	−1.366	2.791
	(1.240)	(3.350)
Pacified [−5]	2.055	−2.405
	(1.918)	(1.809)
Pacified [−4]	0.066	1.324
	(1.244)	(3.657)
Pacified [−3]	0.382	−0.273
	(1.512)	(2.153)
Pacified [−2]	−2.842	−3.002
	(1.984)	(2.004)
Pacified [−1]	−1.170	0.365
	(1.967)	(3.299)
Pacified	2.711*	−3.005*
	(1.517)	(1.520)
Amigos dos Amigos [−6]	−0.330	0.194
	(0.812)	(1.193)
Amigos dos Amigos [−5]	−0.073	−0.487
	(0.872)	(1.475)
Amigos dos Amigos [−4]	0.460	1.716
	(0.990)	(1.272)
Amigos dos Amigos [−3]	−0.040	1.443
	(1.007)	(1.315)
Amigos dos Amigos [−2]	−0.052	1.264
	(1.140)	(1.768)
Amigos dos Amigos [−1]	−0.307	1.293
	(0.945)	(1.512)
Amigos dos Amigos	0.814*	0.511
	(0.469)	(1.267)
No. observations	1,369	1,369

Notes: In the first model, the dependent variable is the monthly homicide rate per 100,000 inhabitants per territory. In the second model, the dependent variable is the monthly resistance case rate per 100,000 inhabitants per territory. Pacified [*x*] is dummy variable that takes a value of one for the *x* month of pacification of a pacified territory, and zero otherwise. Amigos dos Amigos [x] is dummy variable that takes a value of one for the *x* month since the launch of the FPP, and zero otherwise. Standard errors clustered at the territory level are in parentheses.

* Statistically significant at the 10 percent level.

in terms of human lives. As the table shows, thirty homicides and thirty-four resistance cases were avoided in pacified territories as a result of the FPP; that is, sixty-four lives were saved. In ADA territories, twenty-six homicides and four resistance cases were caused by the program; thirty lives were lost. Thus, on balance, thirty-four lives were saved by the program.

In light of the information presented in table 3, the FPP appears to have had a positive effect in terms of lives saved. Drug-trade-related violence decreased with the deployment of police forces in pacified territories. However, there was also a redistribution of violence: pacified territories enjoyed

TABLE 3. Effect of the FPP Expressed in Human Lives

Explanatory variable	*Homicides*	*Resistance cases*	*Total*
Pacified	−30	−34	−64
Amigos dos Amigos	+26	+4	+30
Total	−4	−30	−34

Note: The unit is human lives. A positive number indicates that homicides or resistance cases have increased; a negative number indicates that homicides or resistance cases have decreased.

a significant decrease, whereas territories controlled by the ADA suffered a surge in violence. Moreover, the reduction in violence in pacified territories could derive from possible contamination of the control group, while the increase in violence in ADA territories is robust to this potential problem.

Internal Validity of the Results

A main concern in the methodology employed to evaluate the causal effects of the FPP in this work is the extent to which the control group—the twenty-one CV territories pacified after September 2010—can be assumed to be unaffected by the treatment. Depending on how the control group was affected, the estimates would be biased downward or upward.

The possibility of an upward bias arises because as the FPP unfolded, the CV could have lain low to avoid drawing attention from the police. Thus the control group could have decreased its criminal activity during the post-treatment period, which would yield an upward bias in the estimates. However, this possiblity can be completely discarded. In the fourth week of November 2010, the CV conducted a series of attacks on civilians and police forces across Rio de Janeiro that caused what was called the November 2010 security crisis. During the week, 181 motor vehicles were incinerated, including cars, trucks, and public transport buses, and several police cars were shot by gang members. On November 20, the gang carried out a mass robbery on the streets, during which a bus driver was murdered. The attacks on civilians and police officers continued, and on November 25 the Brazilian Army and the Brazilian Marine Corps were sent to support local police, after the city asked the national government for help. On November 26, local police and military forces conducted a series of pacification operations in Complexo do Alemao and Vila Cruzeiro, after which the attacks stopped.

The attacks were supposedly motivated by the FPP itself; the CV was trying to make a statement by frightening the population and the government. The data sample used in this study goes through September 2010, just a few

TABLE 4. Falsification Tests and Police Activity

Explanatory variable	*Negligent homicides*	*Negligent injuries*
Pacified [*x*]	–0.134	–0.112
	(0.081)	(0.094)
Amigos dos Amigos [*x*]	0.024	0.034
	(0.028)	(0.030)

Note: The dependent variables are indicated in the column headings and are expressed in the monthly homicide rate per 100,000 inhabitants per territory. Pacified [*x*] is dummy variable that takes a value of one for the *x* month of pacification of a pacified territory, and zero otherwise. Amigos dos Amigos [x] is dummy variable that takes a value of one for the *x* month since the launch of the FPP, and zero otherwise. Standard errors clustered at the territory level are in parentheses.

months before the crisis. It is unlikely that the CV was lying low just two months before they conducted the attacks.

The possibility of a downward bias arises to the extent that the treatment may cause criminals expelled from pacified territories to move to unpacified CV territories, increasing violence in the control group during the post-treatment period. In that case, our estimates would be recovering a causal effect of the FPP on violence that is biased downward in both pacified and ADA territories. Thus the reduction of violence in pacified territories may simply be the counterpart of the increase in violence in the control group. Additionally, the increase in violence that the FPP produced in ADA territories could be even larger than found in the estimates. Whereas the reduction in violence that the FPP might have produced in some territories could reflect the contamination of the control group, the results indicating crime displacement to territories controlled by CV rivals are robust to this limitation of the research design.[13]

Robustness and Falsification Tests

To test for robustness, equation 1 was estimated for a series of models, which do not consider event times for $t < 0$ and only one for $t = 0$. Table 4 presents the estimates of equation 1 for two forms of crime that should not be affected by the FPP: negligent homicides and negligent injuries.[14] The falsification tests

13. There is an additional source of downward bias in our estimates of violence displacement to ADA territories. The sample used considered only territories that had been pacified. Territories that had not been pacified at any point, even if controlled by DTOs, or territories that were not under DTO control are not included in the sample. The reason to exclude these territoris is a data limitation: it is not possible to find credible sources indicating which favelas are and are not dominated by DTOs if they were not pacified at some point. Thus, as CV criminals may have displaced their criminal activities to territories that were never pacified, whether controlled by DTOs or not, the effect of FPP on violence displacement is underestimated.

14. Negligent homicides and negligent injuries can be the consequence of, for instance, a car accident.

TABLE 5. Police Activity

Explanatory variable	*In flagranti*	*Arrest warrants*	*Drug arrests*	*Gun arrests*
Pacified [*x*]	22.344***	3.169***	38.979***	−6.438
	(4.421)	(0.885)	(9.838)	(3.979)
Amigos dos Amigos [*x*]	−0.528	−0.116	−0.703	−1.018
	(0.836)	(0.333)	(1.286)	(1.378)

Note: The dependent variables are indicated in the column headings and are expressed in the monthly homicide rate per 100,000 inhabitants per territory. Pacified [*x*] is dummy variable that takes a value of one for the *x* month of pacification of a pacified territory, and zero otherwise. Amigos dos Amigos [x] is dummy variable that takes a value of one for the *x* month since the launch of the FPP, and zero otherwise. Standard errors clustered at the territory level are in parentheses.

***Statistically significant at the 1 percent level.

give the expected result: no statistically significant effect is found. Table 5 shows the results of estimates of equation 1 for four types of police activity. As intuition suggests, police activity increases in pacified territories. The only exception is gun arrests, which can be explained by the expulsion of criminals. No effect is found for ADA territories in any of the models. This suggests that police were not targeting the CV: police activity in ADA and CV territories does not show a change in relative trends during the post-treatment period.

Short-Term Effects

Figures 1 and 2 show a clear pattern with respect to the evolution of the effect of the FPP on homicides and resistance cases, respectively, as the program unfolded during its first twenty-three months. Homicides decreased in pacified territories and increased in ADA territories, while resistance cases decreased in pacified territories. This section takes a closer look at the evolution of the effect in the first months following pacification. Specifically, equation 1 is computed for $t \in [0, 5]$. The results are presented in table 6.

Statistically significant reductions in homicides in pacified territories are captured only in the second quarter of the pacifications. This is consistent with the potential problem that arises to the extent that displaced criminals increase violence in other CV-dominated territories. The results of the resistance case model for pacified territories shows a spike in violence in the first month of pacification, deriving from violent clashes with incumbent criminals who were ultimately expelled from the favela. Afterward, the effect of the FPP shows a decreasing trend, which again may reflect the contamination of the control group.

In ADA territories, the resistance case model reveals no effect, but there is a large positive effect on homicides during the first month after pacification. The potential contamination of the control group implies that the estimated impact on ADA territories represents a lower bound of the true effect.

TABLE 6. Short-Term Effects of the FPP on Drug-Trade Related Violence

Explanatory variable	*Homicides (1)*	*Resistance cases (2)*
Pacified [0]	−0.819	4.532*
	(2.245)	(2.521)
Pacified [1]	0.816	0.189
	(1.333)	(1.859)
Pacified [2]	−2.402	0.801
	(2.117)	(2.589)
Pacified [3]	−1.561***	−2.631*
	(0.569)	(1.395)
Pacified [4]	−0.390	−3.687***
	(2.902)	(1.126)
Pacified [5]	−1.008*	−3.961**
	(0.553)	(1.884)
Amigos dos Amigos [0]	7.856***	3.359
	(2.479)	(2.658)
Amigos dos Amigos [1]	−1.216	−1.351
	(1.042)	(1.931)
Amigos dos Amigos [2]	−0.598	−3.652
	(2.203)	(2.768)
Amigos dos Amigos [3]	0.222	−0.594
	(0.447)	(1.117)
Amigos dos Amigos [4]	−1.076	−1.025
	(3.067)	(0.784)
Amigos dos Amigos [5]	0.613	0.644
	(0.422)	(0.920)
No. observations	1,254	1,254

Notes: In the first model, the dependent variable is the monthly homicide rate per 100,000 inhabitants per territory. In the second model, the dependent variable is the monthly resistance case rate per 100,000 inhabitants per territory. Pacified [*x*] is dummy variable that takes a value of one for the *x* month of pacification of a pacified territory, and zero otherwise. Amigos dos Amigos [*x*] is dummy variable that takes a value of one for the *x* month since the launch of the FPP, and zero otherwise. Standard errors clustered at the territory level are in parentheses.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

General Effect

With any policy, it is important to evaluate whether it improves welfare. If there was no contamination of the control group, and the true effect of the FPP was that thirty-four lives were saved, was the measure cost-effective? The cost of the FPP comes essentially from the salaries paid to the police officers assigned to the PPUs. From November 2008 to September 2010, 2,086 police officers were employed by the FPP. In total, 21,959 wages were paid by the program, at a cost amounting to U.S. $15,678,726. Thus the breakeven point of a life saved is U.S. $461,139, which is a low value in terms of the statistical

value of a life. Therefore, if the program effectively caused a reduction in FPP territories, it did improve welfare. However, as discussed, while the displacement of crime is robust, the decrease in violence in pacified territories may be the result of contamination of the control group.

Conclusions

Drug-trafficking organizations and the violence they impose on citizens are a serious concern in many Latin American societies. To tackle these criminal syndicates, the usual response is to increase police forces. Following the announcement that Rio de Janeiro would host two major sports events, the government of Rio de Janeiro launched the FPP, which pacified thirty-seven territories dominated by DTOs. Magaloni, Franco, and Melo, who exploit the time and space variation in the implementation of the FPP, find that the program caused a decrease in violence through a reduction in resistance cases.[15]

In this work, the research design draws on the organized crime structure of criminal activity in Rio de Janeiro, in addition to the time and space variation in program implementation, and employs an event-study technique to control for the potential endogenous allocation of police forces to drug-trade-related violence rates. The study yields two main results. First, violence declined in pacified territories, which is likely the consequence of the contamination of the control group. Second, the FPP displaced drug-trade-related violence to unpacified territories. This displacement effect highlights a significant negative externality of the program and suggests that the security strategy employed had a relevant distributive component, in terms of violence. Dell and Calderón and others both find similar displacement effects in Mexico as a consequence of the war on DTOs launched in 2006 by former Mexican president Felipe Calderón.[16]

In terms of human lives, the program saved sixty-four lives in pacified territories between November 2008 and September 2010, including thirty homicides and thirty-four resistance cases. At the same time, it caused thirty additional deaths in ADA territories: twenty-six homicides and four resistance cases. Thus the FPP generated negative externalities and distributive effects.

15. Magaloni, Franco, and Melo (2015).
16. Dell (2015); Calderón and others (2015).

Appendix: Supplemental Tables and Figures

TABLE A1. The Favela Pacification Program

Territory	*Gang until the pacification date*	*Population*	*Police officers*	*Pacification date*
Cidade de Deus	CV	47,021	343	11 November 2008
Santa Marta	CV	3,913	123	20 November 2008
Babilonia	CV	3,740	107	15 May 2009
Pavao	CV	10,338	189	30 November 2009
Tabajaras	CV	4,243	185	26 December 2009
Providencia	CV	4,889	209	22 March 2010
Borel	CV	12,815	287	28 April 2010
Formiga	CV	4,312	111	28 April 2010
Andarai	CV	9,704	219	11 June 2010
Salgueiro	CV	3,345	140	30 July 2010
Turano	CV	12,218	173	10 August 2010
Macacos	ADA	19,082	221	14 October 2010
Adeus	CV	4,354	245	28 November 2010
Alemao	CV	15,094	320	28 November 2010
Chatuba	CV	10,205	230	28 November 2010
Fazendinha	TCP	12,399	314	28 November 2010
Fé e Sereno	CV	3,574	170	28 November 2010
Nova Brasília	CV	28,661	340	28 November 2010
Parque Proletário	CV	18,661	220	28 November 2010
Vila Cruzeiro	CV	17,170	300	28 November 2010
São João	CV	7,038	208	1 June 2011
Coroa	CV	9,013	193	2 June 2011
Escondidinho	CV	5,586	182	2 June 2011
São Carlos	ADA	15,244	224	2 June 2011
Mangueira	CV	17,946	332	19 June 2011
Rocinha	ADA	71,085	310	12 November 2011
Vidigal	ADA	10,372	246	12 November 2011
Jacarezinho	CV	36,000	543	13 October 2012
Manguinhos	CV	35,000	588	13 October 2012
Arara	CV	9,315	273	17 January 2013
Barreira	CV	10,404	150	3 March 2013
Caju	ADA	16,000	350	3 March 2013
Cerro-Cora	CV	4,500	232	29 April 2013
Mangueirinha	CV	21,415	220	2 August 2013
Camarista Meier	CV	16,300	230	6 October 2013
Lins	CV	8,850	250	6 October 2013
Vila Kennedy	CV	41,500	250	13 March 2014

Note: Pacification operations are widely reported by the Brazilian media; gangs controlling the territory were identified from numerous media reports. Data on population, police officers, and pacification dates were obtained from the PSI website (www.isp.gov.br).

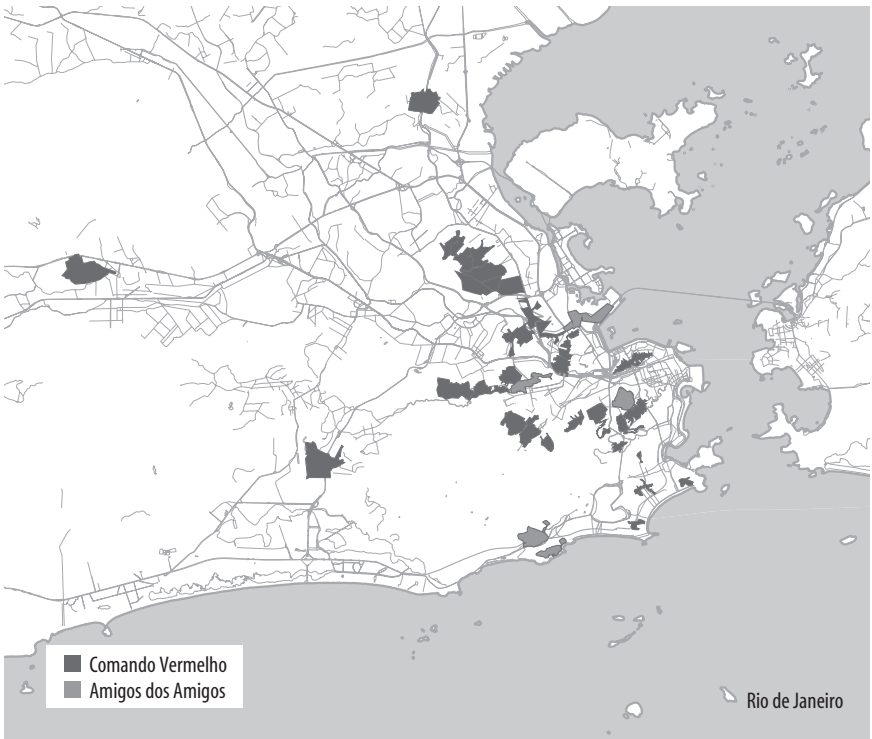
TABLE A2. The Effect of the FPP on CV territories

Explanatory variable	*Homicides*	*Resistance cases*
Pacified [−6]	−1.398	2.775
	(1.208)	(3.327)
Pacified [−5]	2.063	−2.240
	(1.906)	(1.766)
Pacified [−4]	0.078	1.406
	(1.251)	(3.630)
Pacified [−3]	0.296	−0.111
	(1.567)	(2.207)
Pacified [−2]	−2.854	−3.013
	(1.982)	(2.027)
Pacified [−1]	−1.192	0.522
	(1.960)	(3.344)
Pacified	−2.768*	−2.898*
	(1.492)	(1.526)
No. observations	1,184	1,184

Note: In the first model, the dependent variable is the monthly homicide rate per 100,000 inhabitants per territory. In the second model, the dependent variable is the monthly resistance case rate per 100,000 inhabitants per territory. Pacified [*x*] is dummy variable that takes a value of one for the *x* month of pacification of a pacified territory, and zero otherwise. The sample includes only CV territories. Standard errors clustered at the territory level are in parentheses.

* Statistically significant at the 10 percent level.

FIGURE A1. Pacified Territories in Rio de Janeiro



Comando Vermelho and Amigos dos Amigos are two drug-trafficking organizations.

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