Why Limiting Police Raids Decreased Criminal Violence in Rio de Janeiro

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Abstract

Violent law enforcement deployments in Latin America are a common technique to fight organized crime. Officials only rarely intervene to institute limitations on police use of force. Amidst the Covid-19 lockdowns, however, the Supreme Court of Brazil issued an unusual order curtailing the use of police operations in Rio de Janeiro. What impact does a restriction on aggressive policing tactics have on violence, including violence just between citizens? I estimate the causal impact of the police operation ban on violence using a regression discontinuity design. I find that police killings decrease after the federal order by 66%, accompanied by decreases in police shootings and injuries resulting from shootings. A secondary effect of the ban on police operations is a 19% decrease in civilian homicides. These decreases in violence are not accompanied by a substitution effect with increases in non-violent crimes. I suggest that a state-driven de-escalation of tension between the police and criminal groups could decrease short-term violence by slowing the rate of criminal warfare.

Keywords: Police, Police violence, Organized Crime, Police Reform, Violence, Brazil

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1 Introduction

> I think the Military Police of Brazil had to kill and more... You fight violence with violence.[1]
>
> – Jair Bolsonaro, President of Brazil, May 2015 (Araújo 2015)

In order to fight violent crime, President Jair Bolsonaro of Brazil has employed tough-on-crime rhetoric and championed aggressive policing tactics throughout his political career. This strategy of fighting violence with violence long predates Bolsonaro's government and is not unique to Brazil. Across the Americas, governments often choose to respond to violent criminal groups with force, from everyday zero-tolerance policies (Dammert and Malone 2006; Holland 2013) to large-scale crackdowns, often involving the military (Calderon et al. 2015; Dell 2015; A. Duran-Martinez 2015; Flores-Macías and Zarkin 2017; Lessing 2017; Snyder and Angelica Duran-Martinez 2009). Less often do governments enact policies that *limit* police use of force when trying to reduce violence. Violent police tactics have enjoyed broad support in the Americas.

This paper asks the question, "What impact does a restriction on aggressive policing tactics have on violence, including violence just between citizens?" I study the effects of a temporary ban on aggressive police operations in Rio de Janeiro on violence, both police-involved and otherwise. This ban occurred in the midst of Covid-19 lockdowns. I build on recent work on the effects of institutional constraints on the police (González 2020; D. Hausman and Kronick 2020; Magaloni and Rodriguez 2020; North, Wallis, and Weingast 2009), as well as work on the violent consequences of aggressive policing tactics (Calderon et al. 2015; Flores-Macías and Zarkin 2017; Flores-Macías 2018; Lessing 2017; Magaloni, Franco-Vivanco, and V. Melo 2020; Osorio 2015).

This paper first shows that restricting the ability of the police to conduct aggressive operations is accompanied by sweeping declines in police use of lethal force. Through banning a specific type of police raid, police killings and deaths and injuries resulting from police shootings saw daily reductions of 66-100%, even though police were still using their firearms and were still present on the streets. I then show that there is a 19% decrease in the number of homicides between civilians after the implementation of the police operation ban and no noticeable change in nonviolent crime levels. These decreases in violence were not accompanied by a substitution effect towards other types of crime, as classic theories on the

[1] Original quote: "Eu acho que essa Polícia Militar do Brasil tinha que matar é mais... Violência se combate com violência.

economics of crime would predict (Becker 1968; Chalfin and McCrary 2013; Di Tella and Schargrodsky 2004; Steven D. Levitt 1997; Steven D Levitt 2002; Machin and Marie 2011). In line with the above literature that violent policing leads to increases in violence, I show that the inverse may also be true: that a temporary embargo on the most lethal of police actions led to lower levels of violence. This finding contradicts a vein of literature from the economics of crime that argues that more policing leads to lower incidents of violent crime, as well as rhetoric championed by tough-on-crime politicians like Bolsonaro.

I suggest that this drop in police violence and criminal violence following the police operation ban took place because police operations accelerate the rate of territorial conquest amongst criminal groups. The secrecy surrounding the operations means that criminal groups are always fully armed and on guard. Building on arguments about contagion effects of police crackdowns and territorial control (Calderon et al. 2015; Dell 2015; Osorio 2015) and the conditionality of repression (Lessing 2017), I argue that the absence of police operations slows the frequency of territorial battles and makes violence between criminal groups more targeted and lower risk. I provide evidence of this by showing that areas where a police operation is most likely to occur experience the largest decreases in violence after the police operation ban.

I use an interrupted time series analysis to estimate the causal effect of the ban on police operations on violence, leveraging high frequency daily data from two distinct sources that report on crime and violence. By a conservative estimate, my findings show that police killings decreased by 66% percent in the first 30 days, and were accompanied by a drop in police presence at shootings, deaths from shootings, and injuries from shootings. I use the same models to estimate changes in violence, finding that homicides decreased in the post-ban period by at least 19% while other types of crime did not change. A range of robustness checks indicate that the decreases in violence do not appear to be due to potential confounders or model dependency.

The next section introduces existing explanations for how aggressive policing is related to violence. Section 3 explains both the context of violence in Rio de Janeiro and the public security policy context during the ban on police operations. Section 4 presents the data and Section 5 the empirical strategy. I present and discuss results in Section 6, as well as the possible mechanism. The conclusion suggests the limits of top-down policies restraining the police and advances possible reasons why tough-on-crime policies remain popular despite their limited success.

2 A More Nuanced Path to Reducing Violence

Decades of research in the social sciences supports a theory that there is an inverse relationship between policing and violence, suggesting that a greater police presence serves as an effective deterrent against crime or increases the risk of apprehension. The canonical literature beginning with Becker (1968) argues that increases in law enforcement (either apprehension or punishment) can make a crime less attractive to a potential offender. Quasi-expermental work, such as in Di Tella and Schargrodsky (2004) and Machin and Marie (2011), find large decreases in property crime following an exogenous increase in police presence. Steven D Levitt (2002) finds that exogenous increases in the Chicago police force led to decreases in violent crime, especially homicides, and Chalfin and McCrary (2013) find that increases in police presence, across several contexts and model specifications, are more likely to lead to reductions in violent crime rates than property crime rates. A meta-analysis on hot spot policing also finds that problem-oriented policing in high-crime areas leads to lower levels of violent crime and does not displace crime to nearby areas (Braga, Papachristos, and Hureau 2014; Rosenbaum 2006).

That increases in policing decreases violence is plausible if the police operate in a society where violence is organized and monopolized by the state (Weber 1965). Police, as "specialists in violence" (Bates, Greif, and Singh 2002), should be strong enough to monopolize the use of force but weak enough to abide by their institutional constraints (D. Hausman and Kronick 2020) and "political control of a specialized military and police force involves formal institutions and agreements about how and when violence can legitimately be used" (North, Wallis, and Weingast 2009, p. 121). But when a specialist in violence uses their coercive power to disrupt order rather than maintain it, violence could increase. Flores-Macías and Zarkin (2017) link greater law enforcement disruptive capacity to higher levels of police militarization, due to their possession of heavy weaponry, combat training, and tactical organization. They show that violence has increased in six of nine Latin American countries that have militarized their police forces to the greatest extents, what they call "constabularized." Police crackdowns in Mexico clearly show how the disruptive effect of law enforcement intensified violence (Osorio 2015; Tiscornia 2019), decreased the state's ability to provide order and extract fiscal resources (Flores-Macías 2018), and politicized drug-based assassinations (Dell 2015). When studies do show the police are an effective deterrent on violent crime, they generally do not extend their argument to organized crime. A survey of formal models on the possible deterrent effects of police on organized crime by Cameron (1988) shows that police enforcement efforts may actually be beneficial to (some) criminal groups

and increased enforcement could be "rendered endogenous through bribery" (305). Thus, while there is substantial evidence that increased policing reduces the incidence of violent crime, this line of research faces limitations when generalized to contexts where police are poorly constrained by the state and where violent crime is committed by organized actors.

Scholarship on the study of organized criminal groups offers an alternative approach to explain why increased police action may increase violence. Calderon et al. (2015) argue that aggressive policing could lead to greater levels of violence in the context of cartel-state conflict by creating succession struggles when a leader is caught, creating inter-cartel fighting, breaking the chain of command between top cartel leaders and local cells, or incentivizing the cartel to fight the state. They illustrate these possible pathways using anti-cartel crackdowns under the Calderón presidency in Mexico. Two other studies also focus on Mexico, and argue that state crackdowns can cause violence to spread. Dell (2015) maps trafficking routes in Mexico and shows that, as criminal groups try to escape municipalities more likely to crack down on crime, they increase violence by invading territories occupied by their rivals and engage in inter-cartel fighting. This is what Osorio (2015) calls *centrifugal contagion*, where criminal groups divert their criminal activity in an attempt to escape law enforcement. Osorio (ibid.) then introduces a different theory for how violence spreads in Mexico premised on *centripetal contagion*, where criminal groups are weakened by law enforcement crackdowns and become appealing targets, drawing their rivals in from afar with the prospect of territorial conquest.

Taking a microfoundational approach to the behavior of criminal groups responding to state crackdowns, Lessing (2017) develops a "logic of violence in cartel-state conflict," arguing that organized criminal groups may be incentivized to escalate violent conflict when the state tries to repress them. Using the case of Rio de Janeiro in the 1990s as a canonical example of how unconditional state repression incentivizes organized criminal group violence, Lessing (ibid.) states that when an elite arm of the Rio de Janeiro military police force "stopped allowing traffickers to surrender... this gave traffickers every incentive to literally fight to the death" (11). Magaloni, Franco-Vivanco, and V. Melo (2020) look at the same case in the 2010s during the large-scale Police Pacifying Unit (UPP) reform, and find that the level of violence following a state crackdown depends on the type of criminal governance regime in the occupied territory. Different type of criminal regimes have different sources of income, relations with the community, and connections to the state, and they argue that "these criminal regimes shape the outcome of police interventions" (ibid., p. 552).

Despite the growing evidence that increased police use of force can lead to higher levels of

violence, it is unclear if the causal relationship goes in the other direction and if decreasing police use of force affects violence. Recent work by Magaloni and Rodriguez (2020) shows that greater police oversight by the judiciary lowers police violence and brutality (police torture, brute force, and threats) with no subsequent change in violent crime levels. Their theory speaks to the power of institutional constraints on law enforcement: they show that the Mexican government increased use of torture during the anti-cartel crackdowns, and only stopped when a judicial reform was implemented. Lessing (2017) explains how Colombia's *Sometimiento* policy to fight drug trafficking-related violence included plea bargains to criminal groups in order to lower violence, and notably did not mobilize and militarize the police like unsuccessful reform cases in Calderón's Mexico or Rio de Janeiro in the 1990s. These successful examples are what Kleiman (2009) would call a "consequence-focused approach" to controlling violent crime that focuses on mitigating the negative effects rather than "brute force strategies."

González (2020) argues that limiting the coercive power of the police–even in democracies–requires the convergence of major societal preferences and political incentives *in the presence* of a high-profile act of police deviance that becomes a scandal. These opportunities for police reform happen infrequently and explain why authoritarian, coercive institutions persist, even in democratic countries. González (ibid.) underlines the difficulty in predicting which cases of police deviance rise to the level of a scandal, arguing that "the process by which a deviant event (1) occurs, (2) becomes known, (3) receives media coverage, and (4) generates a strong negative reaction from a broad swath of society is plausibly exogenous" (49). The absence of a scandal, she argues, means this major convergence of societal preferences and political incentives needed to enact reform is unlikely. She underscores how politically difficult it is to pass laws that limit the police's power.

Moreover, hard-on-crime policing tactics can be politically popular, at times helping politicians win elections (Holland 2013). Despite mounting evidence that violent policing begets more violence, politicians may be tempted to support these policies if it gets them more votes. Understanding the unlikely conditions under which governments actually do limit police use of force are all the more relevant in the context of contemporary policy conversations about what appropriate police use of force, oversight, and funding levels should be. In Latin America, there is mounting evidence that tough-on-crime strategies to fight the war on drugs failed and carried the high price tag of thousands of lost lives (Drugs and Democracy 2009). Recent work examining the unintended consequences of violent policing tactics has also been critical of these policies, showing how cartel-state conflict and state-

driven crime crackdowns can have adverse effects on education, economic development, and labor market participation (Monteiro and Rocha 2016; Jarillo et al. 2016; Sviatschi 2020) Interventions like the one described below are an ideal opportunity to assess the short-term effects of limiting police use of force on violence.

3 Context

3.1 Violence in Rio de Janeiro

Violent interactions in the state of Rio de Janeiro are usually between rival criminal groups or between criminal groups and the police. Conflict between rival criminal groups is primarily about territory (Arias and Barnes 2017; Zaluar and Conceição 2007; Zaluar 2006). Rio de Janeiro has been in a decades-long, equilibrium-less turf war between warring criminal organizations to either run their illicit drug business, to extort citizens in the territories they dominate, or sometimes to do both. All of the groups fighting over territory are heavily armed and control pockets of land across the state (Arias 2006). Violence is mainly contained inside or bordering the areas that these groups dominate, which represents a significant proportion of land and of the population: a recent report showed that the extortion-based militias dominate 57% of the geographic territory in the city of Rio de Janeiro, which includes approximately a quarter of all of the city's residents (Satriano 2020). The *favelas* (informal settlements) that criminal groups dominate are some of the most densely populated areas in the entire country.

Conflict between criminal groups and the police comes in two distinct forms. The first, known as ordinary policing, constitutes routine patrolling or response to an incident by police officers (Imprensa 2020). They may be called to break up an incident, make an arrest, or quell violence between civilians that is already ongoing. Ordinary policing may result in violence, but is far less violent than the second form of criminal-police conflict: police operations. Police operations are raids planned in advance that can involve the use of heavy weapons, armored vehicles, and elite or militarily-trained police, and are conducted primarily in areas where illicit drug trafficking occurs. Small police operations may involve 1-2 vehicles and a targeted arrest of an individual, while large operations may involve several vehicles, including armored personal carriers (vehicles used in wartime settings), and dozens of officers and heavy weaponry. They are far more deadly than ordinary policing activities, not only for the criminal actors that are the targets of the operations, but also for civilians that are caught in the crossfire between the two parties (International 2015; Imprensa 2020). They

typically occur in the densely populated favelas where drug trafficking gangs run their illicit businesses but are home to thousands and up to hundreds of thousands of the urban poor. The operations routinely interrupt public services in favelas, invade bystanders' homes in the search for criminal actors, and involve weapons meant for war in dangerously close proximity to the innocent.

The Governor of Rio de Janeiro, Wilson Witzel, was elected at the same time as President Bolsonaro in 2018 and has similar tough-on-crime views. This is relevant because the state government is in charge of setting public security policy, which includes the work of both the Rio de Janeiro State military police and civil police. The military police's daily duties include all ordinary policing, but they are often also involved in police operations when one is occurring in or near their police station. There is an elite division of the Military Police, the Special Operations Battalion[2] (BOPE), which is militarily-trained and is exclusively deployed for higher-violence operations and raids. The civil police, on the other hand, do not engage in ordinary policing; they are in charge of investigations. The civil police's elite division,the Coordination of Special Assets[3] (CORE), are also involved in police operations when they are the result of a criminal investigation, and the two agencies cooperate to a certain extent in order to share intelligence.

Since the beginning of Witzel's and Bolsonaro's mandate, police operations have increased, reflecting their tough-on-crime rhetoric. Between ordinary policing and police operations, police in Rio de Janeiro killed 1,814 people in 2019, an average of five people per day and the highest number since official records began in 1998 (B. News 2020; Andreoni, Londoño, and Galdieri 2020). Shootings involving police in 2019 were approximately four times more likely to result in death than shootings just involving civilians, according to data from Fogo Cruzado, whose open source data on gun-related violence is described in more detail in Section 4. Figure 1 shows the prevalence and lethality of shootings in 2019, measured by Fogo Cruzado. The top panels show total shootings, subset by whether or not the incident involved a police officer. The bottom show the same for civilian deaths from shootings. Panels 1a and 1c show that 10.5% of the shootings just between civilians resulted in the death of a civilian. While there were more than double the amount of shootings in the metropolitan area involving just civilians than those involving the police, they were far less lethal. This stands in stark contrast with the 40.4% of shootings involving police that resulted in the death of a civilian, shown in panels 1b and 1d. Of the 908 civilians killed

[2]BOPE stands for *Batalhão de Operações Policiais Especiais*.
[3]CORE stands for *Coordenadoria de Recursos Especiais*.

in police officer-related shootings, shown in panel 1d, 387 (42.6%) were killed during police operations (Segurança Pública 2020).

3.2 Public Security in Rio de Janeiro and Covid-19

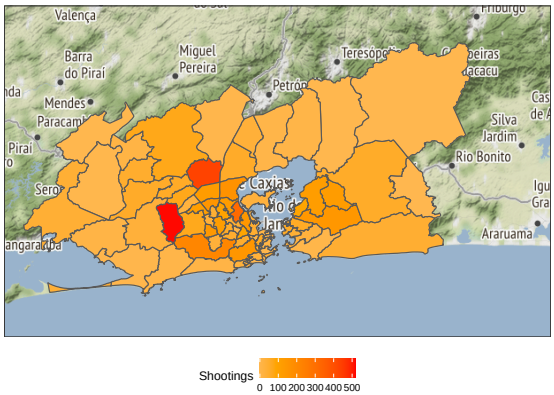
The arrival of Covid-19 imposed immediate constraints on the police. During the beginning of the pandemic, police were asked to do new, different tasks. In addition to their patrolling duties, police were asked to limit entry to public spaces that could lead to overcrowding like parks and the beach, conduct traffic stops, and monitor occupancy at testing centers (ISTÓE 2020). Not only were these new duties unfamiliar, but this was especially onerous on a police force that was incredibly pressed for staff: around 8% - 10% of the police force contracted Covid-19 early in March and each precinct was operating with limited human resources. The addition of pandemic-related policing duties has been noted in other countries as well(Matthew P J Ashby 2020a; Jennings and Perez 2020).

Despite their reduced capacity, the police continued to conduct large-scale operations. The police operations, controversial even in the absence of stay-at-home restrictions, became even more dangerous for favela residents as more people stayed at home to quarantine, due to pandemic-related business closures, or recent unemployment. This came to a head in mid-May, as shown in the timeline below in Figure 2. On May 15 between 5:30 and 6:00 in the morning, residents of Complexo de Alemão, one of Rio's largest favelas, awoke to the sound of an armored personal carrier entering the neighborhood, carrying members of the BOPE special police forces who were firing "gunshots and grenades" (RioOnWatch 2020b). By the time the operation concluded, neighborhood leaders counted 13 civilian deaths, at least 80 empty shell casings strewn on the streets, and countless broken windows and damaged property that would be up to each resident to try and repair.

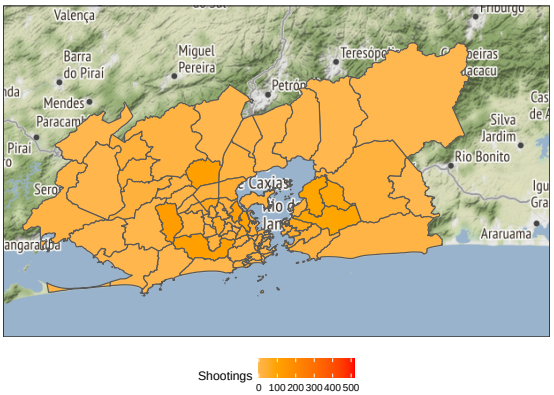
Just three days later during a police operation intended to target drug traffickers in the Complexo de Salgueiro favela, police shot and killed João Pedro, a 14-year-old boy (Phillips 2020). Police erroneously stormed João Pedro's house in search of drug traffickers, saw him playing with friends, and began shooting at the teens. It appears that the police quickly realized their error and took the body with them for more than 48 hours, neglecting to inform his family and violating protocols about tampering with forensic evidence.

The João Pedro incident was not the first police operation to result in civilian casualties during the coronavirus lockdowns. However, it was the first to become known, receive media coverage, and immediately generate a strong negative reaction from the public, just as González (2020) explains how police malfeasance scandals that gain traction do. Public

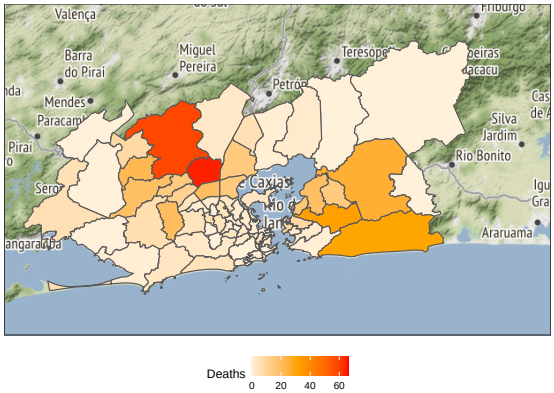
Figure 1: Total Shootings and Deaths Resulting from Shootings Registered in the Rio de Janeiro Metropolitan Area in 2019, by Police Presence



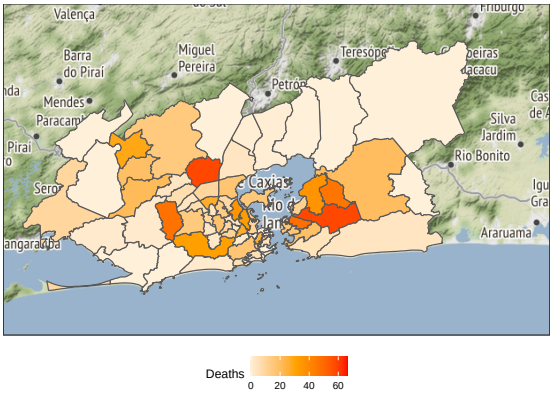
(a) Shootings not involving a police officer (n = 5121)



(b) Shootings involving a police officer (n = 2247)



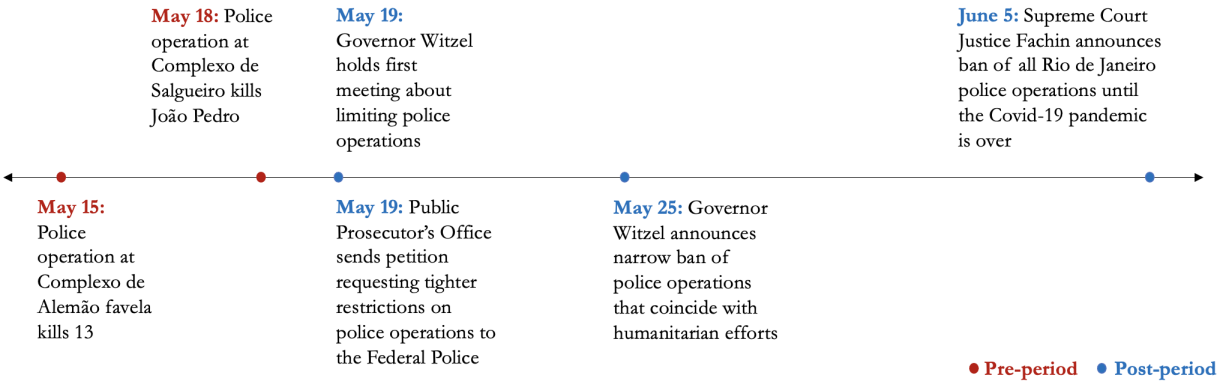
(c) Deaths resulting from shootings not involving a police officer (n = 540)



(d) Deaths resulting from shootings involving a police officer (n = 908)

Source: Fogo Cruzado database. All shootings and deaths are geocoded to the police precinct (*delegacia*) level for the 2019 year.

Figure 2: Timeline of Key Events Related to the Ban on Police Operations

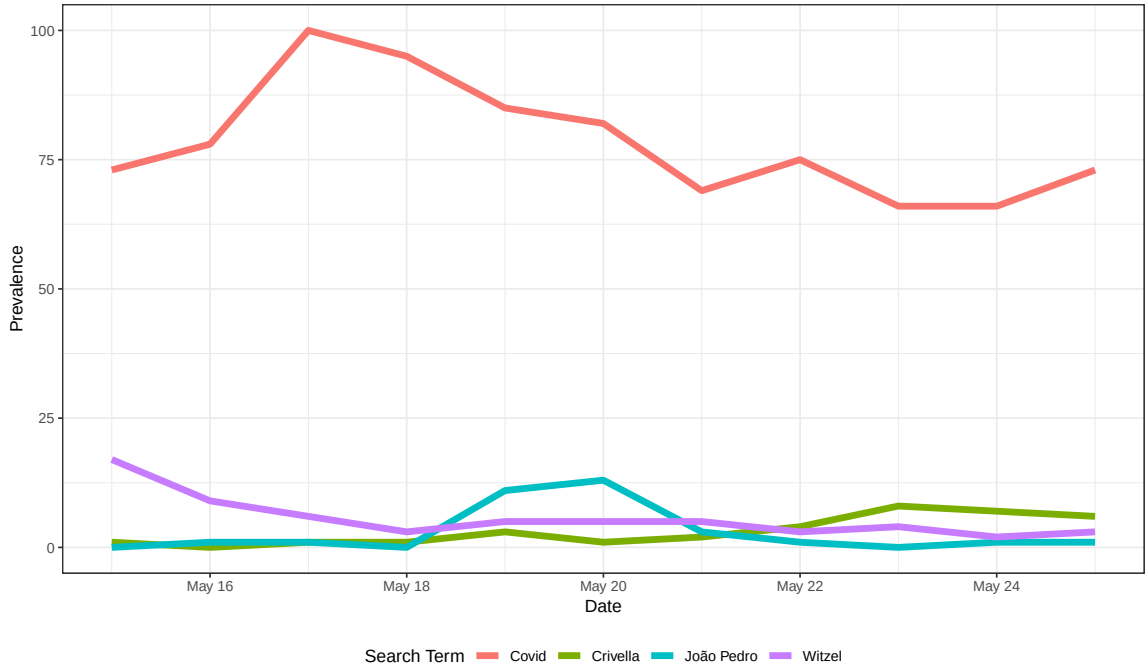


calls for action were flooding social media and official news outlets. Google trends data shows that João Pedro was more googled during the two-day period after his death than either the Governor or Mayor of Rio de Janeiro by factors of three and thirteen, as shown in Figure 3. Rio de Janeiro residents google searched for João Pedro at approximately one sixth the rate they google searched for "covid," at a time when hospital beds were filling up and the virus was spreading quickly throughout the state.

Political leaders immediately began to respond to the scandal. The day after Jõao Pedro's assassination, May 19, Rio de Janeiro Governor Wilson Witzel participated in the first of several meetings with favela community leaders, members of Amnesty International, pro-police reform state legislators, and military and civil police leaders about the role of police in favelas. At the same time, the Rio de Janeiro Public Prosecutor's Office sent a petition to the Federal Police requesting that police conduct operations only in the case of "extreme urgency" (Alves 2020), and a Supreme Court justice expedited review of a petition filed in 2019 requesting the suspension police operations. On May 25, Governor Witzel announced that police operations would not be held while community organizations were doing humanitarian work or distributing Covid-19 related aid, but would not be suspended entirely. One week later, a Supreme Court Justice issued an injunction banning all police operations in the state of Rio de Janeiro for the remainder of the Covid-19 epidemic[4]. The injunction argued that police operations in the times of Covid-19 were counterproductive to the more important public health and humanitarian goals in favelas, and made specific reference to the João Pedro case. It laid out a protocol where police precincts that still wanted to conduct

[4]Full text of the injunction is available in Portuguese here:
http://www.stf.jus.br/arquivo/cms/noticiaNoticiaStf/anexo/ADPF635DECISaO5DEJUNHODE20202.pdf

Figure 3: Google Search Trends During the João Pedro Scandal



These trend lines represent the relative daily prevalence, scaled to be between a minimum of zero and maximum of 100, of Google searches in the State of Rio de Janeiro for the time period May 15, 2020 - May 25, 2020. The trend for Covid is shown as a benchmark to indicate highly searched terms during this time, and Witzel (Governor of Rio de Janeiro) and Crivella (Mayor of Rio de Janeiro city) are shown as benchmarks of other important political figures.

a police operation had to justify why it was important to do so and required a plan for how the operation would not reach bystanders. Precincts then had to get their plan approved by the Public Prosecutor's Office in order to conduct the operation.

There are three important outcomes to note from this series of meetings and the Supreme Court injunction. First, the rate of daily police operations slowed immediately following the João Pedro incident until the injunction, when it approached zero. Though police leaders continued to emphasize the importance of continuing operations during the negotiation period in public interviews (Alves 2020) and pro-police Governor Witzel never commented on whether he asked them to temporarily halt operations, the level of operations per day was less than half of the daily rate the week prior to João Pedro's assassination. Second, the ban on police operations does not place limits on any type of police activity related to ordinary patrolling. In other words, police officers would still be free to use lethal violence against a suspect while ordinary policing, but the opportunities to shoot to kill may be less frequent than in police operations. For this reason, this paper conceptualizes the ban on police operations as a "limit on the use of lethal force" rather than a retreat or absence of state forces. In the post-ban period, the police were absolutely present and patrolling, just not participating in their most lethal form of activity. Third, that the ban was enacted at all is historic. This is one of a few federal interventions in the history of public security policy in Brazil aimed to limit policing power and resources rather than increase their power. There are far more occasions where the federal government has used their own resources, either financial or military, to help the state police of Rio de Janeiro fight violence with violence rather than restraint (Barnes 2019; Harig 2020).

4 Data

This project uses two primary data sources to measure the impact of the police operation ban on violence. I look at various measures of violence, both those involving the police and not involving the police, across both sources. The first database contains official police reports, obtained from the Public Safety Institute (ISP). ISP reports daily statistics for all crimes they measure at the police precinct level, including police killings. I first look at their daily measure of police killings to analyze violence directly involving the police, and then consider how the police operation ban affected other types of violent and non-violent crimes, looking at daily precinct-level totals for homicides, robberies, theft, and extortion.

The second source of information on violence is the Fogo Cruzado[5] database, containing 4,494 records of shootings in the Rio de Janeiro metropolitan area just in 2020. Fogo Cruzado is a civic tech and data collection nonprofit that primarily serves two populations. For residents of favelas concerned about safety, Fogo Cruzado is primarily accessed through a cell phone app where citizens can opt in to notifications if a shooting is happening close to them or can report a shooting if they hear one. For researchers, journalists, or those interested in in taking a closer look at the data, Fogo Cruzado publishes the geolocation of all verified shootings and relevant covariates, accessible through their public API (*Perguntas Frequentes* 2019). Shootings submitted to Fogo Cruzado are not published immediately; the data team first corroborates them with verified sources (press, community leaders, and their partners within law enforcement agencies) before publishing. Each entry in the Fogo Cruzado database represents one shooting event in a specific location, even if multiple shots were fired. Additional covariates (number of victims, presence of a police officer, if it was a police operation, etc.) are added to the shooting event once verified by their official sources. The verification process, in tandem with an algorithm to catch duplicate entries from being published help to assuage concerns about reporting bias and the quality of the data. Since the Fogo Cruzado data is geolocated, I calculate the daily number of shootings per police precinct so that it is comparable to the ISP data.

These two sources are complements. The ISP official data has limitations in that it only registers events recorded as crimes. This means that any violent police operation that does not result in a civilian death, even if it results in injury, would not appear in the ISP data. By only measuring violent events that are charged as official crimes, it likely underestimates the prevalence of violence involving police. The Fogo Cruzado data is a useful complement since it measures all shooting events across the metropolitan area. The database includes shootings resulting in an official crime that also appear in the ISP data, such as homicide, police killing, or serious injury, as well as those not resulting in an official crime but that are highly disruptive, such as police operations or shootouts among criminal groups that the police do not respond to. The covariates linked to each shooting allow us to identify which shootings were more lethal, which ones involved police, and of those, which were a result of a police operation versus ordinary policing. Taken together, they paint a clear picture of violence across the Rio de Janeiro metropolitan area.

[5] In English, "Cross Fire."

5 Empirical Strategy

I use an interrupted time series analysis to estimate the causal effect of the Rio de Janeiro police operation ban on police killings and shooting-related violence. This takes the form of a regression discontinuity design where time is the running variable (C. Hausman and Rapson 2018). This design has yielded estimates close to experimental benchmarks (St.Clair, Cook, and Hallberg 2014) and is increasingly used in high-frequency studies on crime and policing (Carr and Packham 2020; Jassal 2020; Lovett and Xue 2018; Mummolo 2017) The high frequency of measurement allows me to isolate the specific day on which the government began limiting police use of force, bolstering the assumption that possible omitted variables related to crime are not also changing discontinuously on that very day. The statewide control of police forces also reduces discretion between treated and control units since the Governor's and Supreme Court's ruling applied to all police precincts at the same time, eliminating the possibility of spatial spillovers if the policy's rollout had been staggered across geographic units.

I use 2020 daily data on reported shootings and crimes at the police precinct level in the greater Rio de Janeiro metropolitan area, from Fogo Cruzado and ISP, respectively. I look at the change in police killings and shooting-related violence on and after May 19, 2020, the day after João Pedro's assassination when there were signs of mass convergence of preferences and when the Governor began issuing statements about increased restrictions on the police force (González 2020). Though the police operation ban was symbolic at this point and didn't enter into force until June 5, the language that state and federal officials used about the possibility of a ban implied little tolerance for the same level of police operations. I code the post-period as all days on and after May 19 to account for these anticipation effects. The identifying assumption underlying this approach is that no other policy or related events occur that coincide with the João Pedro scandal, which would imply that other determinants of police-related violence are smooth across the treatment date. To reduce bias and test this assumption, I estimate models that look at shootings and crime only in a narrow window around the date the scandal broke, with a bandwidth of 30, 60, and 90 days around May 19. The specification is as follows, for police precinct i and day t:

$$Y_{it} = \alpha + \beta_1 Ban_t + f(days_t) + \beta_2(days_t \times Ban_t) + \lambda_d + \gamma_m + \pi_i + u_{it} \tag{1}$$

where Y_{it} represents the main outcome variables of interest: the share of shootings with a policeman present and the number of police killings. Ban_t is a dummy equal to one on and

after May 19 and $f(days_t)$ represents linear, quadratic, and cubic functions that model time trends on either side of the treatment threshold in days, which is the running variable. To account for the seasonality of crime, I include day of the week fixed effects (λ_d) and monthly fixed effects (γ_m), as well as police precinct-level fixed effects (π_i). There are 73 precincts in the greater metropolitan area covered by both Fogo Cruzado and ISP. The coefficient of interest, β, captures the effect of the police operation ban on the outcomes after adjusting for precinct-level or daily fluctuations in crime. I estimate Newey-West standard errors to adjust for heteroskedasticity and serial correlation (Newey and West 1987).

6 Results

In this section, I investigate the argument that banning police operations could decrease violence. I first present evidence that the ban unequivocally decreased police violence in Section 6.1. I then explore the effects of the police operation ban on other types violent and non-violent crime in Section 6.2. Section 6.3 includes robustness checks exploring the possible confounding effect of social unrest and Covid-19, as well as an alternate model specification.

6.1 Did the police operation ban decrease police violence?

Figure 4 shows how police violence changes throughout the 2020 year. Panel A shows that the daily number of police killings in Rio de Janeiro stayed constant at the beginning of 2020 and during early Covid-19 lockdowns in March through May. Following the ban on police operations, we see a sharp discontinuity in the number of police killings per day as the number approaches zero. Panel B shows the daily share of registered shootings where a police officer was present, indicating a drop in the proportion of shootings that had a police officer present following May 19. As panels C and D further show, the decrease in the share of police present at shootings is primarily due to a decrease in the number of total shootings, the denominator. Both the number of police at shootings (numerator) and number of total shootings (denominator) decreased following the police operation ban, but the number of total shootings decreased by more, indicating that there was also a decrease in shootings not involving the police. This informs my discussion on the consequences of the police operation ban for other forms of violence and crime in Section 6.2 below.

Closely analyzing the number of total shootings (denominator) provides supporting visual evidence that there are fewer violent shootings occurring in the post-period, not just that

police are responding to fewer of them, which could be a possible alternative explanation for the decrease in the share of shootings with police present (panel B). For instance, proponents of law-and-order policing could view the decrease in the share of shootings involving police as a sign of increasing lawlessness: this could indicate a greater share of shootings that the police are not responding to. That there are decreases in the number of shootings involving police as well as shootings not involving police supports the argument that violence post-police operation ban decreased. Broadly, the decrease in police killings and police presence at shootings shown in panels A and B indicates that the police were limiting their use of force or had fewer events to respond to while on duty.

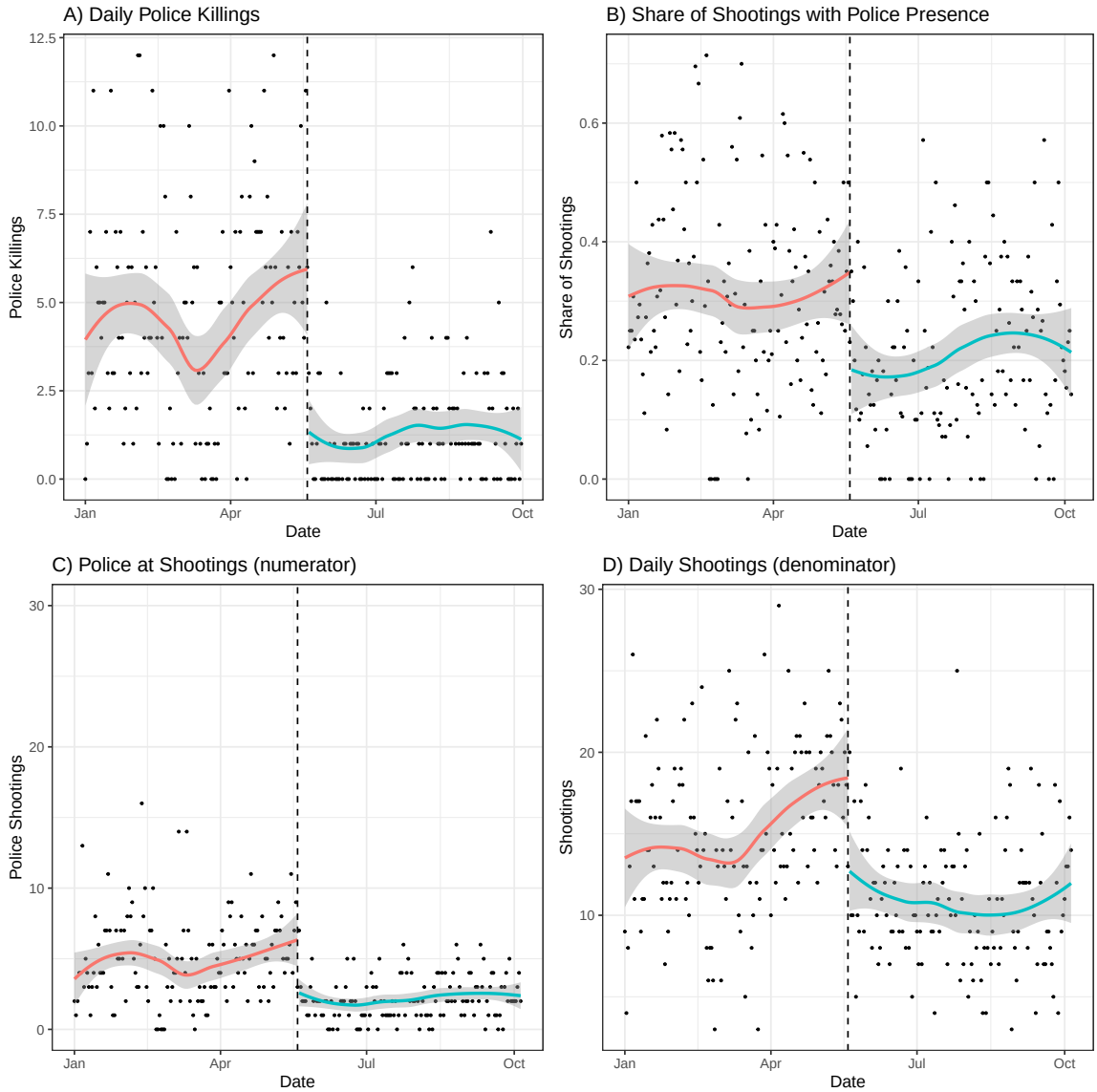
Table 1 presents a variety of formal tests on whether police killings and the share of shootings involving police changed following the ban on police operations. The models presented in this table show three different functional forms of the OLS equation 1: a linear, quadratic, and cubic fit. The panels also show coefficient estimates for increasingly tighter bandwidths, beginning with a 90-day interval on either side of the police operation ban, then estimates for models using 60- and 30-day bandwidths. Across a variety of specifications, the coefficient on police killings is negative and highly statistically significant, ranging from -0.051 to -0.089 (the mean number of daily police killings per precinct in the 30 days prior to limiting police use of force was 0.077[6]). In other words, these results imply that the number of killings by police dropped by 66-100% immediately after the government began limiting police use of force. This precipitous drop is reflected in panel A of Figure 4, where police killings abruptly begin approaching zero. The proportion of shootings involving police is also negative and statistically significant regardless of model specification, ranging from -0.29 to -0.04 (the mean daily rate of shootings involving police per precinct in the 30 days prior to limiting police use of force was 0.058[7]). Across the metropolitan area, the share of police present at shootings per precinct decreased by 50%-83%. Tables in Appendix A show the same models with a logged dependent variable and with a poisson regression for police killings, since police killings are count data. Results are substantively similar and also highly significant.

Given that police were banned from conducting operations–events where shootings are guaranteed to occur–it is perhaps unsurprising that the proportion of shootings involving police decreased. The police operation ban, however, does not preclude police officers from

[6]Mean numbers of daily police killings in the 60 and 90 days prior to limiting police use of force were 0.069 and 0.062, respectively.

[7]Mean rates of police presence in the 60 and 90 days prior to limiting police use of force were 0.052 and 0.048, respectively.

Figure 4: Police Involvement in Violent Events



This figure represents the daily totals (panels A, C, and D) and daily proportion (panel B) for each variable starting on January 1, 2020. Each plot has a vertical dashed line drawn on May 19, 2020. Panel A shows the daily police killings per day, based on official data from the Public Safety Institute (ISP), panel B shows the share of Fogo Cruzado registered shootings where at least one police officer was present, and panels C and D show the raw data comprising of the proportion in panel B, the total number of shootings involving at least one police officer and the total number of registered shootings. The curves are the predicted number of incidents or share of police present at shootings, generated by locally weighted (LOESS) regression and without covariate adjustment. These plots are aggregated as day-level sums (or shares, in panel B) to aid in visualization; in the following analyses the unit of analysis is the police precinct-day.

Table 1: Effect of Police Operation Ban on Police Violence

	Dependent variable:					
	Police Killings			Proportion of Shootings with Police		
	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)
			90 Day Bandwidth			
Ban	-0.058^{***}	-0.081^{***}	-0.075^{**}	-0.031^{***}	-0.031^{***}	-0.040^{***}
	(0.015)	(0.020)	(0.026)	(0.009)	(0.011)	(0.015)
Observations	13,213	13,213	13,213	13,213	13,213	13,213
			60 Day Bandwidth			
Ban	-0.067^{***}	-0.065^{***}	-0.086^{***}	-0.030^{***}	-0.034^{**}	-0.033^{*}
	(0.016)	(0.024)	(0.030)	(0.010)	(0.013)	(0.017)
Observations	8833	8833	8833	8833	8833	8833
			30 Day Bandwidth			
Ban	-0.051^{***}	-0.079^{***}	-0.089^{***}	-0.029^{**}	-0.036^{**}	-0.018
	(0.016)	(0.025)	(0.031)	(0.012)	(0.016)	(0.021)
Observations	4453	4453	4453	4453	4453	4453

Note: Models (1) to (3) estimate the effect of the police operation ban on daily precinct-level police killings from the ISP official crime statistics. Models (4) to (6) estimate the effect of the police operation ban on daily precinct-level proportion of shootings involving police from the Fogo Cruzado database. Models in the 90- and 60-day bandwidth control for police precinct, month, and day of week, while models in the 30-day bandwidth control for police precinct and day of week. All models cover the same sample of 73 precincts (*delegacias*) in the greater Rio de Janeiro metropolitan area. HAC standard errors (Newey-West) are shown in parentheses. *p<0.1; **p<0.05; ***p<0.01

using violence while ordinary policing. To more closely look at how the police operation ban affected police violence, I look at two subsets of shootings that involve police.

Results from Table 2 confirm that the decrease in police involvement in shootings and subsequent violence is mainly driven by shootings classified as police operations. The top panel of Table 2 shows the daily total of shootings per precinct for the entire sample of shootings (the denominator in Figure 4 and Table 1), as well as the daily number of deaths and injuries from shootings per precinct for a variety of bandwidths. Shootings and injuries from shootings significantly decreased, and the coefficient for deaths is negative, though it is not statistically distinguishable from zero. This further supports the claim that violence decreased after the police operation ban. The second panel shows a subset of these shootings, just those involving police. Shootings involving police and the number of injuries resulting from this group of shootings all show large and highly significant decreases compared to

their levels prior to the ban on police operations. The decrease in deaths is only statistically distinguishable from zero with the 60-day bandwidth, but other coefficients remain negative and similar to the estimates with the full sample.

Table 2: Effect of Police Operation Ban on Shooting-Related Violence, by Type of Policing

	Dependent variable:								
	Shootings			Deaths			Injuries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Sample 1: All Shooting Events								
Ban	−0.091***	−0.091***	−0.071**	−0.027*	−0.031*	−0.030	−0.030***	−0.034***	−0.028**
	(0.031)	(0.032)	(0.033)	(0.015)	(0.017)	(0.022)	(0.009)	(0.010)	(0.012)
N	13,213	8833	4453	13,213	8833	4453	13,213	8833	4453
Days	90	60	30	90	60	30	90	60	30
	Sample 2: Just Shooting Events Involving Police								
Ban	−0.046***	−0.047***	−0.046***	−0.027*	−0.032**	−0.031	−0.030***	−0.031***	−0.026**
	(0.013)	(0.014)	(0.017)	(0.014)	(0.016)	(0.022)	(0.009)	(0.010)	(0.012)
N	13,213	8833	4453	13,213	8833	4453	13,213	8833	4453
Days	90	60	30	90	60	30	90	60	30
	Sample 3: Just Shooting Events not Classified as "Police Operations"								
Ban	−0.019**	−0.016*	−0.016	−0.008	−0.010	−0.010	−0.011*	−0.013**	−0.007
	(0.009)	(0.010)	(0.012)	(0.007)	(0.007)	(0.008)	(0.006)	(0.006)	(0.008)
N	11,826	8176	4161	11,826	8176	4161	11,826	8176	4161
Days	90	60	30	90	60	30	90	60	30

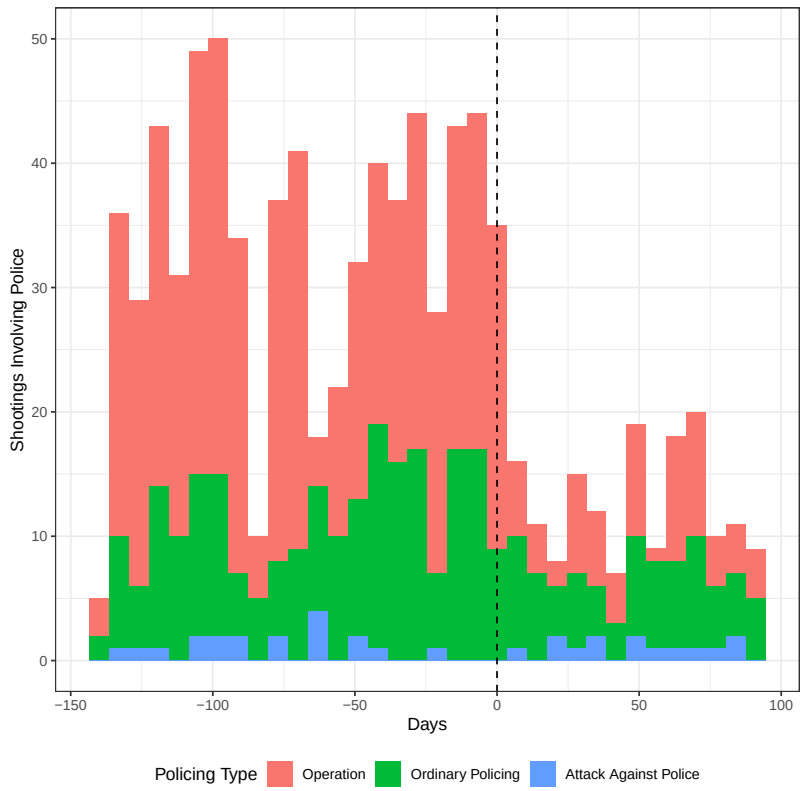
Note: Models (1) to (3) estimate the effect of the police operation ban on daily precinct-level shootings, models (4) to (6) daily precinct-level deaths, and models (7) to (9) on daily precinct-level injuries from the Fogo Cruzado database, for 90-, 60-, and 30-day bandwidths. All models shown present a linear specification. Models in the 60- and 90- day bandwidths control for police precinct, month, and day of week, while models in the 30-day bandwidth control for police precinct and day of week. All models cover the same sample of 73 precincts (*delegacias*) in the greater Rio de Janeiro metropolitan area. HAC standard errors (Newey-West) are shown in parentheses. *p<0.1; **p<0.05; ***p<0.01

The final panel in Table 2 shows that the ban on police operations caused minor, if any, changes in other forms of policing. I leverage Fogo Cruzado's detailed event tagging system to create a sample of police shootings that are not police operations. I drop all shootings classified by Fogo Cruzado as police operations[8] in both the pre- and post-period, and find that there was a slight decrease in shootings and injuries resulting from shootings, both of which are only perceptible in the 60- and 90- day windows. This strongly suggests that banning police operations lowered the level of civilian fatalities and serious injuries resulting

[8]In the Fogo Cruzado database, each shooting is tagged with a primary and secondary motive (*motivo principal* and *motivo complementar*). This sample excludes all shootings not involving police as well as shootings involving police tagged with the motive *operação policial*.

from conflict with the police, and there was no subsequent substitution effect where police began using lethal force more often while ordinary policing. Striking visual evidence in Figure 5 confirms that police continued ordinary policing (and shooting while ordinary policing) at nearly the same rates as in the pre-period, and supports the claim that the reduction in police operations led to fewer shooting-related deaths and injuries.

Figure 5: Shooting Events Involving Police, by Type of Police Action



Note: This figure represents the weekly total shootings involving police beginning on January 1, 2020, and ending 90 days after the policing ban began, taken from the Fogo Cruzado database. Daily data is aggregated in 7-day bins for this histogram. Shootings coded as police operations correspond to the motive *"operação policial"*, shootings coded as ordinary policing correspond to the motive *"ação policial"*, and shootings coded as attacks against police correspond to the motive *"ataque a agentes de segurança."*

6.2 Did the police operation ban decrease other forms of crime and violence?

Did potential criminals take advantage of the tighter limits on the police and commit more crimes? Evidence from deterrence-based theories about preventing crime would suggest that this was a possibility following the ban on police operations (Becker 1968; Chalfin

and McCrary 2013; Steven D Levitt 2002). But proponents of theories that police violence disrupts criminal networks and that criminal groups only deploy violence when under direct threat or trying to conquer (Calderon et al. 2015; Lessing 2017; Osorio 2015) might suggest that the police operation ban would lead to stagnating or lower levels of violence, allowing organized criminal groups to focus on their economic activities rather than defending their territory from the police. Testing this does requires the assumption that most crime and violence is organized-crime related, which is especially true for violent crimes and those involving firearms. Table 3 shows the number of shootings, deaths, and injuries resulting from a shooting for the subset of just civilian-civilian shootings. This a complement to the middle panel of Table 2 in the previous section and shows that shooting-related incidents just among civilians stayed stagnant after the ban on police operations. Despite the lower risk of a police operation, there was no increase in shootings related to turf war, executions, torture, and other type of organized crime-related shootings.

Table 3: Effect of Police Operation Ban on Shooting-Related Violence, Only Shootings not Involving Police

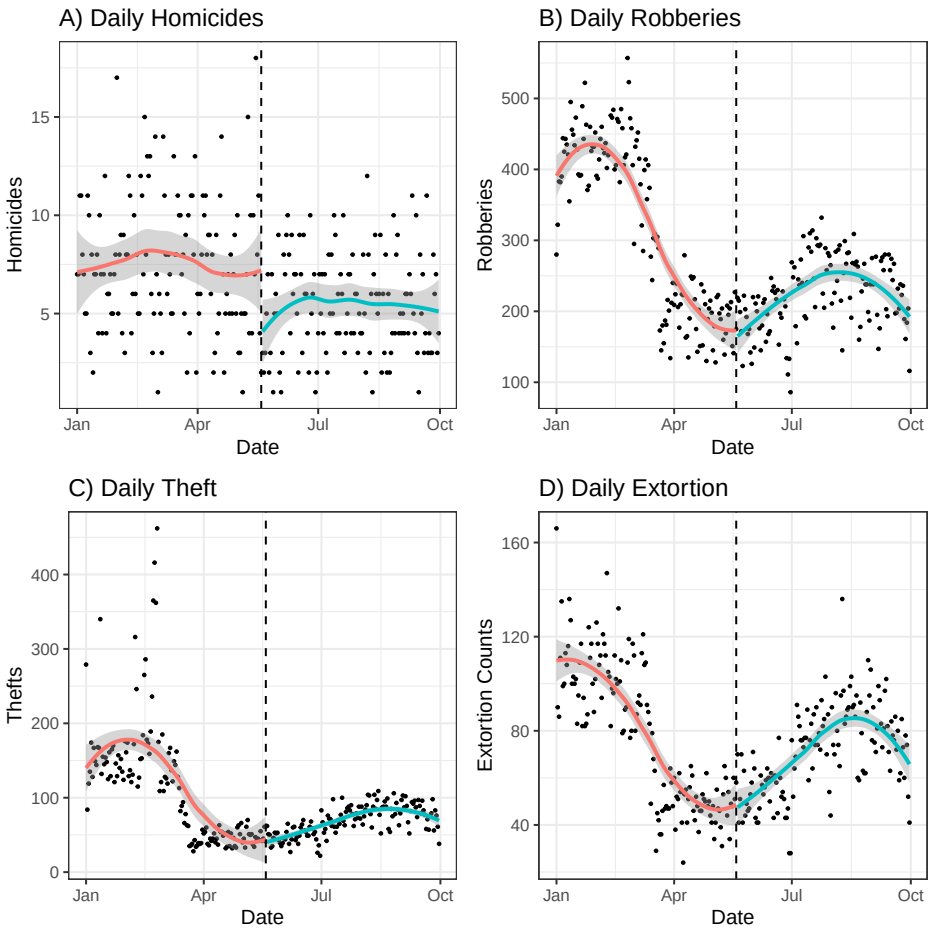
	Dependent variable:								
	Shootings			Deaths			Injuries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ban	−0.045*	−0.044*	−0.025	0.001	0.001	0.001	−0.0002	−0.003	−0.002
	(0.023)	(0.023)	(0.029)	(0.005)	(0.005)	(0.006)	(0.003)	(0.003)	(0.002)
N	13,213	8833	4453	13,213	8833	4453	13,213	8833	4453
Days	90	60	30	90	60	30	90	60	30

Note: Models (1) to (3) estimate the effect of the police operation ban on daily precinct-level shootings, models (4) to (6) daily precinct-level deaths, and models (7) to (9) on daily precinct-level injuries from the Fogo Cruzado database, for 90-, 60-, and 30-day bandwidths. All models shown present a linear specification. Models in the 60- and 90- day bandwidths control for police precinct, month, and day of week, while models in the 30-day bandwidth control for police precinct and day of week. All models cover the same sample of 73 precincts (*delegacias*) in the greater Rio de Janeiro metropolitan area. HAC standard errors (Newey-West) are shown in parentheses. *p<0.1; **p<0.05; ***p<0.01

I examine the daily incidence of other types of crimes, both violent and non-violent. Figure 6 presents evidence that the most violent of crimes, homicide, precipitously decreased following the ban on police operations. Property crimes, both violent (robbery) and non-violent (theft) do not appear to change following the police operation ban, along with extortion, another crime commonly associated with Rio de Janeiro's criminal groups.

To isolate the effects of limiting police operations on other types of crime, I estimate a flexible bandwidth of 30, 60, or 90 days around the treatment date and estimate various

Figure 6: Violent and Non-Violent Crime After the Police Operation Ban



Note: This figure represents the daily totals for each crime type starting on January 1, 2020. Each plot has a vertical dashed line drawn on May 19, 2020. Panel A shows the daily homicides (excluding police killings), Panel B shows the daily robberies, Panel C shows the daily thefts, and Panel D shows the daily threats and extortion (*ameaças* and *extorsão*), based on official data from the Public Safety Institute (ISP). The curves are the predicted number of incidents, generated by locally weighted (LOESS) regression and without covariate adjustment. These plots are aggregated as day-level sums to aid in visualization; in the following analyses the unit of analysis is the police precinct-day.

specifications of equation 1 in Table 4, using these four types of crime as the dependent variables. Regardless of model specification or time frame, homicides decreased markedly following the police operation ban, showing an expressive decrease from a pre-police operation ban mean of 0.094 per precinct per day. The most conservative estimate shows that daily homicides decreased by 19% per precinct. For all other crimes, although some coefficients are positive, none are robust across time frames or model specifications. Consistent with the visual representation in 6, the ban appeared to have no effect on other types of crimes.

Taken together, the results from Section 6.1 and 6.2 show robust evidence that police violence and homicides sharply decreased following the ban on police operations, across

Table 4: Effect of Police Operation Ban on Violence

	Dependent variable:								
	Homicides								
	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)
Ban	−0.063***	−0.094***	−0.056	−0.030**	−0.053**	−0.098***	−0.020*	−0.040**	−0.060**
	(0.020)	(0.029)	(0.035)	(0.014)	(0.021)	(0.026)	(0.011)	(0.018)	(0.024)
	Robberies								
	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)
Ban	−0.131	0.279	0.276	−0.263**	0.221	−0.214	0.742***	−0.595***	−0.021
	(0.124)	(0.173)	(0.221)	(0.104)	(0.148)	(0.179)	(0.157)	(0.161)	(0.173)
	Theft								
	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)
Ban	−0.075	0.111	0.077	−0.125***	0.013	−0.031	0.593***	−0.527***	0.162
	(0.048)	(0.072)	(0.104)	(0.042)	(0.054)	(0.070)	(0.151)	(0.144)	(0.123)
	Extortion								
	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)
Ban	0.035	0.083	0.108	−0.037	0.138**	0.017	0.148***	−0.039	0.108
	(0.057)	(0.091)	(0.123)	(0.042)	(0.065)	(0.088)	(0.044)	(0.057)	(0.123)
N	4453	4453	4453	8833	8833	8833	13,213	13,213	13,213
Days	30	30	30	60	60	60	90	90	90

Note: All models estimate the effect of the police operation ban on daily precinct-level crimes from the Public Safety Institute (ISP) official crime statistics, with three different functional forms to model the running variable. Models use either a 30-, 60-, or 90-day bandwidth and control for police precinct and day of week. All models cover the same sample of 73 precincts (*delegacias*) in the greater Rio de Janeiro metropolitan area. HAC standard errors (Newey-West) are shown in parentheses.
*p<0.1; **p<0.05; ***p<0.01

a variety of time periods and model specifications. There is no evidence of subsequent increases in property crimes or extortion or a substitution effect of police increasingly using more violence while ordinary policing.

6.3 Robustness Checks

I check the robustness of these findings by conducting various tests. First, I provide evidence that the change in violence was in fact due to the restrictions on police operations, and not the plausibly omitted variable of social unrest. I exploit the fact that the coverage of the João Pedro policing scandal was nationwide but the political response was focused solely on Rio de Janeiro. The ultimate ruling that came from the Supreme Court only applied to police operations conducted in Rio de Janeiro and not in other states, despite the fact that it sparked a conversation about policing nationwide. The accompanying social unrest and

protest struck the entire country, reaching "at least 20 state capitals and several other cities in Brazil" (ACLED 2020). This can serve as a useful placebo test to ensure that the cause of the decrease in violence in Rio de Janeiro was the ruling itself, not concurrent social movements and protests. I estimate the model in equation 1 in the metropolitan area of Recife, another Brazilian city that is also plagued by high violence, warring criminal factions, and police malfeasance. The Recife metropolitan area is the only other area where Fogo Cruzado also collects data. Results using the Recife sample in Table 5 show that there was no noticeable change in shootings, deaths, or injuries resulting from shootings, even when subsetting just to the sample of shootings that involved the police[9]. The results from this show that social unrest and the strong negative reaction from the public to the scandal (González 2020) alone are not enough to change police violence. This underscores the importance of the official meetings about policy changes immediately following João Pedro's assassination, as well as the federal ban that eventually cemented this policy change.

Second, I consider the possibility that the changes in violence are not due to the police operation ban but are instead due to Covid-19. There is already substantial evidence around the world that Covid-19 reduced crime rates–except domestic violence–largely because there were fewer people on the streets (Estévez-Soto 2020; Matthew P J Ashby 2020a; Matthew P. J. Ashby 2020b; Bloem and Salemi 2020; Jennings and Perez 2020). The Covid-19 lockdowns began in mid-March and the police operation ban coincided with the Governor easing restrictions, allowing some small non-essential small businesses to open again. In Figure 7, I plot a parallel regression discontinuity plot of the Social Isolation Index in Rio de Janeiro, constructed by In Loco, a consumer geo-tracking and advertising software company that tracks mobile phone movement (J. L. Melo 2020). The Social Isolation Index is a percentile ranking of all the people in a region that are staying in their homes. Higher values on the index indicate that more people are staying at home, lower values indicate that there are more on the streets. The plot in Figure 7 exhibits continuity across the beginning of the police operation ban (May 19), showing gradually higher mobility levels after the initial lockdown commenced in mid-March. This provides supporting evidence that, even as businesses were re-opening, it did not have a discontinuous effect on mobility around the date of the police operation ban. While we cannot rule out whether the decreases in violence would have been different outside of Covid-19, one benefit of using the high-frequency daily data is that all observations in both the pre- and post-period samples fall within the post-

[9]The state government only releases crime statistics at the monthly level, so I was unable to conduct the same analysis for police killings.

Table 5: Effect of Police Operation Ban on Shooting-Related Violence in Recife

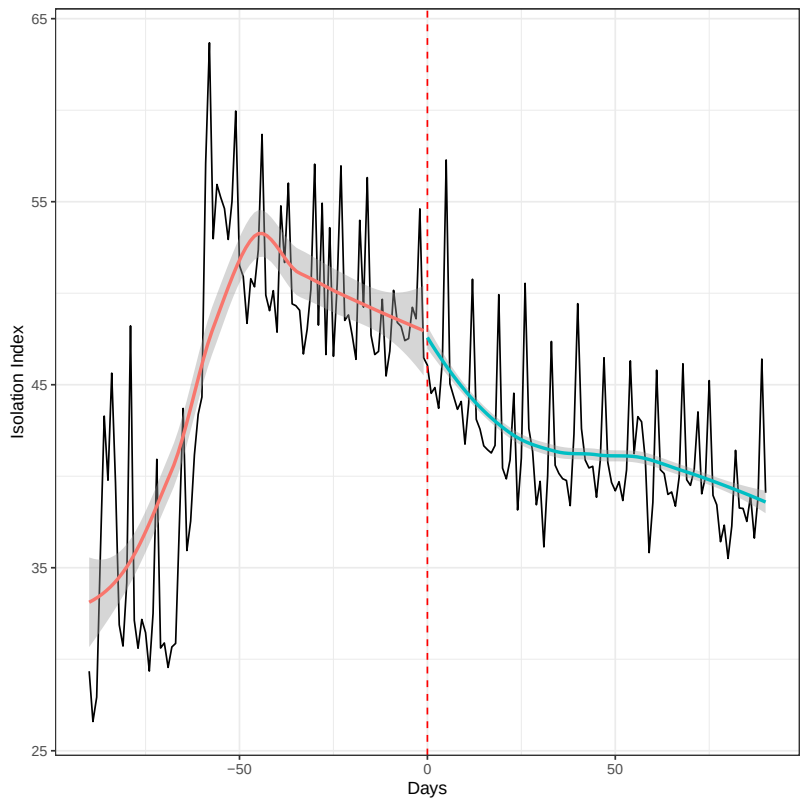
	Dependent variable:								
	Shootings			Deaths			Injuries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Sample 1: All Shooting Events								
Ban	0.015	0.050	0.044	0.052	0.086*	0.066	−0.012	0.007	0.011
	(0.061)	(0.060)	(0.060)	(0.052)	(0.050)	(0.053)	(0.036)	(0.038)	(0.042)
N	2595	1725	870	2595	1725	870	2595	1725	870
Days	90	60	30	90	60	30	90	60	30
	Sample 2: Just Shooting Events Involving Police								
Ban	−0.006	0.001	−0.016	−0.006	0.002	−0.003	−0.005	0.006	−0.007
	(0.012)	(0.012)	(0.012)	(0.008)	(0.009)	(0.010)	(0.008)	(0.009)	(0.008)
N	2595	1725	870	2595	1725	870	2595	1725	870
Days	90	60	30	90	60	30	90	60	30
	Sample 3: Just Shooting Events Involving Civilians								
Ban	0.015	0.050	0.044	0.052	0.086*	0.066	−0.012	0.007	0.011
	(0.061)	(0.060)	(0.060)	(0.052)	(0.050)	(0.053)	(0.036)	(0.038)	(0.042)
N	2595	1725	870	2595	1725	870	2595	1725	870
Days	90	60	30	90	60	30	90	60	30

Note: Models (1) to (3) estimate the effect of the police operation ban on daily city-level shootings, models (4) to (6) daily city-level deaths, and models (7) to (9) on daily city-level injuries from the Fogo Cruzado database, for 90-, 60-, and 30-day bandwidths. All models shown present a linear specification. Models in the 60- and 90- day bandwidths control for municipality, month, and day of week, while models in the 30-day bandwidth control for municipality and day of week. All models cover the same 15 municipalities in the greater Recife metropolitan area. HAC standard errors (Newey-West) are shown in parentheses.
*p<0.1; **p<0.05; ***p<0.01

Covid-19 lockdown period and are subject to these same constraints. The major changes in mobility when lockdown restrictions began are only picked up in the models with a 90-day bandwidth. Lastly, Figure 7 shows that there were slightly more people on the streets during the post-police operation ban period than the pre-ban period, suggesting that the reductions in violence during the post-period are even more stark.

Third, I test the sensitivity of the model specification by using an alternative estimation strategy. I use a general difference-in-differences design to estimate the causal effect of the federal police operation ban on violence. I consider data from 2019 as the comparison group and consider all precincts in 2020 to be "treated," whereas all precincts in 2019 are in the

Figure 7: Social Isolation Index Before and After Police Operation Ban



Note: This figure represents the daily Social Isolation Index (SII) from February 19, 2020, to August 17, 2020, 90 days before and after the date public officials began discussing the limits of police force, May 19. The SII, which ranges from 0 (not at all isolated) to 100 (extremely isolated) was constructed from the geo-tracking company In Loco which uses 600+ partner cell phone applications to track geographic locations of its users. The unit of analysis for this plot is the Rio de Janeiro metropolitan area, the Rio de Janeiro *arranjo*, coded by the Brazilian Institute for Geography and Statistics (IBGE). A 7-day locally weighted (LOESS) regression is fit on either side of the cutpoint without covariate adjustment.

control group. I use the same daily data on shootings, deaths from shootings, and injuries from shootings from Fogo Cruzado, and crime statistics from ISP. The identifying assumption underlying this approach is that the seasonal changes in violence in the previous year are a good counterfactual for the changes that would have been observed in the absence of the federal ban, and the model allows us to control for yearly, weekly, and weekday variation in violence levels. The specification is as follows, for police precinct i and day d:

$$Y_{id} = \beta_0 + \beta_1(Ban_{id}) + \pi_w + \gamma_e + \alpha_i + \epsilon_{iw} \tag{2}$$

Where Y_{id} again represents the main outcome variables of interest: police killings, share of shootings with a police officer present, and other violence-related variables of interest. Ban_{id} is a dummy equal to one for all units in the sample after May 19, 2020, π_w represents

week-by-year fixed effects to account for the seasonality of crime, γ_e represents weekday fixed effects, and α_i represents precinct fixed effects. The coefficient of interest, β_1, captures changes in violence after the police operation ban that is not captured after adjusting for unit-level violence, weekday, or weekly fluctuations in crime. I cluster standard errors at the precinct level. Results in Table 6 also show strong decreases in shootings, deaths and injuries from shootings, and the share of police present at shootings when compared to the same week in 2019. The difference-in-difference models recover a similarly significant and negative effect size for both the police killings and homicide coefficient as well. This alternative specification allays concerns about model dependence and the seasonality of crime.

Table 6: Effect of Police Operation Ban on Violence:
Difference-in-Differences Specification

	Dependent variable:					
	Shootings	Deaths	Injuries	Share Police	Police Killings	Homicides
	(1)	(2)	(3)	(4)	(5)	(6)
Ban	-0.164^{***}	-0.025^{***}	-0.027^{***}	-0.040^{***}	-0.055^{***}	-0.067^{***}
	(0.016)	(0.007)	(0.007)	(0.005)	(0.013)	(0.013)
N	10,220	10,220	10,220	10,220	10,220	10,220

Note: Models (1) to (4) estimate the effect of the police operation ban on daily precinct-level shootings using Fogo Cruzado data and models (5) to (6) estimate the effect of the police operation ban on daily crime statistics using ISP official crime statistics. The sample size for all models is 30 days before and after May 19, for both 2019 (the comparison group) and 2020 (the treatment group). Models control for police precinct, week, and day of week. All models cover the same sample of 73 precincts (*delegacias*) in the greater Rio de Janeiro metropolitan area. Precinct-level clustered standard errors are shown in parentheses. *p<0.1; **p<0.05; ***p<0.01

7 The Mechanism Lowering Violence Levels

The above evidence makes clear that the large reductions in police violence were due to the ban on police operations, showing that police-civilian conflict during police operations is the primary cause of violence, injuries, and death in Rio de Janeiro. Results also indicate that civilian-civilian shootings and homicides decreased, while other forms of crime plateaued. Why would the ban on police operations also affect violent crime not involving officers? A plausible explanation is that the *absence* of police operations lowers the rate of criminal warfare. This could happen in two ways. First, the absence of police operations could slow

territorial diffusion of conflict. In Rio de Janeiro, where favelas dominated by rival groups are mere meters from each other, either the *centrifugal* (where criminal groups flee to avoid law enforcement) or the *centripetal* (where criminal groups invade neighbors weakened by law enforcement) type of contagion is plausible. Journalists reporting on criminal group responses to police operations have noted occasions where "the traffickers' response... attracted more attention than the operation itself" and as a response to the operation, "the [armed] traffickers sowed terror in various parts of the city" (Martín 2017). A blog reporting on criminal violence in the city provide evidence of centripetal contagion, describing a police operation that resulted in the imprisonment of four drug traffickers, several guns, a supply of drugs, and a motorcycle (B. C. News 2017). They suggest that rivals of this group "will try to retake the area" following these losses. The absence of these police operations, I argue, could slow territorial contagion and its associated violence in Rio de Janeiro.

The second way in which the police operation ban could decrease criminal warfare is because it eliminates the element of surprise when an operation happens. Police operations cause exogenous changes to the balance of power between criminal groups–a police operation that weakens one gang creates opportunities for their rivals to gain stronger. Scholars have even documented how the targeting of police operations serves to strengthen some criminal groups that are infrequently targeted by operations (Magaloni, Franco-Vivanco, and V. Melo 2020). If criminal groups never know when the police are headed to their community and know that police action is "extremely violent and to a large extend indiscriminate" (Lessing 2017, p. 183), the most reasonable way to protect themselves against the police and against their rivals is to be constantly on edge, armed, and invest heavily in their capacity to fight. Advocates of police reform argue that violent police operations paradoxically leads to more violence because of criminal groups' focus on arming themselves in order to face the police. The research institute *Public Security Observatory Network - Rio de Janeiro* claims, "After confrontations with the police, drug gangs and militia groups become even stronger than they were before" (Observatórios da Segurança 2020).

Being constantly armed and ready for the possibility of unconditional repression (Lessing 2017) raises the stakes for conflict not involving the police. While the police operation ban does not preclude criminal groups from invading each others' territory or fighting with each other, it makes conflict more predictable: it is more likely that a criminal group knows when tension with a rival is about to erupt, versus conflict with the police which they have little information about unless they have an informant on the inside. Under the canonical assumption the organized criminal groups deploy violence strategically (Schelling 1967), the

absence of police operations allows criminal groups to target their violence more effectively and perhaps devote more time to other criminal activities. Removing the unknown threat of police operations could create the possibility to focus more on the economic or social activity in their communities and possibly even come to an uneasy détente with neighboring factions, or, more ruthlessly, to focus wholly on conquering their neighbors.

Evidence consistent with this mechanism would show violence declining the most precipitously in areas most likely to be targeted by a police operation. This could be because of the slowing rate of territorial conquest, because the criminal groups are better able to predict (and thus prevent) when and where violence will occur, or both. The violence that happens inside a criminally-dominated area, therefore, is more likely to be the violence sanctioned by or caused by the criminal group itself, instead of in battle with the police. To quantify this, I look at the effect of the police operation ban on violence, just within the police precincts that had the most police operations in the year prior, in 2019. The top quantile included precincts where between 18 and 58 operations had been conducted in 2019, 19 precincts in total. Table 7 shows some evidence that the areas where police operations were most likely to occur in 2019 are also the areas that exhibited the greatest declines in shootings and homicides following the ban on police operations. There is a null effect for the same models estimating property crimes and extortion shown above in Table 4. Due to the narrow bandwidth and limited sample size, the estimates are relatively imprecise, but the strong negative coefficients for all measures of violent crime support the mechanism that violence decreases in the same communities where there is an absence of police operations.

8 Conclusion

Supreme Court Justice Edson Fachin wrote in his June 5 injunction, "Nothing justifies a 14-year-old child being shot at more than 70 times. That fact alone indicates that given current norms, nothing will be done to diminish police lethality, a state of affairs that in no way respects the Constitution" (RioOnWatch 2020a). The conversation about what appropriate levels of police use of force is and how to restrain the police while still giving them the power to enforce the law has never been more relevant than it is today. Previous scholarship on the effect of violent policing has shown that it can incite more violence, especially when deployed against organized crime. This paper adds to this argument by showing the other side of the same coin: that a temporary suspension of aggressive policing tactics reduces violence. I show that a limit on police operations–the most violent form of policing–reduced

Table 7: Effect of Police Operation Ban on Violence, Quartile with 2019 Highest Police Operation Rate

	Dependent variable:		
	Shootings		
	(Linear)	(Quadratic)	(Cubic)
FederalBan	-0.193^{**}	-0.209^{*}	-0.225
	(0.096)	(0.122)	(0.147)
	Deaths from Shootings		
	(Linear)	(Quadratic)	(Cubic)
FederalBan	-0.021	-0.036	-0.069
	(0.040)	(0.059)	(0.082)
	Injuries from Shootings		
	(Linear)	(Quadratic)	(Cubic)
FederalBan	-0.049	-0.072	0.028
	(0.037)	(0.056)	(0.084)
	Homicides		
	(Linear)	(Quadratic)	(Cubic)
FederalBan	-0.099^{*}	-0.173^{*}	-0.097
	(0.055)	(0.090)	(0.094)
Observations	1159	1159	1159
Days	30	30	30

Note: All models estimate the effect of the police operation ban on daily precinct-level shootings and shooting-related violence from the Fogo Cruzado database or on homicides, from the Public Safety Institute (ISP) official crime statistics. The estimates use three different functional forms to model the running variable and the sample is restricted to those precincts that were in the top quartile of police operations for the prior year, 2019. All models use a 30-day bandwidth and control for police precinct and day of week. These models cover the same restricted sample of 19 precincts (*delegacias*) in the greater Rio de Janeiro metropolitan area. HAC standard errors (Newey-West) are shown in parentheses. *p<0.1; **p<0.05; ***p<0.01

police killings, police shootings, deaths, and injuries from police shootings. This observation is plainly visible in the raw data and confirmed by a more rigorous analysis using regression discontinuity and difference-in-differences models. My findings underscore that the ban on police operations not only lowered police violence, but lowered violence between civilians as well. Shootings between civilians and homicides showed expressive decreases following the police operation ban, with no apparent increase in any other forms of crime. In short, the police operation ban led to broad decreases in violence and no increases in other forms of crime.

That the reform was temporary underlines an important limitation to this study and the need for more research on the short, medium, and long term consequences of limiting aggressive policing. Studies looking at restrictions on other areas of law enforcement suggest that institutionalized police reform can lead to longer term reductions in police brutality (Magaloni and Rodriguez 2020) and violent consequences of the drug war (Lessing 2017). Understanding when, if at all, the effects of the police operation ban will subside is important for research and policy alike.

However, these results should not be romanticized. The police operation ban is neither a panacea nor a viable long-term crime-fighting strategy when taken alone. I posit that the mechanism driving broad decreases in violence is related to the underlying power dynamics between criminal groups and that a decline in police violence slows the rate of criminal warfare. One possible concern about this could be that criminal organizations grow stronger when one does not "fight violence with violence." As sobering statistics in Rio de Janeiro show, however, fighting violence with violence has been the dominant approach for several decades and has been a losing strategy: criminal groups are more armed, more embedded in state apparatuses, and govern over more residents than ever before. The results from this study reveal that a more restrained approach to policing in the short term will have no worse–and likely more humane–consequences than a "brute force approach" to controlling crime (Kleiman 2009). It bears critical lessons for debates in other countries, especially countries in the Americas ravaged by the war on drugs, on the fallacy of the "fight violence with violence" approach that has unnecessarily cost tens of thousands of lives and yielded little ground. Such findings demand renewed attention from policymakers wishing to minimize the damages from policies aimed to control organized crime.

A Appendix

Table 8: Effect of Police Operation Ban on Police Violence with Logged Dependent Variable

	Dependent variable:					
	Police Killings			Proportion of Shootings with Police		
	(Linear)	(Quadratic)	(Cubic)	(Linear)	(Quadratic)	(Cubic)
			90 Day Bandwidth			
FederalBan	-1.136^{***}	-1.517^{***}	-1.278^{**}	-1.103^{***}	-1.146^{***}	-1.290^{***}
	(0.260)	(0.412)	(0.589)	(0.291)	(0.357)	(0.440)
Observations	9709	9709	9709	13,213	13,213	13,213
			60 Day Bandwidth			
FederalBan	-1.312^{***}	-1.295^{***}	-1.562^{**}	-1.107^{***}	-1.132^{***}	-1.013^{**}
	(0.300)	(0.486)	(0.607)	(0.306)	(0.408)	(0.492)
Observations	7519	7519	7519	8833	8833	8833
			30 Day Bandwidth			
FederalBan	-1.035^{***}	-1.510^{***}	-1.606^{***}	-1.043^{***}	-1.112^{**}	-0.564
	(0.300)	(0.486)	(0.607)	(0.381)	(0.484)	(0.614)
Observations	4453	4453	4453	4453	4453	4453
Note:						*p<0.1; **p<0.05; ***p<0.01

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Table 9: Effect of Police Operation Ban on Police Killings (Poisson Regressions)

	Dependent variable:		
	Police Killings		
	(Linear)	(Quadratic)	(Cubic)
	90 Day Bandwidth		
FederalBan	-1.431^{***}	-1.918^{***}	-1.417^{*}
	(0.356)	(0.712)	(0.807)
Observations	9709	9709	9709
	60 Day Bandwidth		
FederalBan	-1.533^{***}	-1.612^{**}	-1.705^{**}
	(0.353)	(0.751)	(0.796)
Observations	7519	7519	7519
	30 Day Bandwidth		
FederalBan	-1.132^{***}	-1.367^{*}	-1.477^{*}
	(0.353)	(0.751)	(0.796)
Observations	4453	4453	4453
Note:		*p<0.1; **p<0.05; ***p<0.01	

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