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## Limiting aggressive policing can reduce police and civilian violence



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### ABSTRACT

Governments in the Americas rely on aggressive policing tactics to fight crime, despite scant evidence of impact. While recent studies depict militarized policing as a driver of violence, few governments have reconsidered their use of it. What impact does a restriction on aggressive policing have on violence, and why? This paper examines limits on police use of force and how they can be implemented to reduce both police and civilian violence. I argue that reforms that require internal, non-police oversight can be effective institutional constraints, minimizing police violence. In settings where organized crime is widespread, these limits can have spillover effects and further decrease civilian violence by (1) slowing the territorial diffusion of criminal conflict and (2) making conflict more predictable. I test these claims by examining an abrupt limit on police raids in Rio de Janeiro, Brazil. I find that limiting raids – militarized police strikes targeting criminal gangs and communities under their control – led to a 66% decrease in police killings and a 58% decrease in homicides. The effects were concentrated in police precincts where rival criminal groups are in close proximity. Limiting raids did not lead police to be more violent during ordinary patrolling duties, and did not affect property crimes. The implication is that restraining police use of force in high-violence settings may save lives and be no worse than hard-on-crime strategies.

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### 1. Introduction

Governments in the Americas respond to crime with startlingly high use of force. The Mexican government continues slowly replacing civilian police forces with the military, police snipers in Brazil are authorized to shoot suspects from helicopters, and special forces in Venezuela execute the poor in broad daylight.<sup>1</sup> These are emblematic of the decades-long slow march towards more violent policing, focused on eliminating criminal gangs. Yet there is scant evidence that aggressive policing tactics work in fighting organized crime, instead, such tactics may contribute to higher levels of societal violence (Calderón, Robles, Díaz-Cayeros, & Magaloni, 2015; Castillo & Kronick, 2020; Dell, 2015; Flores-Macías, 2018; Flores-Macías & Zarkin, 2019; Lessing, 2017; Magaloni, Franco-Vivanco, & Melo, 2020; Osorio, 2015; Snyder & Duran-Martinez, 2009). Governments in turn respond to higher levels of violence with more aggressive policing, and the cycle continues.

Rarely, however, do governments *limit* police use of force in their efforts to fight crime, either for political or practical reasons. Policymakers may shy away from limiting aggressive policing for fear of blame if violence were to erupt (Flom & Post, 2016), and

even well-intentioned reforms can go awry or lead to unintended consequences when the rank-and-file don't comply (Brehm & Gates, 1999; González, 2019; Hausman & Kronick, 2021; Lipsky, 1980).

What is the impact of a restriction on aggressive policing on violence? Why might limiting police use of force affect societal levels of violence? Such questions remain largely unexamined in developing world contexts, partially because limiting police use of force is a rare event.<sup>2</sup> In theorizing the relationship between the two, much of the literature on how policing intensity impacts violence draws from Becker's (1968) classic deterrence-based model, developed in North America. Yet low levels of police legitimacy (Cruz, 2010) and the extent to which criminal groups control territory (Arias, 2006) make it difficult to extend these theories to the developing world.

I argue that limiting aggressive policing tactics may lead to decreases in both police violence and criminal violence. Such restrictions on policing that require internal, non-police oversight have a greater chance of being implemented by risk-averse politicians and of imposing institutional constraints on police behavior, thereby reducing police violence. A less brutal police force may in

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<sup>1</sup> See recent reporting from Mexico (Meyer, 2020), Brazil (Andreoni, Londoño, & Galdieri, 2020), and Venezuela (Berwick & Kinoshian, 2019).

<sup>2</sup> There are far more cases of expansions of police use of force than restrictions. Studies have identified policies that restrict the police in Mexico (Magaloni & Rodriguez, 2020), Venezuela (Hausman & Kronick, 2021), and Argentina and Colombia (González, 2019).

turn, lower civilian violence – largely driven by criminal conflict – through two mechanisms. First, fewer episodes of police violence may slow the territorial diffusion of conflict between rival criminal groups battling over territory, either between themselves or with law enforcement. Second, the decline in aggressive policing can make criminal conflict more predictable and avoidable. The insight underpinning both of these claims is that criminal groups, as profit-motivated entities, will reallocate the resources they would have used fighting the police towards productive economic activity, likely lowering violence (Schelling, 1967).

I empirically investigate the effect of a limit on police raids on police and civilian violence in Rio de Janeiro, Brazil. Following a police killing of a teenage boy, the governor of Rio de Janeiro suspended raids – highly militarized police strikes targeting criminal group leaders. Days later, the Supreme Court issued a temporary injunction reinforcing the suspension. These raids often happen in the densely populated informal settlements where criminal groups operate, and are notoriously lethal for neighborhood residents. I use an interrupted time series to estimate the causal effect of the suspension of raids on police and civilian violence, leveraging high frequency daily data from two distinct sources that report on police violence, homicides, and shootings.

I present two key sets of findings. First, the limit on raids led to sweeping declines in police use of lethal force. Police killings saw daily reductions of at least 66%, even though police were still conducting routine patrolling duties on the streets. Police shootings decreased and were less lethal; injuries and deaths from shootings decreased by 63% and 60%, respectively.

Second, the limit on raids led to an abrupt decrease in civilian homicides. Daily homicides decreased by at least 58% and there was no substitution effect towards non-violent property crimes. Precincts with high levels of criminal conflict and where multiple criminal groups were in close proximity to each other were driving the effect, lending supporting evidence to the territorial diffusion of conflict and predictability of conflict mechanisms.

These findings contradict a vein of literature that argues that more policing can deter violent crime, as well as rhetoric frequently championed by tough-on-crime politicians. I build on recent work on institutional constraints on the police (Brinks, 2007; Hausman & Kronick, 2021; Magaloni & Rodriguez, 2020; Mummolo, 2017; Rivera & Ba, 2020) and the violent consequences of aggressive policing tactics (Flores-Macias, 2018; Flores-Macias & Zarkin, 2019; Lessing, 2017; Magaloni et al., 2020; Osorio, 2015) to show that the inverse may be true: limiting police use of force – through the creation of internal institutional constraints and oversight – can lead to lower levels of police and civilian violence. These findings are significant, given the political and implementation challenges to police reform. Though not a standalone or a permanent solution, restraining police use of force in high-violence settings may save lives and be no worse than hard-on-crime strategies.

## 2. Police use of force and societal violence

### 2.1. The relationship between policing and violent crime

Decades of research in the social sciences support the claim that there is an inverse relationship between policing and violence. The canonical literature argues that increases in law enforcement effectively deters potential offenders from committing crimes (Becker, 1968). Past studies, mainly focused on North America, document that increases in the presence of law enforcement officers deters property crime (Di Tella & Schargrodsky, 2004; Machin & Marie, 2011) and violent crime (Chalfin & McCrary, 2013; Levitt, 2002), and increased hot spot policing in high-crime areas lowers violent

crime while not displacing it to nearby areas (Braga, Papachristos, & Hureau, 2014; Rosenbaum, 2006).

As crime has risen in some parts of the world, so too have states' deterrence tactics. Police as state "specialists in violence" has taken on a new meaning as countries have steadily militarized the police over the past few decades, blurring the lines between those that are intended to maintain public order and those that are intended to wage war (Bates, Greif, & Singh, 2002). Latin America leads the way in militarizing the police, although it is not alone. The escalation in militarizing the police is largely a response to the sophistication, technology, and brutality that organized criminal groups have and routinely deploy today. *Police militarization* is the process by which a police force adopts weaponry, training, and organizational structure to more closely resemble the armed forces (Flores-Macias & Zarkin, 2019; Mummolo, 2018).

Scholars of police militarization cast doubt on classic theories of deterrence, suggesting that such extreme use of violence may disrupt order rather than maintain it. Flores-Macias and Zarkin (2019) highlight how higher levels of police militarization has produced violence rather than contained it across Latin America. The relationship between police militarization and increased violence has been documented cross-nationally (Tiscornia, 2019) and studied extensively in the Americas: studies suggest that highly militarized, disruptive policing can intensify violence (Osorio, 2015), decrease the state's ability to provide order and extract fiscal resources (Flores-Macias, 2018), destroy local markets (Gentil-Fernandes & Inicio, 2022), and generate political violence (Dell, 2015).

A related strand of research on organized crime rectifies these inconsistencies and offers an alternative explanation for why police use of force may increase violent crime. These arguments focus on contexts where the police routinely deploy high levels of violence, yet often fail to contain crime, largely in Latin America. Calderón, Robles, Díaz-Cayeros, & Magaloni, 2015 argue that police crackdowns on drug cartels could increase violence by creating succession or decentralization struggles, inter-cartel turf wars, or police-cartel wars. Lessing (2017) shows how police crackdowns can backfire, arguing that organized criminal groups may escalate violent conflict when the state tries to repress them unconditionally. Magaloni et al. (2020) find that the level of violence following a state crackdown depends on the type of criminal governance regime, their sources of income, relations with the community, and connections to the state. Castillo and Kronick (2020) further argue that when police use force to seize contraband, such as criminal groups' illicit drug supply, criminal groups will likely retaliate with violence.

I build on these arguments about fighting organized crime to question conventional deterrence-based theories and argue the inverse: that *limiting* police use of force has the potential to decrease violence, both that committed by police officers and that which occurs between civilians.

### 2.2. Limiting police use of force as a path to lower violence

Restraining the police has the potential to lower violence in high-crime settings. This study focuses on illuminating this effect in Latin America for two reasons: there is a strong presence of organized crime across much of the region, and police already use considerable force in order to fight crime. Below I explain how restraining the police can lower both police violence and civilian violence, respectively.

First, governments have little to lose from trying to lower police violence. The cost of fighting crime in Latin American countries is 3.5% of their GDP, double the cost in developed countries and roughly the same annual amount spent on infrastructure (Jaitman et al., 2017). These states often have little to show for

the exorbitant resources spent on fighting crime. Mexico is an emblematic case where the homicide rate has kept pace with the billions of foreign and domestic dollars spent on increasing funding, size, and capacity of the police (Pardo Veiras & Arredondo, 2021). After decades of increased violence, militarization has triggered backlash amongst civil society as people grow frustrated with permanently high levels of insecurity and lose trust in the police themselves, whose persistent overpolicing of select residents can reproduce inequalities and lower legitimacy (Cruz, 2010; Owens & Ba, 2021).

Despite limited success in fighting organized crime with heavy use of force, few states have walked back these policies. One possible reason is because of politics: public officials are unlikely to repeal public security policies because they are concerned with minimizing political risk and avoiding blame from the public, should a crime become salient (Flom & Post, 2016; Weaver, 1986). Scholars of police reform underline this, arguing that politicians aren't incentivized to undertake institutional reform unless there is a profound change that challenges social inequalities (Brinks, 2007) or a scandal that mobilizes the public and makes the status quo untenable (González, 2020).

Another possible reason why governments face challenges limiting police use of force is because it is difficult to constrain the behavior of individual officers. In theory, police forces should be strong enough to have a monopoly of the use of force vis-à-vis civilians, but weak enough that they must abide by their institutional constraints (Bates et al., 2002; North, Wallis, & Weingast, 2009). Yet well-documented principal-agent problems among the police force indicate that the state often has imperfect control over the rank-and-file (Brehm & Gates, 1999; Denyer, 2018; Lipsky, 1980).

One way forward is for governments to focus on building more internal oversight mechanisms. These mechanisms could be within the police force (e.g., a supervisor) or in non-police agencies (e.g., regulatory bodies or the courts). The promise of internal reform has been underlined in Hausman and Kronick (2021) as a way to ensure that officers' incentives align with restrictions on the use of force. I extend this argument; non-police agencies' oversight can address politicians' reluctance to reform the police as well as principal-agent challenges. Politicians may perceive a reform that creates cross-agency accountability structures as less politically risky because the oversight agency could accept some blame if a rare violent event becomes salient. Though non-police oversight could create inefficiencies, they may be worth the cost if they address agency dilemmas. For example, a reform of the search warrant process might require the oversight of both police supervisors and judges. Even if a police supervisor turns a blind eye to a violation, if the judge denied the warrant, this could still prevent the officers from conducting the search, serving as an effective institutional constraint. Non-police internal oversight can help politicians diffuse blame if the policy goes awry and ensure that the entire policy's success is not just predicated on police leadership monitoring the rank-and-file.

There is already a precedent for success with institutional reforms that focus on internal oversight tactics. For example, Magaloni and Rodriguez (2020) study how a mandate that a defense attorney be present when police extract confessions from suspects reduced police officers' use of torture in Mexico. Rivera and Ba (2020) show how the Chicago police union warned officers that they would share cases of officer misconduct with the courts and the public, which led to increased accountability. Mummolo (2017) shows how a new internal record-keeping procedure for stop-and-frisk reports changed officer behavior during stops in New York City. In all of these instances, a clear oversight procedure (e.g., what officers had to report, or to whom) was defined. As a corollary, Hausman and Kronick (2021) demonstrate that two externally-imposed reforms in Venezuela (making arrests) and

Chicago (pedestrian stops) were sabotaged by officers who substituted tactics in order to meet internal benchmarks. I add nuance to growing literature on the promises of internal oversight, suggesting that one way to tie the hands of the police and make reforms politically viable is to require internal oversight with clear procedure from a state organ that is not the police. Applying this logic to police use of force, I hypothesize that *reforms that require internal, non-police oversight are likely to constrain the police and lead to lower levels of police violence*.

Second, limiting police use of force could also lower civilian violence, primarily that which is committed by criminal organizations. One important assumption grounding this prediction is that criminal organizations derive power from territorial control – the control of land and the people who live there – and fight to control this territory (Arias, 2006; Blattman, Duncan, Lessing, & Tobón, 2021; Lessing, 2020; Magaloni et al., 2020). Given that one crime-fighting objective is to disrupt criminal control over territory, I predict that constraining police violence lowers criminal violence in two ways, (1) by slowing the territorial diffusion of conflict and (2) by making criminal violence more predictable.

A decline in police violence slows the spread of conflict between criminal groups. Police crackdowns are known to cause violence to break out, either by "centrifugal contagion" (driving violence outward) or "centripetal contagion" (drawing violence inward) (Osorio, 2015). Aggressive policing can lead to centrifugal contagion when criminal groups invade rival territories while fleeing law enforcement (Calderón, Robles, Díaz-Cayeros, & Magaloni, 2015), or when the capture of a leader changes cartel incentives (Castillo & Kronick, 2020). It can lead to centripetal contagion when criminal groups are weakened by law enforcement crackdowns and become appealing targets, seducing their rivals with the prospect of easy territorial conquest (Dell, 2015). In this study's test case, Rio de Janeiro, either centrifugal or centripetal contagion following high levels of police violence is plausible. Journalists have noted instances of centrifugal contagion following police raids, where "the traffickers' response...attracted more attention than the raid itself...the [armed] traffickers sowed terror in various parts of the city" (Martín, 2017). An anonymous blog received intelligence about possible centripetal contagion following a raid, reporting that rivals of a weakened group "will try to retake the area" from a weakened opponent (Blog Crimes News, 2017). A decline in police violence, I argue, could slow both centrifugal and centripetal contagion and its associated violence.<sup>3</sup>

A decline in police use of force also decreases civilian violence by making conflict more predictable, and thus, avoidable. Episodes of police violence are not routine, and criminal groups never know precisely when the police are likely to use high levels of violence against them. They may react to this lack of information by being constantly armed and ready to fight at a level that is higher than what is efficient. While restraining police use of force does not minimize criminal groups' incentives to arm themselves when facing rivals, it makes conflict with the state more predictable. This insight draws from Snyder and Duran-Martinez (2009), who show that the predictability of state enforcement of the law helps to explain drug-related violence levels in Mexico. In Rio de Janeiro, advocates of police reform argue that violent policing paradoxically begets more violence, because criminal groups focus on arming themselves in order to confront the police.<sup>4</sup> Under the canonical

<sup>3</sup> This argument could even be generalized to cases where only one criminal organization is present. Police crackdowns and use of force against a sole criminal organization are a common cause of high levels of violence due to the within-group fragmentation and succession struggles that follow (Calderón, Robles, Díaz-Cayeros, & Magaloni, 2015; Phillips, 2015).

<sup>4</sup> 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" (Rede de Observatórios da Segurança, 2020).

assumption that profit-maximizing organized criminal groups deploy violence strategically and hope to avoid unnecessary conflict (Schelling, 1967), a decrease in police use of force could temporarily lower violence as criminal groups focus more on their economic or social goals.

Limiting police use of force could reduce civilian criminal violence through the territorial diffusion of conflict channel or through the predictability of conflict channel. I hypothesize that *a limit on police use of force will lead to lower levels of civilian violence*. Below, I explore the effects of a limit on one specific tactic – police raids – on both police and civilian violence in Rio de Janeiro.

### 3. Context

#### 3.1. Violence and policing in Rio de Janeiro

Most violence in Rio de Janeiro is between rival criminal groups or between criminal groups and the police. Conflict between rival criminal groups is primarily over territory (Arias & Barnes, 2017; Zaluar et al., 2007; Zaluar, 2006), which they use to run illicit drug businesses, extort citizens, or both. All criminal groups are heavily armed and control irregularly shaped territories scattered across the state (Arias, 2006). Violence is mainly contained inside or bordering the areas that these groups dominate, which include but are not limited to Rio de Janeiro's many informal settlements, *favelas*.

Police violence comes in two distinct forms. The first, known as ordinary policing, includes routine patrolling and responding to incidents (Associação Brasileira de Imprensa, 2020). The second and more violent form is police raids (*operações policiais*, or police operations). Raids are generally planned in advance and involve the use of heavy militarized weapons, vehicles, and combatants. Large raids may involve several armored vehicles, dozens of officers, and heavy weaponry. They are far more deadly than ordinary policing activities because of their use of weapons intended for war in dangerously close proximity to bystanders. (Amnesty International, 2015; Associação Brasileira de Imprensa, 2020). Raids typically occur in Rio de Janeiro's favelas that are home to thousands and up to hundreds of thousands of the urban poor.

Between ordinary policing and raids, police in Rio de Janeiro killed 1,814 people in 2019, an average of five people per day. Shootings involving police were approximately four times more likely to result in death than shootings just between civilians (Andreoni et al., 2020; BBC News, 2020). Fig. 1 shows the prevalence and lethality of shootings in 2019. While there were more than double the amount of shootings involving just civilians than those involving the police, they were far less lethal. Panels 1a and 1c indicate that 10.5% of the shootings between civilians resulted in the death of a civilian, whereas 40.4% of shootings involving police resulted in the death of a civilian, shown in panels 1b and 1d. Of the 908 civilians killed in police-related shootings, shown in panel 1d, 387 (42.6%) were killed during police raids (Rede de Observatório de Segurança, 2020).

#### 3.2. The limit on deadly police raids

The reform that eventually limited police use of force was spurred by two important factors in early 2020: the arrival of Covid-19 and subsequent lockdowns, and the police assassination of an innocent boy, João Pedro.

The arrival of Covid-19 imposed immediate constraints on the police. Around 8–10% of the police force contracted Covid-19 early in March (ISTÓE, 2020) yet violent crime did not appear to decrease, despite the stay-at-home restrictions (Bullock & Pellegrino, 2021; Monteiro, 2020). Despite their reduced capacity,

the police continued to conduct raids. Activists argued that police raids -- controversial even during regular times -- became even more dangerous for *favela* residents as more people stayed home due to Covid-19.

These fears were realized when police shot and killed a 14-year-old boy, João Pedro, in a police scandal that swept the nation. During a raid, police erroneously stormed João Pedro's house in search of drug traffickers and began shooting. The police then took the body with them for more than 48 hours, neglecting to inform his family and violating protocols about tampering with forensic evidence (Phillips, 2020). While not the first police raid to result in civilian casualties during the coronavirus lockdowns,<sup>5</sup> the João Pedro incident was the first to become known, receive widespread media coverage<sup>6</sup> and generate a strong negative reaction from the public, which are the requisite elements in order to turn a scandal into an opportunity for police reform, according to González (2020).

Political leaders had no choice but to respond to the scandal.<sup>7</sup> The day after the assassination, the Governor – an unlikely candidate to restrain the police, given his hard-on-crime platform – held the first of several meetings about police raids during the pandemic. On the same day, the Rio de Janeiro Public Prosecutor's Office sent a petition to the Federal Police requesting that police conduct raids only in the case of “extreme urgency” (Alves, 2020). Six days later, the Governor announced that police raids would not be held during Covid-19 related humanitarian relief in favelas, and one week later, a Supreme Court Justice extended the ban further, issuing an injunction prohibiting police raids in the state of Rio de Janeiro for the remainder of the pandemic.<sup>8</sup> The injunction banned all raids except those in cases that were deemed “absolutely exceptional.” It further laid out an internal oversight protocol where precincts attempting to conduct “exceptional” raids had to submit a written justification detailing how the raids would not reach bystanders for approval by the Public Prosecutor's Office.

There are three details to note from this series of events that matter for measurement. First, that the limit was enacted at all is historic and significant. This is one of a few state and federal interventions in the history of public security policy in Brazil aimed to limit policing power and resources. Second, since the reforms of interest in this paper are those that limit raids, I define the beginning of the limit as the day after João Pedro's assassination when the temporary pause on raids was enacted. Third, the limit on police raids does not place limits on any type of police actions related to ordinary policing, and officers were still free to use force while ordinary policing. For this reason, this paper conceptualizes the reform as a “limit on police use of force” rather than a retreat or absence of state forces. Following the limit, the police were still present and patrolling, but prevented from using their most violent policing tactic.

### 4. Data

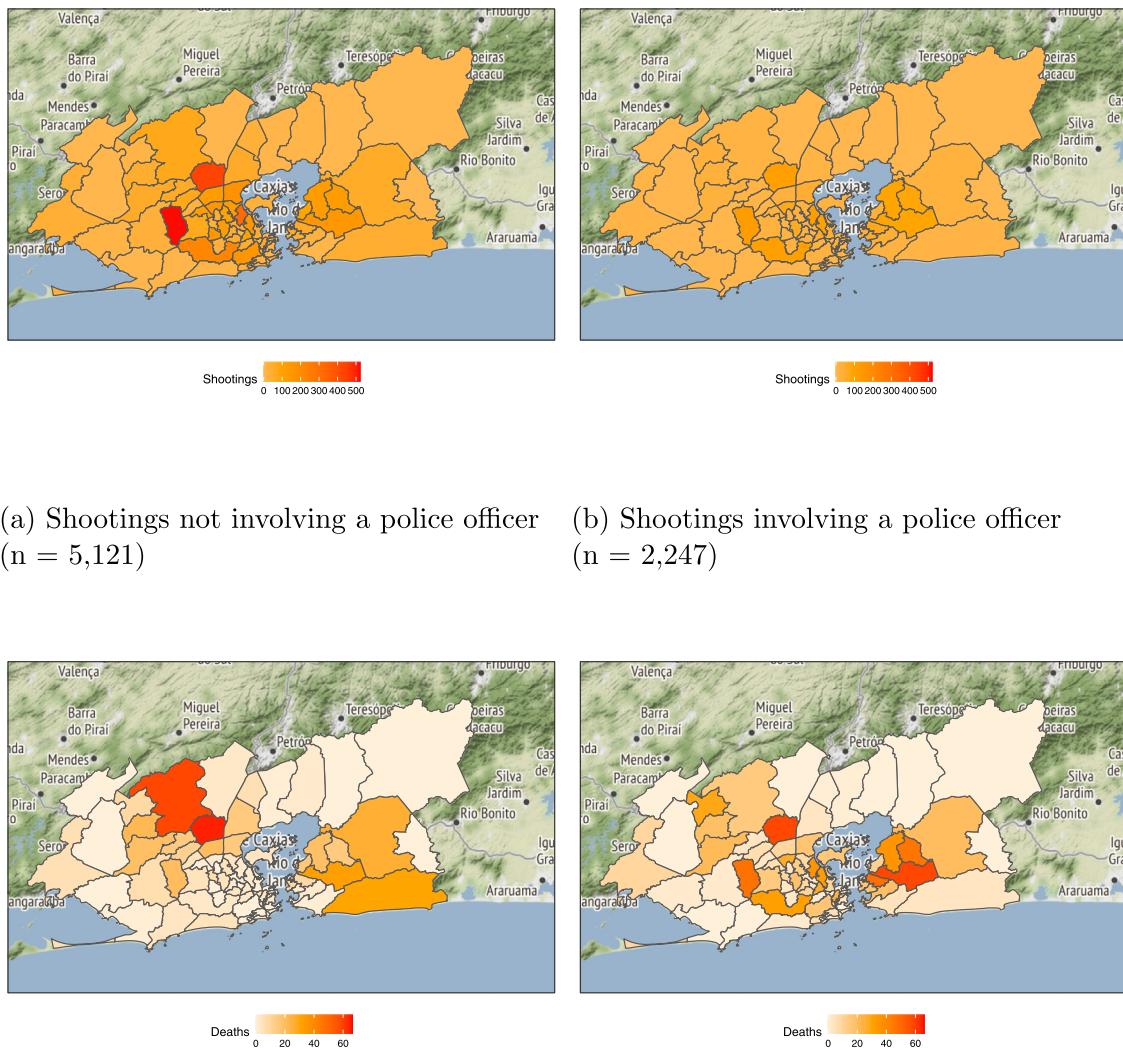
This project uses two primary data sources to measure the impact of the limit on violence in the Rio de Janeiro metropolitan area. The first database contains official police reports, obtained from the Public Safety Institute (ISP). ISP reports daily statistics for all crimes at the police precinct level. I look at their daily mea-

<sup>5</sup> Just three days prior, on May 15, one of the largest recorded police massacres occurred in the Complexo de Alemão favela, leaving 13 civilian casualties (Ruge & Lima, 2020).

<sup>6</sup> See Appendix A.1 for Google trends data documenting media coverage.

<sup>7</sup> See Appendix A.1 for a detailed timeline of the events described in this paragraph.

<sup>8</sup> The injunction argued that primary reasons for banning police raids during Covid-19 were related to community public health and human rights protections in favelas. The injunction made specific reference to the João Pedro case. Full text is available in Portuguese here: <http://www.stf.jus.br/arquivo/cms/noticiaNoticiaStf/anexo/ADPF635DECISA05DEJUNHODE20202.pdf>.



**Fig. 1.** Total shootings and deaths resulting from shootings registered in the Rio de Janeiro Metropolitan Area in 2019, by police presence. *Notes:* All shootings and deaths are geocoded to the police precinct (*delegacia*) level for the 2019 year. 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. Source: Fogo Cruzado.

sure of police killings for my first hypothesis, and then consider other types of violent and non-violent crimes for my second hypothesis, looking at daily precinct-level totals for homicides, robberies, theft, and extortion.

The second source is the Fogo Cruzado<sup>9</sup> 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 non-profit. Favela residents use their cell phone application to receive push notifications warning them if a shooting is happening close to them, or to report a nearby incident. Fogo Cruzado publishes the geolocation of all verified shootings and relevant covariates, accessible through their public API. Shootings submitted to Fogo Cruzado are not published immediately; the data team first corroborates them with verified sources (press, community leaders, and

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 raid, etc.) are added to the shooting once verified by their sources. The verification process helps to assuage concerns about reporting bias and the quality of the data. Since the Fogo Cruzado data is geolocated, I aggregate the daily number of shootings to the police precinct level so that the unit of analysis 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 act of police aggression 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 police violence. The Fogo Cruzado data is a useful complement since it measures shootings across the metropolitan area. It includes

<sup>9</sup> In English, "Cross Fire."

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 raids, 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 the result of a police raid versus ordinary policing. Taken together, the ISP and Fogo Cruzado data paint a clear picture of violence across the Rio de Janeiro metropolitan area.

## 5. Empirical strategy

I use an interrupted time series analysis to estimate the causal effect of the limit on police raids on police and civilian violence in Rio de Janeiro. This takes the form of a regression discontinuity design where time is the running variable (Hausman & Rapson, 2018). The design has yielded estimates close to experimental benchmarks (St.Clair, Cook, & Hallberg, 2014) and is increasingly used in high-frequency studies on crime and policing (Carr & Packham, 2020; Jassal, 2020; Lovett & Xue, 2022; Mummolo, 2017). The high frequency of measurement allows me to isolate the specific day on which the state 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.

For my dependent variables, I use 2020 daily data on reported crimes and shootings at the police precinct level in the greater Rio de Janeiro metropolitan area, from ISP and Fogo Cruzado, respectively. I look at the change in police killings, shooting-related violence, and other crimes on and after May 19, 2020, the day after João Pedro's assassination when the Governor began informally restricting the police force. 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 dependency on any particular modeling decisions, I estimate models using a triangular weighting kernel to calculate the MSE-minimizing "optimal" bandwidth (Calonico, Cattaneo, & Titiunik, 2014) and using a fixed narrower bandwidth of 30 days, both around the cutpoint of May 19. The specification is as follows, for police precinct  $i$  and day  $t$ :

$$Y_{it} = \beta Limit_t + f(days_t) + \lambda_d + \gamma_m + \pi_i + u_{it} \quad (1)$$

where  $Y_{it}$  represents the main outcome variables of interest: the number of police killings, the share of shootings with a police officer present, and the number of homicides or other crimes committed.  $Limit_t$  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.<sup>10</sup> To account for the seasonality of crime, I include day of the week fixed effects ( $\lambda_d$ ) and monthly fixed effects ( $\gamma_m$ ), as well as police precinct-level fixed effects ( $\pi_i$ ). There are 73 precincts in the greater metropolitan area covered by both Fogo Cruzado and ISP. The coefficient of interest,  $\beta$ , captures the effect of the limit on police raids on the outcomes after adjusting for precinct-level or daily fluctuations in crime. I estimate precinct-level clustered standard errors to adjust for within-precinct heteroskedasticity and serial correlation.

<sup>10</sup> I write the full model specifications in Appendix A.2.

## 6. Results

This section explores the effect of limiting police raids on violence, first by showing that restricting police raids led to large decreases in police violence in Section 6.1. I then show that limiting police raids led to a decrease in civilian violence, while not appearing to affect other types of non-violent crime in Section 6.2. Section 6.3 presents a variety of robustness checks and Section 6.4 looks at heterogeneous effects.

### 6.1. Did the limit on police raids decrease police violence?

Fig. 2 shows that police killings and shootings plummeted following the limit on police raids. Panel A shows that daily police killings stayed constant throughout Covid-19 lockdowns in March through May, but they quickly approached zero following João Pedro's assassination. Panel B shows the daily share of shootings where a police officer was present, which also plummeted. 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 shootings (denominator) decreased, but the number of total shootings decreased by more, indicating that there was also a drop in shootings not involving police.<sup>11</sup> The raw data in panels C and D suggest that the decrease in share of shootings involving police (panel B) is not driven by increases in non-police shootings that could have mechanically produced the same result.

Table 1 presents a variety of formal tests estimating how much police use of force decreased following the limit on raids. The models presented in this table show three different functional forms of Eq. 1: a linear, quadratic, and cubic fit for two different bandwidths: the fixed 30-day "narrow" bandwidth and the "optimal" bandwidth defined by the procedure in Calonico et al. (2014). Results indicate that police killings plummeted regardless of specification or window. The range in point estimates represents a decrease in police killings of 66%-100% immediately after the government began limiting police raids.<sup>12</sup> The proportion of shootings involving police is also negative and statistically significant regardless of model specification, representing a decrease in the share of police present at shootings per precinct of 50%-83%.<sup>13</sup>

A closer look at the Fogo Cruzado data reveals that the limit on police raids decreased police shootings and made shootings less lethal. Table 2 reports linear specifications for three outcomes: the daily number of shootings, injuries, and deaths from shootings per precinct. Panel A considers the sample of all shootings (the denominator in Fig. 2). Shootings decreased by at least 28%, and injuries and deaths from shootings by at least 63% and 60%, respectively.<sup>14</sup> Panel B restricts the sample to just shootings involving police. The limit appears to have effectively constrained police behavior; police shootings decreased by 57% and injuries and deaths from shootings decreased by 61% and 76%, respectively.<sup>15</sup>

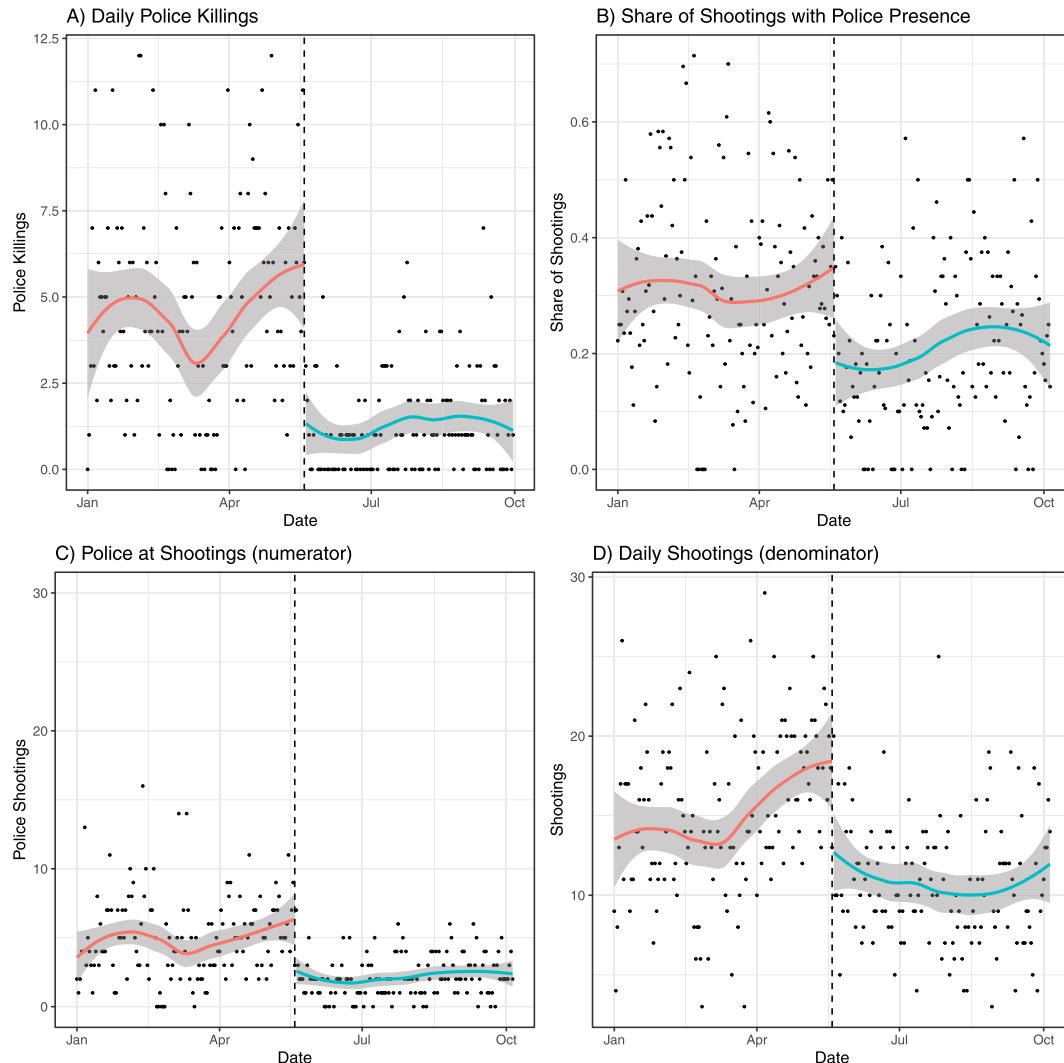
<sup>11</sup> This conceptualization and visual representation draws from Mummolo (2017).

<sup>12</sup> The mean number of daily police killings per precinct in the 30 days prior was 0.077.

<sup>13</sup> The mean daily rate of shootings involving police per precinct in the 30 days prior was 0.058.

<sup>14</sup> The minimum percent change for all three outcomes corresponds to the coefficients with the 30-day narrow bandwidth. In the 30 days prior to limiting police use of force the mean daily number of shootings, injuries, and deaths from shootings was 0.251, 0.044, and 0.049, respectively.

<sup>15</sup> The minimum percent change for all three outcomes corresponds to the coefficients with the 30-day narrow bandwidth. In the 30 days prior to limiting police use of force the mean daily number of police shootings, injuries, and deaths from police shootings was 0.081, 0.043 and 0.041, respectively.



**Fig. 2.** Police involvement in violent events. Notes: 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.

Despite new limits on use of force during raids, it does not appear that police were substituting tactics and increasing use of force elsewhere. Panel C of Table 2 shows that police use of force during ordinary policing did not increase. I leverage Fogo Cruzado's detailed event tagging system to analyze all police shootings with the motive labeled as "ordinary policing" and drop all police raid-related shootings.<sup>16</sup> The limit on police raids did not increase shooting-related violence and may have led to a 46% decrease in shootings during ordinary policing and up to 100% decrease in injuries from shootings, but these results are sensitive to the bandwidth and model specification.<sup>17</sup>

A close look at shootings in Fig. 3 provides clear visual evidence that the limit changed police behavior, yet there was no apparent substitution effect. Though shootings during raids plummeted,

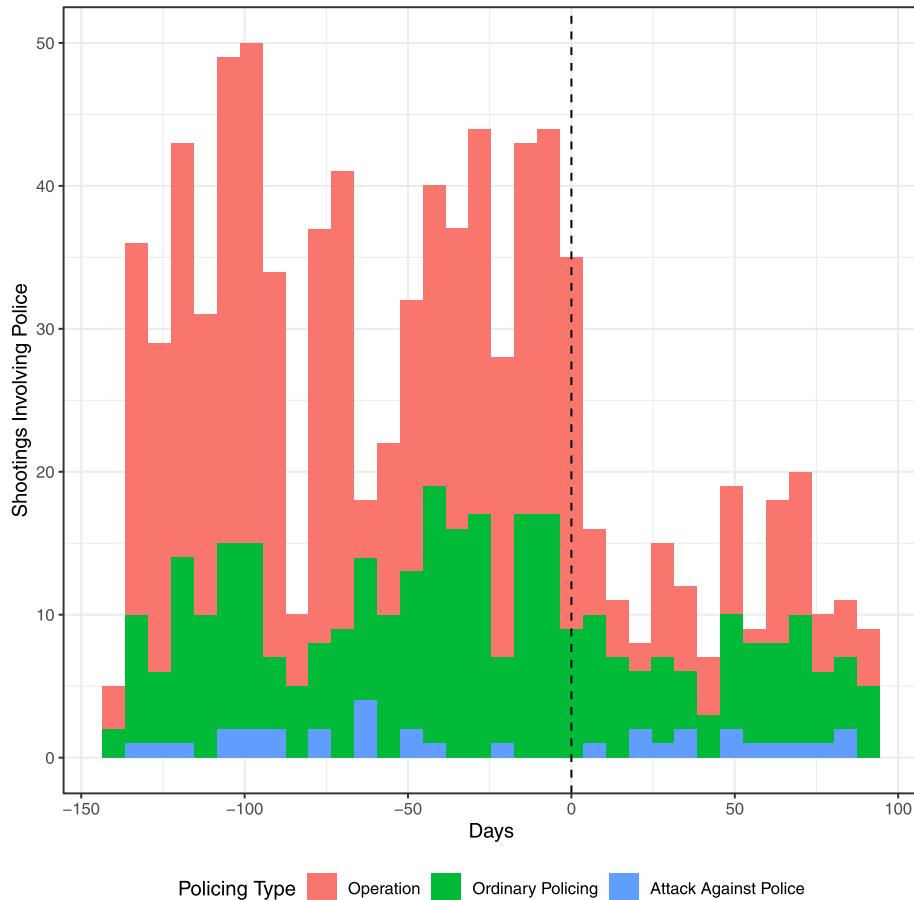
shootings during ordinary policing appear unchanged during the post-period, and may have also slightly decreased. Fig. 3 also provides evidence that police still were shooting following the limit on raids, and that the limit should not be equated with the disappearance of the police force. A key takeaway from Table 2 and Fig. 3 is that the institutional constraints limiting police raids did appear to effectively lower police use of force without leading to unintended consequences during ordinary policing.

Taken together, these findings suggest that the policy reform limiting police raids had large, immediate effects on the levels of police use of force. Research institutes note that the limit on raids led to an unprecedented drop in police use of lethal force (Monteiro, Fagundes, & Chaves, 2020; Hirata et al., 2021) and dozens of journalists, activists, and researchers participating in a Supreme Court hearing ten months later vociferously pushed for a permanent ban on police raids as a pathway to long-term violence reduction (Fogo Cruzado, 2021). Watchdog organizations observed some, but not many, violations of the limit in the months following, noting that the police had reasonably high compliance with the internal oversight protocol involving Public Prosecutor's

<sup>16</sup> In the Fogo Cruzado database, each shooting is tagged with a primary and secondary motive (*motivo principal* and *motivo complementar*). This sample in Panel C excludes all shootings not involving police as well as shootings involving police tagged with the motive *operação policial*.

<sup>17</sup> The mean daily number of ordinary policing shootings and injuries from them in the 86 and 66 days prior to the limit was, 0.039 and 0.019, respectively.





**Fig. 3.** Shooting events involving police, by type of policing. Notes: 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 raids 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*”.

Office and that few petitions for “exceptional circumstances” to justify raids were filed (Hirata et al., 2021; Silva Pacheco, 2022). That police violence during ordinary policing and the petitions for “exceptional circumstances” did not skyrocket during this time provides further evidence that the limit on police raids was an effective institutional constraint, ultimately leading to lower levels of police violence.

#### 6.2. Did the limit on police use of force decrease civilian violence?

In addition to tying the hands of police, the limit on police raids led to a decrease in homicides and no change in other crimes. Fig. 4 shows that the most violent of crimes, homicide, precipitously decreased following the limit on raids. Property crimes, both violent (robbery) and non-violent (theft) did not appear to change, along with extortion, another crime commonly associated with Rio de Janeiro’s criminal groups. While robberies, theft, and extortion were already at relatively low levels due to social distancing measures during Covid-19 (this drop is visible on the left side of Panels B, C, and D), the limit on police raids does not appear to have led to more delinquency in the narrow time interval considered.

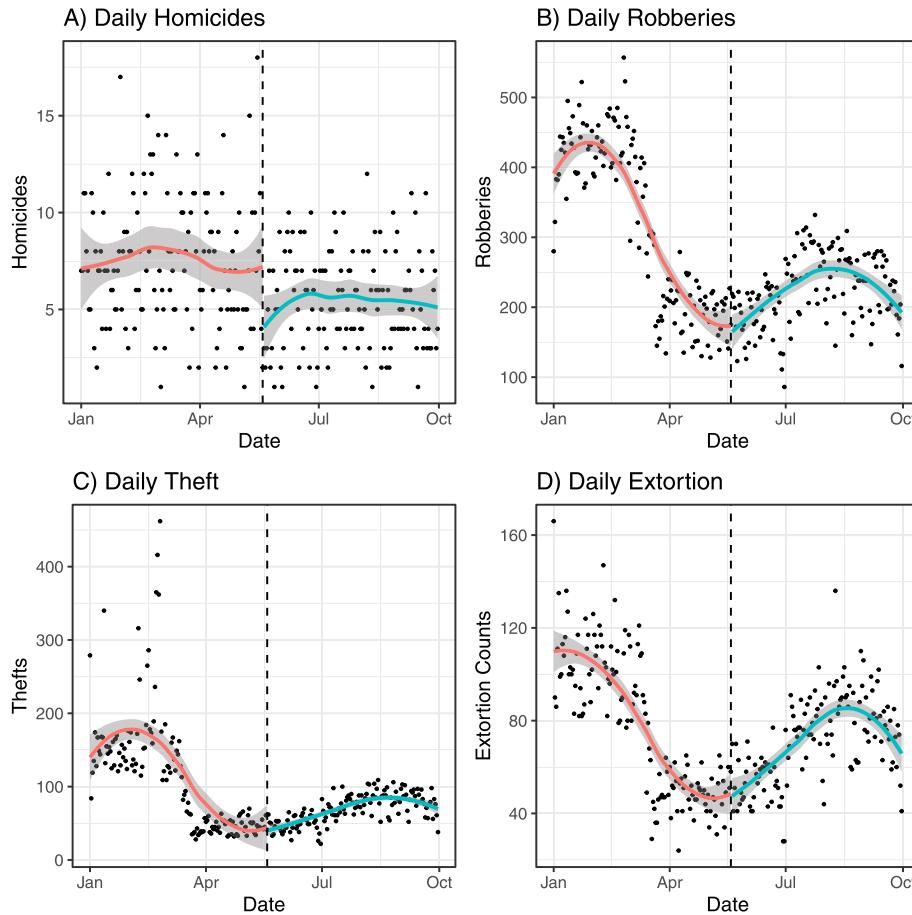
My estimates suggest that homicides fell by at least 58% while other crimes experienced no changes from their early pandemic levels. To estimate the effects of the limit on police raids on homicides, robberies, theft, and extortion, I estimate linear, quadratic, and cubic specifications of Eq. 1 in Table 3 for both the optimal and the narrow bandwidth. The most conservative estimate indi-

cates that homicides decreased by 58% following the limit on police raids, showing an expressive decrease from a pre-period mean of 0.094 homicides per precinct per day. For all other crimes, no point estimates are robust across time frames or model specifications to be statistically distinguishable from zero.

What is responsible for the decline in homicides? Evidence consistent with my proposed mechanism would show that the decline in homicides was largely driven by decreases in criminal conflict. This could be because of the slowing territorial diffusion of conflict, because the criminal groups are better able to predict (and thus prevent) conflict, or both. I take a closer look at the change in homicides within a subset of precincts that had high pre-treatment levels of criminal conflict. As a proxy for high levels of criminal conflict, I consider the 19 precincts (25% of the total) with the highest pre-treatment incidence of violence and drug trafficking from the year prior (2019).<sup>18</sup> I focus on the subset of precincts with high pre-treatment violent and drug-related crime levels rather than the precincts with high pre-treatment levels of police raids to mitigate concerns that the police selectively target their raids. Results consistent with my proposed mechanisms would reveal that these high-crime precincts experienced the most significant declines in violence.

Estimates from Table 4 show that precincts with high pre-treatment levels of violence and drug-related crime were driving the decreases in homicides following the limit on police raids.

<sup>18</sup> See Appendix A.3 for more details on this sample.



**Fig. 4.** Violent and non-violent crime after the limit on police raids. Notes: 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 *extorsões*), 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.

These precincts faced the most staggering declines in homicides following the limit, despite the fact that the pre-period mean number of homicides in these 19 precincts was nearly double that of the full sample.<sup>19</sup> The most conservative model in Table 4, model 2, indicates that homicides decreased by 54%, and the average decrease calculated across all six models indicates that homicides decreased by 73%. Despite the smaller sample size and number of precincts, estimates are consistent in sign, magnitude, and statistical significance, across bandwidths and specifications.

Qualitative evidence supports the story that the limit on police raids lowered criminal conflict. One notable location where this occurred is Complexo da Maré, a massive complex of 16 favelas dominated by rival criminal groups that is subject to frequent raids (Barnes, 2021). In Maré, there was a 59% decrease in raids following the limit, accompanied by a 58% decrease in homicides, consistent with the above estimates (Redes da Maré, 2020).<sup>20</sup> Various reports suggest that the decline in raids may have slowed Maré's territorial diffusion of conflict and made it more predictable. Prior to the limit, clashes over the "border region" territory in Maré were a near-daily occurrence, and redrawing of criminal borders occasionally followed a raid that weakened one group more than the others.

A neighborhood watchdog organization notes that criminal boundaries and conflict stayed in a steady state following the limit on raids (Redes da Maré, 2020). That no conflict escalated or borders were redrawn – despite reduced police presence in the area – lends support to the territorial diffusion of conflict mechanism. Other organizations collected evidence of criminal groups doing other tasks rather than fight police, including putting up roadblocks to fortify their territory (Sampaio, 2021) or enforcing Covid-19 curfews (Moraes, Moreira, & Gaier, 2020). Redes da Maré, 2020 also provides documentation showing that routine border spats became less lethal, lending supporting evidence to the predictability of conflict mechanism. While criminal conflict did not disappear, the decline in surprise raids allowed rival groups in close proximity to better predict when and where they would need to use violence, and try to minimize losses.

### 6.3. Robustness

I check the robustness of these findings by conducting various tests, all reported in Appendix B. Tables B1–B6 show that the main results are robust when the dependent variables are logged or modeled as a Poisson regression, since homicides and police killings are count data. Figs. B1–B4 present plots of the estimated treatment effects for all dependent variables that vary both the bandwidth and functional form. I report alternate versions of Table 2 with quadratic and cubic specifications in Tables B7–B8. I

<sup>19</sup> The mean number of homicides per precinct in the 30 days prior to limiting police use of force was 0.177.

<sup>20</sup> Complexo da Maré is located in the 22nd police precinct. The most conservative difference in means for various windows shows that homicides decreased by at least 58% following the limit.







civilian violence as the number of raids plummeted. Both police and civilian violence stayed unusually low until October 2020, when 49 raids were conducted in a single month and police killings crested to exceed monthly pre-pandemic levels (Hirata et al., 2021). During this fifth month of the Supreme Court's active ban on raids, police increased petitioning for more raids through the "exceptional circumstances" loophole, and began conducting raids without petitioning at all, blatantly flouting the law (Fogo Cruzado, 2021). In 2021, police killings and the number of monthly raids increased above pre-pandemic levels, despite the Supreme Court ban still being in place.

What explains why the limit was short-lived? The eventual noncompliance with the limit on raids underscores the political difficulties of police reform. One possible interpretation of the sequence of events is that the limit was an attempt by the Governor Wilson Witzel to consolidate political power, yet noncompliance increased as his power waned. Shortly after the limit on police raids, Witzel came under investigation for a procurement scandal related to Covid-19 supplies, and was eventually suspended and impeached (Viga Gaier, 2020). As Witzel came under more public scrutiny in August, September, and October, it is possible that the police sensed political weakness and stopped complying with the limit on raids. Another possible interpretation is that the internal oversight protocol were never spelled out well enough, and judicial motivation to enforce the Supreme Court's limit faded over time. A prosecutor explained that they had limited technical capacity and training to evaluate whether or not a raid qualified as exceptional circumstances, and recalled a point in time when "the key turned" and a judges' approval became little more than a rubber stamp.<sup>24</sup> A final possible interpretation is that the new governor hoped to benefit politically from not enforcing the ban, even though it was still in place at the federal level. Witzel's replacement, Claudio Castro, was quickly sworn in around the time of the increase in raids, and being hard on crime may have seemed like a safer electoral strategy. As Castro's 2022 reelection campaign draws near, his behavior has been consistent with (Holland, 2013) predictions for risk-averse right-wing candidates that favor punitive policing over reforms that could open the door to blame. Any of these possible interpretations highlight how violence-reducing police reforms can be derailed by policymakers' individual incentives.

One of the more surprising findings is that violence between civilians, largely driven by organized crime, declined following the short-term limit on police raids. One possible concern that many politicians share about restraining the police is that criminal organizations grow stronger when one does not fight violence with a "brute force approach" (Kleiman, 2009). The findings from this paper push back against that idea and suggest instead that *fighting violence with restraint* may be a more promising tactic. That we observe decreases in homicides in Rio de Janeiro, a context where organized crime is heavily armed and prone to violence, is especially promising. One important limitation to this study and urgent direction for future research is in understanding the medium- and long-term consequences of limiting aggressive policing.

Yet there are crucial lessons to learn from this short-lived attempt to limit police violence about police reform. 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 controlling crime by using violence. Though neither a panacea nor a viable long-term crime-fighting strategy when taken alone, the short-term limit could be more politically attainable than large, structural reforms, and kickstart the process of institutional change. At a minimum, restricting the most lethal

kinds of police tactics *does no harm*. In Rio de Janeiro, the brief months when the limit on raids was enforced has had an outsized impact on human rights groups' and journalists' messaging about police reform. Though police killings are high again, they herald the ban on police raids as a policy goal and are pushing the Supreme Court for a permanent ban (Fogo Cruzado, 2021), though are highly critical of the Public Prosecutor's lack of specificity in defining what qualifies as "exceptional circumstances" (Silva Pacheco, 2022). Rio de Janeiro's experience bears critical lessons for debates in other contexts, especially those in the Americas that have been reluctant to rein in the police despite little progress with the "fight violence with violence" approach. Such findings demand renewed attention from policymakers wishing to minimize the damages from policies aimed to control organized crime.

## Acknowledgements

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## Appendix A. Notes on context, data, and model specification

### A.1. The João Pedro scandal

Immediately following the police raid that led to the disappearance of João Pedro's body from his home, local activists mobilized mass public calls for action that flooded 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 Fig. A1. 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. A detailed timeline of João Pedro's assassination, a related act of police violence, and the limitations on police use of force enacted by the Governor, Public Prosecutor's office, and Supreme Court, are shown in Fig. A2.

### A.2. Model specification

The treatment effects from the main model, Eq. 1, were estimated using ordinary least squares regression. For each outcome, I estimated a linear, quadratic, and cubic function, represented by  $f(days_t)$  where  $days_t$  indicated the number of days since May 19, the day that Governor Witzel began limiting police raids. The coefficient of interest is  $\beta_1$ . The full model for each is reported below.

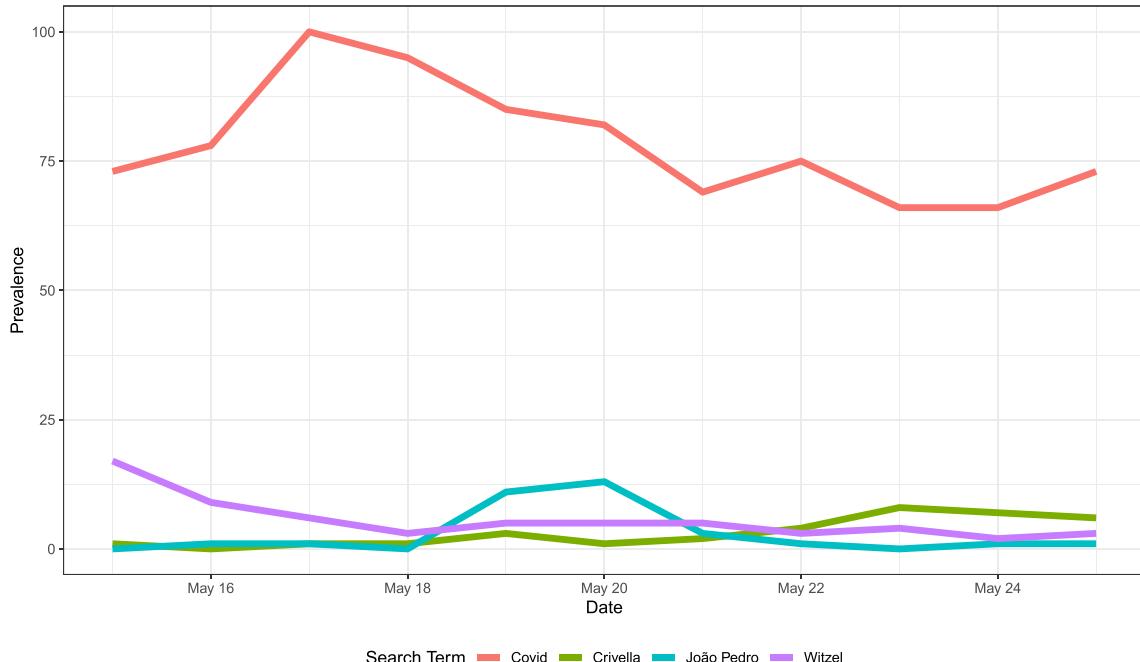
#### Linear:

$$Y_{it} = \beta_1 Limit_t + \beta_2 days_t + \beta_3 (Limit_t \times days_t) + \lambda_d + \gamma_m + \pi_i + u_{it}$$

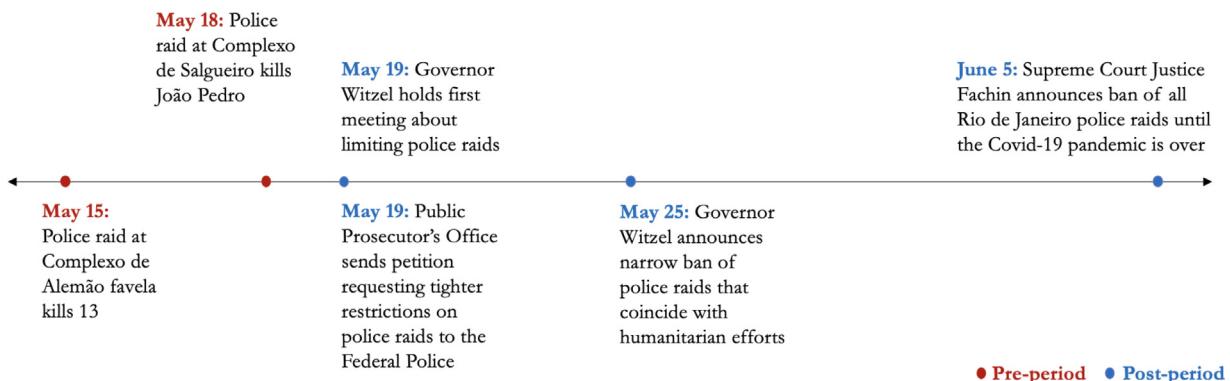
#### Quadratic:

$$Y_{it} = \beta_1 Limit_t + \beta_2 days_t + \beta_3 (Limit_t \times days_t) + \beta_4 days_t^2 + \beta_5 (Limit_t \times days_t^2) + \lambda_d + \gamma_m + \pi_i + u_{it}$$

<sup>24</sup> Author's interview, February 2021.



**Fig. A1.** Google search trends during the João Pedro scandal. Notes: 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.



**Fig. A2.** Timeline of key events related to the limit on police raids.

### Cubic:

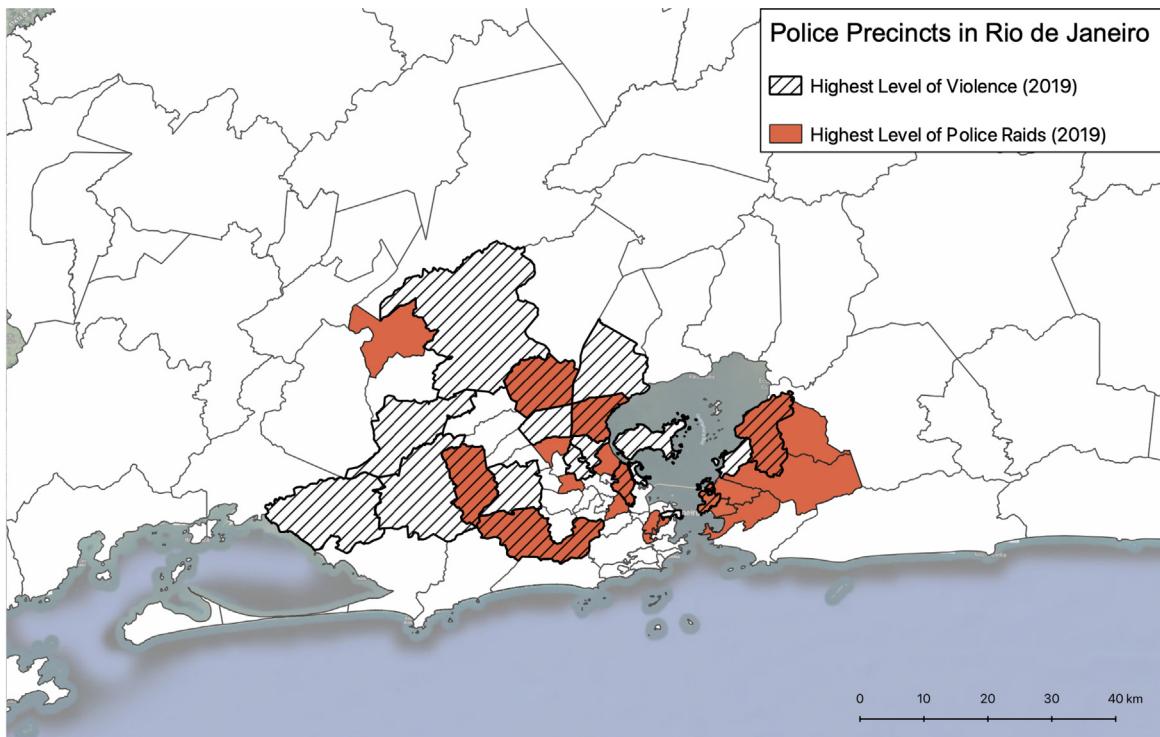
$$\begin{aligned}
 Y_{it} = & \beta_1 \text{Limit}_t + \beta_2 \text{days}_t + \beta_3 (\text{Limit}_t \times \text{days}_t) + \beta_4 \text{days}_t^2 + \beta_5 (\text{Limit}_t \\
 & \times \text{days}_t^2) + \\
 & \beta_6 \text{days}_t^3 + \beta_7 (\text{Limit}_t \times \text{days}_t^3) + \lambda_d + \gamma_m + \pi_i + u_{it}
 \end{aligned}$$

I further calculate various bandwidths to reduce model dependence for each treatment effect. I calculate the “optimal” bandwidth in Calonico et al. (2014) and accompanying bias-corrected clustered standard errors using the `rdrobust` R package. I also report results using a narrower fixed bandwidth of 30 days that focuses on the short-term, immediate treatment effects in order to eliminate concerns about relying on observations far from the treatment date.

### A.3. Precincts with high levels of criminal conflict

An analysis in Section 6.2 considers how crime changed in the precincts with the highest ex ante levels of criminal conflict, which I define as the quartile of precincts (the top 19 out of 73) that registers the highest incidence of violence and drug-related crimes in 2019, according to ISP police reports. ISP reports an index of violent crime (“CVLI”) that includes homicides, violent but not lethal crime, and violent property crime (robbery) that I use in calculating this threshold. Results are reported in the main body of the text in Table 4. These 19 precincts in the top quartile are, with name and number:

(5) Mem de Sá, (21) Bonsucesso, (27) Vicente de Carvalho, (32) Taquara, (33) Realengo, (34) Bangu, (35) Campo Grande, (36) Santa Cruz, (37) Ilha do Governador, (38) Braz de Pina, (54) Bel-



**Fig. A3.** Precincts with high levels of criminal conflict and high propensity to be raided. Notes: This figure shows the 19 precincts analyzed in Table 4, those registering the highest ex ante level of violence (2019), contrasted with those that registered the highest ex ante level of raids (2019). Seven of the 19 (9.5% of all precincts) are in the top quartile for both high levels of violence and most likely to receive police raids.

ford Roxo, (56) Comendador Soares, (58) Posse, (59) Duque de Caxias, (60) Campos Elíseos, (64) Vilar dos Teles, (72) São Gonçalo, (73) Neves, (76) Niterói – Centro.

I use 2019 crime reports to identify these precincts that have high underlying organized crime-related incidents, even though they are not necessarily the precincts most likely to be targeted with a police raid. Fig. A3 shows a map of the precincts in the greater Rio de Janeiro Metropolitan area, highlighting (1) the 25% of precincts with the highest levels of violence and drug trafficking crimes in 2019, reported in Table 4, contrasted with (2) the 25% of precincts with the highest number of raids in 2019. Fig. A3 shows that higher levels of criminal conflict is only weakly correlated with receiving more police raids. Only seven precincts are in the top quartile for both violence levels and level of police raids. The takeaway is that violence decreased dramatically in precincts with high levels of criminal conflict, even those that were relatively less likely to be recipients of raids.

#### A.4. Precincts with differential treatment by police officers

The analysis in Section 6.4 considers how crime changed in precincts that are treated differently by police officers. Though not documented in official records, it is well documented by journalists and researchers that police are more likely to raid favelas controlled by drug trafficking organizations, less likely to raid favelas controlled by *milícias*, and more likely to patrol and closely monitor favelas in the *Zona Sul* part of the city, close to wealthy residential, commercial, and touristic areas. To consider how limiting raids affected these different types of areas, I classify precincts as (1) precincts that encompass favelas dominated by at least two drug trafficking organizations, (2) precincts with only a *milícia* presence, and (3) precincts in the wealthy *Zona Sul* neighborhoods. 56% of all precincts (41) are in one of the three categories. To classify pre-

cincts, I use the map of armed groups created by NEV-USP researchers in collaboration with Fogo Cruzado (accessible here). Tables B13–B18 report results for each of the following three samples of precincts, with name and number:

##### Precincts with at least two different drug trafficking groups:

(6) Cidade Nova, (21) Bonsucesso, (31) Ricardo Albuquerque, (34) Bangu, (37) Ilha do Governador, (38) Braz de Pina, (39) Pavuna, (50) Itaguaí, (54) Belford Roxo, (56) Comendador Soares, (59) Duque de Caxias, (60) Campos Elíseos, (64) Vilar dos Teles, (71) Itaboraí, (74) Alcântara, (78) Fonseca.

**Milícia-only precincts:** (16) Barra da Tijuca, (28) Campinho, (32) Taquara, (35) Campo Grande, (36) Santa Cruz, (41) Tanque, (43) Pedra de Guaratiba, (48) Seropédica

**Zona Sul-only precincts:** (9) Catete, (10) Botafogo, (11) Rocinha, (12) Copacabana, (13) Ipanema, (14) Leblon, (15) Gávea

## Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.worlddev.2022.105961>. Replication files can be found at <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/2Z5E9W>.

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