# Cooperation between National Armies: Evidence from the Sahel borders*

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**Abstract**

The effectiveness of security operations often depends on cooperation between national armies. Such cooperation can be particularly important when international borders are porous and armed groups can operate across borders. We investigate how the creation of an international armed force that could operate across international borders (the G5-Sahel Joint Force) together with improved communication between national armies affected conflict dynamics in the Sahel region. Relying on a regression discontinuity design, we find that the G5 mission lowered the intensity of conflict locally in its zone of operation, especially along border segments more porous due to their geographical features or ethnic composition. Further analysis of geographical conflict propagation patterns indicates that the G5-Sahel force facilitated security operations in border areas.

**Keywords**: Counterinsurgency, Civil Conflict, Borders, Cooperation

**JEL Classification**: D72, D74, L23

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# 1 Introduction

Borderlands tend to concentrate violence: in 2023, 18.7% of recorded violent events occurred within 50 kilometers of an international land border, despite these areas accounting for only 5.8% of the world's population.[1] Border areas are more prone to violence due to their distinctive political and economic peripheral situations. International borders, whether coinciding with ethnic boundaries, or splitting ethnic groups between different countries (Michalopoulos and Papaioannou, 2016), materialise points of contact between state and non-state actors with potentially diverging interest (Mueller et al., 2022). Beyond these factors, the discontinuity in state authority at international borders can itself generate conflict dynamics. Security operations are often constrained by international borders. Different countries may not share the same interests in conflicts, and armed groups can use neighboring territories as a safe haven. Such safe havens have emerged along the border between Afghanistan and Pakistan, or the one between Venezuela and Colombia (Martínez, 2017). Even if the interests of neighboring countries are broadly aligned, armed groups could exploit frictions in information-sharing between neighbors, legal constraints on armed forces crossing borders, or a failure to internalise the displacement of conflict across borders. Since 1945, more than 55% of insurgencies have operated across international borders (Cunningham et al., 2013).

The ongoing jihadist conflict in the Sahel clearly illustrates these frictions. This conflict spans several West-African nations and is most intense around the region's porous borders. Particularly, the three-border region, where Mali, Niger, and Burkina Faso converge without distinct physical demarcation, has become the focal point of most violence in the Sahel. The threat of jihadist groups finding a safe haven in these areas motivated the intervention and support from Western countries, most notably France, which spent

[1] Source: Authors' own calculations based on ACLED data. Similarly, 31% of recorded violent events in 2023 occurred within 10 km of an international land border, despite these regions accounting for only 23% of the world population

around 600 million euros per year on its Barkhane mission (2014-2022).[2] In addition to these international forces, all major West-African national armies have been heavily involved in the fight against jihadist groups. Overall, these efforts have failed to contain the proliferation of violence from Mali to neighboring countries - and the coordination problems between actors could have been a key constraint. Our study demonstrates that cooperation between national armies in the Sahel region made security operations locally more effective, especially along most porous border segments.

We focus in particular on the creation of a multi-national military force that could cross international borders, known as the 'G5 Sahel' Joint Force. Launched in 2017, this force has prioritized operations in the tri-border region of Mali, Niger, and Burkina Faso. Its primary mandate was to combat terrorism, trans-border crime, and human trafficking.[3] Comprising 5,400 personnel from the national armies of Mali, Burkina Faso, Niger, Mauritania, and Chad, the Joint Force conducted regular border patrols as well as joint and coordinated cross-border operations.

The G5 Sahel mission was created to solve legal constraints on operations in border areas and may have improved communication between national armies, reducing asymmetry in cross-border mobility between armed groups and national armies. In addition, it may have led to an internalization of the externalities that characterize security provision in border areas, leading to increased troop levels and activities. The Joint Force could also have created new coordination challenges between army units, but if the benefits of cooperation outweighed the frictions, the G5-Sahel force should have boosted military capacity and enforcement at the borders. And we could expect that such increased enforcement by security forces would reduce the violence committed by armed groups. The paper describes how this logic can be captured by a simple sequential model.

[2]Le Monde, 30 June 2017, https://www.lemonde.fr/afrique/article/2017/06/30/macron-et-le-sahel-c-est-par-ou-la-sortie_5153480_3212.html

[3]Additionally, the Joint Force was tasked with supporting the restoration of state authority and the implementation of development projects and humanitarian operations

Relying on data from the Armed Conflict Location and Event Database (ACLED), we assess the effect of the introduction of the G5 Joint Force on the basis of two empirical exercises. First, we exploit the limitation of the zone of operation of the G5 Joint Force to a 50 kilometer bandwidth around the concerned borders. Using a regression discontinuity around the zone of operation, we show that conflict is less intense where the G5 mission is active. We observe less violence initiated by jihadist groups (in particular against civilians), and less violence initiated by security forces against ethnic militia. As the mandate of the G5 Joint Force was restricted to combating jihadist groups, these results suggest that the G5 mission operated in line with its objectives and achieved a degree of effectiveness in the outcomes we measure. Furthermore, the reduction in violence within the G5 Sahel Joint Force's operating zone is more pronounced in areas with the most porous borders - where shared ethnic groups and moderately rugged terrain facilitated cross-border insurgency. Additionally, the Joint Force seem to have exclusively reduced fatalities induced by armed groups operating across borders. As such, it seems that the mission successfully reduced the asymmetry in cross-border mobility between armed groups and military forces.

To support our RD approach, we document that there are no discontinuities in key geographical and socio-economic characteristics along the border of the G5 operation zones. In addition, the observed reduction in violence within the G5 mission's operation zone is robust to: (1) including conflict events coded with less precision, (2) excluding cells split by an operation zone border, (3) removing the top-coding of fatalities, (4) using dummy outcomes, (5) expanding the maximum possible bandwidth up to 300 km, (6) applying optimal symmetrical bandwidths, (7) using quadratic and cubic localy polynomial, (8) estimating the RD coefficient using OLS with flexible controls for coordinates, and (9) omitting the time period during which the G5 mission was incapacitated following an attack on its headquarters. While we cannot rule out general displacement of violence, our results do not seem to be driven by geographical displacement just outside

of the zone of operation.Given that armed groups derive strategic advantages from border proximity, including access to smuggling routes and the ability to project influence across multiple jurisdictions, reducing violence in these areas represents a meaningful policy achievement even if some broader displacement had occurred.

A second empirical exercise, which is motivated by our theoretical framework, sheds more light on the mechanism that underlies our main result. If the increased enforcement capacity of the G5 Sahel mission deters violence by armed groups, we should see that security forces become more responsive when the G5 mission is active. To measure responsiveness, we first identify trigger events, for which we use major French attacks on jihadist groups. We expect these attacks to trigger the movement of (and violence by) jihadist groups. In the aftermath of these trigger attacks, we see fewer security operations in border areas when the G5 mission is not active - which suggests that security forces are constraint in border areas. However, when the G5 mission is active, this effect disappears. These findings offer additional support for the idea that the G5 force facilitated security operations in border areas.

Our paper adds to a small literature in economics and political science that studies the effect of borders on conflict outcomes with granular conflict data. Martínez (2017) shows that the presidency of Hugo Chavez in Venezuela increased the presence of FARC rebels in Colombian municipalities along the border. Malik et al. (2023) study the Federally Administered Tribal Areas in Pakistan, and argue that the specific institutions of this frontier region contributed to the intensification of violence after the 9/11 attacks of 2001. Studying the geography of conflict, Mueller et al. (2022) argue that raising physical barriers at ethnic frontiers could reduce conflict. Blair (2023) provides evidence from Iraq showing how border protections reduce the victimization of civilians by rebel fighters. However, this paper does not look at how borders affect the propagation of groups whose objectives are not limited to one country. In addition, the role of a cross-national force is particularly interesting as a policy intervention, as the construction of fences is

practically not feasible in many settings and may hamper economic activity.

To our knowledge, our paper is the first to measure the effect of military cooperation between national armies on the conflict dynamics in border areas. We add to the large literature on the empirical study of conflict using econometric methods. This literature has studied the effects of economic shocks on conflict extensively (e.g. Miguel et al., 2004; Ferrara and Harari, 2018; Dube and Vargas, 2013; Berman et al., 2015; Vanden Eynde, 2016). The role of religious and ethnic diversity (e.g. Montalvo and Reynal-Querol, 2005; Esteban et al., 2012), as well as the role of political institutions as drivers of civil conflict (Besley and Persson, 2011) have also been studied at length.[4] In parallel, there is increasing evidence on how development interventions affect conflict (Berman et al., 2011; Crost and Johnston, 2014; Fetzer, 2020)). The role of media and information interventions are also increasingly studied. For example, Armand et al. (2020) find that radio campaigns can contribute to demobilization of armed groups.[5] Finally, and closest to the current project, a limited set of papers evaluates the effect of military interventions. This literature is both recent and small, which is remarkable, given that military operations are arguably the most important policy lever in conflicts. Dell and Querubin (2018) find that the US aerial bombing campaigns in Vietnam increased the support for communist insurgents. There is not much work studying in the organizational aspects of war and military planning.[6] Fetzer et al. (2021) study changes in military cooperation in the context of the security transition from NATO to the Afghan National Army in Afghanistan. This paper finds that the security transition improved security initially but worsened

[4] A number of recent papers have highlighted how specific sub-national institutions can spur or mitigate conflict (e.g. Shapiro and Vanden Eynde, 2023; Fetzer and Kyburz, 2023), or how institutional arrangements arise in war settings (Sanchez de la Sierra, 2020; Dincecco et al., 2022).

[5] For related work on the role of media, see: Yanagizawa-Drott (2014); Durante and Zhuravskaya (2018); Adena et al. (2015). While communication technology touches on a very important aspect of war, the focus of this existing work is on persuasion or coordination outside of the security forces. In contrast, this paper focuses on military cooperation.

[6] Exceptions are Ager et al. (2022), who study the role of incentives for fighter pilots in the German air force during World War II, and Acemoglu et al. (2020) who study the incentive for Colombian soldiers to target civilians and claim them as rebel fatalities. These papers focus on on individual incentives, whereas we focus on military cooperation. Focusing on the organization of armed groups, König et al. (2017) study networks of rebels in the DRC, and Blattman et al. (2023) study criminal gangs in Medellin.

outcomes once NATO troops were physically withdrawn. The authors argue that these patterns are consistent with the Taliban lying low strategically to facilitate withdrawal. A related study shows that frictions between different NATO allies led to worse security Fetzer et al. (2024), while Langlotz (2024) documents that areas in Afghanistan where the NATO mission was active had lower social cohesion. Our paper adds policy relevance to this work by showing that institutionalized cooperation between armies can impact security outcomes. There is a broader question under which conditions external military interventions can be effective (For a recent survey, see Rohner, 2024). There is evidence that UN peacekeeping missions help to reduce conflict (Hultman et al., 2014). They also appear to protect the civilian population against rebel abuse, but not against government force abuse (Fjelde et al., 2019). Dworschak and Cil (2022) also study UN peacekeeping missions, but focus on the challenges of international cooperation: they find that more culturally diverse troop-sending countries are associated with worse security outcomes. Of course, these settings are distinct from the one of military cooperation between neighboring countries, which we focus on in this paper. Given the importance of international alliances for the provision of security, the questions addressed by our paper are particularly relevant - for the Sahel region and beyond.

As far as work on the Sahel region is concerned, our paper is also one of the first quantitative empirical studies of conflict in the region. Focusing on seasonal migration of herders (transumant pastoralists), McGuirk and Nunn (2022) find that rainfall deficiency has exacerbated the conflict between pastoralists and agriculturalists. In line with these findings, Eberle et al. (2020) show that increased temperature generates more violence between farmers and herders. Although these two recent papers do not restrict their analysis to the Sahel region, the processes they study are particularly important in the region we study. The work of Michalopoulos and Papaioannou (2016) is also relevant for our context, as the splitting of ethnic groups between different countries could have contributed to the security challenges of border regions. In Mali, Richard (2022) finds

that insecurity on migration routes induced by the conflict constrains migration destinations and reduces temporary mobility in reaction to drought episodes, hence reducing lean season consumption in villages affected by these shocks. Calvo et al. (2020) study the effect of conflict in Mali on social capital and find that conflict exposure increases engagement within political associations. Premand and Rohner (2023) study a large-scale conditional cash transfer scheme in Niger, and find that it increased violence. All of these recent contributions highlight important aspects of the Sahel conflict. However, our paper is the first to focus on security operations in this conflict. These operations were at the heart of international efforts to contain the threat of jihadist groups in the Sahel border areas. And, this setting allows us to shed light on a key question for the international community: does institutionalized military cooperation between national armies improve security provision in border areas?

## 2 Background

The Sahel region has been plagued by conflict in recent years, with armed groups operating across borders and increasing violence since the 2012 Tuareg-led rebellion in Mali. This rebellion was followed by the proliferation of armed groups, including ethnic militias and jihadist groups. The concentration of violent events has been particularly high in the three-borders area, spreading from Mali to neighboring Niger and Burkina Faso. This region is inhabited by various ethnic groups, including the Fulani and Tuareg, who constitute a majority in the area but are ethnic minorities in their respective home countries. As a result, it has become a recruitment target for jihadist groups. In 2021, 31% of conflict-related fatalities in these countries occurred within 50 kilometers of these unmarked borders [7]. Concentration of political violence in borderland areas has increased in West and North Africa since the end of the 1990s (OECD/SWAC, 2022).

[7] 56.7% within 100 kilometers, 10.1% within 10 kilometers

To address this instability, several international peacekeeping and counter-terrorism missions have been launched in the region. In January 2013, the French launched Operation Serval to regain control of the north of Mali, which was followed by the Barkhane operation, which has maintained a lasting presence in the country until its complete withdraw in May 2022. In April 2013, the United Nations deployed the Multidimensional Integrated Stabilization Mission in Mali (MINUSMA).

In February 2014, the G5 Sahel was created to facilitate military cooperation between Mali, Burkina Faso, Niger, Mauritania, and Chad. The G5 Sahel Joint Force was formally launched with the support of a UN Security Council resolution in June 2017,[8] and its command became active in September of that year. Although the initiative was supported by France, analysts emphasize that it was largely based on the political will of the participating states themselves (Touchard, 2018). The Joint Force was designed to operate independently of the French mission Barkhane, but France provided military and logistic support.[9] The UN mission in Mali (MINUSMA) was mandated in December 2017 (UNSCR 2391) to provide operational and logistic support to the Joint Force, but this support remained limited: it was confined to Malian territory and subject to MINUSMA's own overstretched capacities (Touchard, 2018).

The G5-Sahel force had a mandate focused on combating terrorist groups and trafficking gangs in border areas. It gave national armies the possibility to operate outside of the national territory, within pre-defined operation zones. In those zones, the force was also tasked with restoring state authority, and supporting development and humanitarian interventions (Touchard, 2018).

The Joint Force of the G5 Sahel was composed of 5,400 men across eight battalions. The battalions were distributed around three operations areas, with a Malian and a Mau-

[8]UN Resolution 2364 (2017).

[9]Internal declassified documents clearly distinguish coordination among G5 Sahel members from cooperation with Barkhane. In the ACLED data for 2017–2020, 7 conflict events, all describing joint operations, reference both the G5 Sahel and Barkhane. Reports from meetings of the organization's highest decision-making body also record the participation of the French Chief of Defence Staff and the Barkhane commander (G5 Sahel, 24 October 2019, https://cdg5s.org/fr/node/1335).

ritanian battalion operating jointly in the Western operation zone at the border between Mali and Mauritania, four battalions with troops from Mali, Burkina Faso, Niger and Chad based in the Central Zone, at the border between Mali, Niger and Burkina Faso (the three-borders area), and a Nigerian and Chadian battalion based in the Eastern operation zone at the border between Chad and Niger. In G5 Sahel internal unclassified documents we have access to, 14 operations were reported in the Central Zone between 2017 and 2020, while only five and four operations were conducted respectively in the Western and Eastern operation zone during the same period.

The planning of operations, along with other operational responsibilities such as coordinating resources and ensuring effective communication and cooperation between operational zones, fell under the purview of the Commander of the Joint Force, and had to be approved by the Council of Defense and Security (CDS). The CDS was composed of the Chief of Staff of national Armed Forces of its members and met on a regular basis. However, internal reports from the G5 Sahel suggest that, in practice, heads of national armed forces retained control over operational responsibilities and often engaged in bilateral dealings rather than utilizing G5 Sahel institutions. Despite these shortcomings, the G5S mission facilitated communication between army units along the border. For example, reports mention the creation of a phone book that covers border zones with mobile numbers of officers along the border, which improves the reactivity of forces in these areas (Boeke and Chauzal, 2017).

For each of the three zones of operation, the G5S had a dedicated command. Commanders of these operation zones were in charge of tactical decisions, such as planning routine operations such as patrols or conducting spontaneous operations either to exploit a temporary vulnerability of an terrorist groups (called "opportunistic operations"), or respond to urgent needs of civilian protection. Among the operations conducted by the Joint Force listed in its internal documents (or in ACLED) were regular patrols in border areas, as well as spontaneous or planned joint cross-border operations. These operations

involved airstrikes on armed group positions, conducted in cooperation with Barkhane, as well as the neutralization or arrest of terrorists and seizure of weapons.

The operating zones for the G5-Sahel mission were initially defined as buffers of 50 km around the international borders the borders. In January 2020, an announcement was made to extend the operating zone to 100 km.[10] However, the implementation of this extension is unclear,[11] and the focus in our empirical analysis is on the 50 km buffer zone between September 2017 and January 2020.

We do not have access to the exact geographical locations for all G5-Sahel operations. However, in figure 1 we map all the events reported in the ACLED data that mention the G5-Sahel force explicitly or that involve G5-Sahel members operating outside of their national territories. The spatial distribution of these events is consistent with a focus of the G5 Sahel joint force on the three-borders region between Mali, Niger and Burkina Faso, and with a restriction of operations within the 50 km buffer zone around these borders. For most of our empirical analysis, we will hence focus on this Central zone.

# 3 Theoretical Framework

## 3.1 Key mechanisms of enforcement

The main objective of the G5 Sahel mission was to strengthen enforcement in border areas. Providing security in border areas entails specific challenges. Armed groups operating across borders have a mechanical advantage over national armies that are restricted to their own territories. In the absence of communication or coordination between national armies, crossing a border effectively allows them to evade detection and pursuit. This asymmetry in mobility allows armed groups to sustain their operations

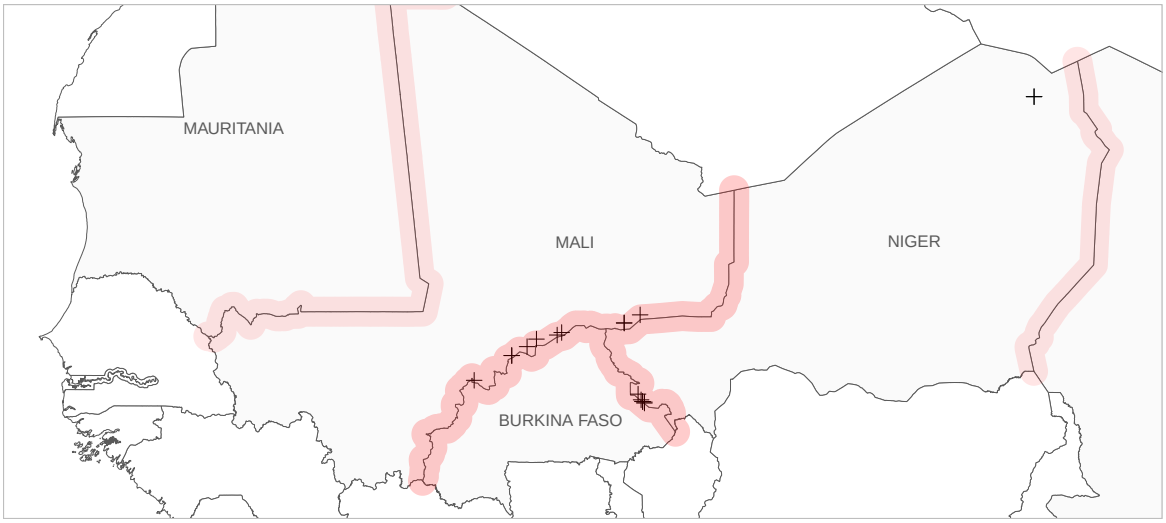
[10] G5 Sahel, 26 January 2020, https://www.g5sahel.org/les-chefs-d-etat-major-des-pays-du-g5-sahel-rendent-plus-operationnelle-la-force-conjointe.

[11] We observe no single trans-border operation outside of the 50 km buffer in ACLED. As late as December 2021, the French UN delegation website described the G5 mission as being active in a 50 km zone (https://onu.delegfrance.org/france-s-action-in-the-sahel.

Figure 1: Foreign Military Operations in Sahel regions

*Panel A:* Foreign Military Operations before G5-Sahel Joint Force Creation


*Panel B:* Foreign Military Operations during G5-Sahel period




Notes: Foreign Military Operations include all events involving G5 Sahel or G5-Sahel country members military forces outside of their national territory. The red shaded areas represent the 50 km operation zones around borders where the G5-Sahel operated officially between January 2017 and January 2020.

by exploiting the jurisdictional and informational gaps created by borders. Anticipating the possibility of armed groups to flee to safe havens, security forces may decide not to intervene in border zones. In addition, investments in security in border areas may have externalities for neighboring countries that are not internalized. For all these reasons, security provision might be under-optimal in border areas.[12]

The G5-Sahel mission addresses these local coordination challenges through two key mechanisms. First, it provides a commitment mechanism for states to effectively use their troops in border areas, thus overcoming the potential free-riding problem and internalizing cross-border security externalities. Second, by gathering battalions from national forces in a Joint Force allowed to operate across borders within 50 km of border areas and establishing communication and coordination channels between national armies, enabling security forces to share intelligence and align their operations, it addresses the discontinuity in state authority at borders, ensuring that armed groups cannot rely on crossing borders as a strategy to evade pursuit. In this view, enhanced local enforcement in border areas under the G5 mission would be the result of both international cooperation at the macro-political level - the commitment to allocate troops - and enhanced operational coordination at the local level - joint operations and information sharing. By reducing the jurisdictional and informational gaps that armed groups exploit and encouraging countries to internalize border security externalities, the G5 Sahel may therefore have enhanced security provision in border areas.

In addition to these local coordination mechanisms, the G5 mission may also have raised the force strength in border areas. In this sense, it is a bundled treatment: the establishment of coordination mechanisms are combined with an increased military presence in the operation zone. One may therefore wonder how the G5 mission compares to a counterfactual intervention that would concentrate more national troops in border

[12]Theoretically, the possibility of displacement could also lead to a number of security operations in border zones that is above its optimal level, as neighboring countries compete to try to push groups across the border. However, this mechanism seems most plausible when investments in security and displacement are long-lived, which is not the case in the context of the Sahel.

areas. It is important to keep in mind that the G5 mission did not increase total troop sizes in the participating countries. The G5 mission had just 5,400 troops at its disposal, which is a small number compared to the area that was covered by the mission, as well as compared to the combined size of the armed forces in the G5 countries (more than 138,000 active personnel). In addition, the G5 mission was constituted from existing national units. In that sense, it was certainly feasible for each of the G5 countries to replicate the numeric efforts of the G5 mission by relying exclusively on their own national armies. However, as explained above, the commitment mechanism embedded in the G5 structure was key to ensuring this reallocation occurred. In the empirical analysis, we will not have precise data on the troop assignments in border areas, but this does not prevent us from estimating the impact of the G5-Sahel mission.

Indeed, a first order question is whether the mission improved the enforcement capacity of the armed forces. Organizational frictions between national armies could reduce the effectiveness of the Joint Force. Descriptive accounts point to severe coordination problems in terms of equipment and command structures (Touchard, 2018)[13]. However, if the joint mission succeeded in strengthening the military enforcement capacity, we expect to see impacts on violence outcomes.

## 3.2 A simple sequential model

The G5 mission aimed at improving security force effectiveness in border areas - and the previous subsection described the mechanisms through which this boost in enforcement could be achieved. To clarify how local improvements in enforcement affect observed violence, we can think of the interaction between armed groups and the state as a sequential game. We describe this game in detail in the online appendix G, and we summarize its intuition here.

[13] Fetzer et al. (2024) show that organizational frictions between NATO allies worsened security outcomes in Afghanistan.

We consider the strategic interaction an between armed group and the state security forces. The armed groups can be understood as hybrid terrorist-criminal groups, which best correspond to the jihadist groups operating in the Sahel (Nsaibia and Weiss, 2018). These groups use violence to gain control of territory, secure access to resources, or mobilize through terror attacks (de Mesquita and Dickson, 2007). In the model, security forces decide on an intensity of retaliation in response to the decision of armed groups to engage in violence. We assume that armed groups have higher payoffs from attacks in proximity to borders, to reflect income from smuggling and opportunities for expansion in multiple countries. To incorporate frictions due to coordination failures in border areas, we make the assumption that the return to retaliation is lower when the security forces operate closer to the border, but that the G5 mission mitigates this decrease. As a result, armed groups will anticipate weaker retaliation in border areas when the G5 mission is not active. Expecting lower retaliation, these armed groups are more likely to engage in violence. Conversely, when the G5 mission is active, armed groups anticipate greater security forces retaliation, which creates a deterrent effect. These effects are muted when borders are less porous, as the G5 merely operates through enhancing the security provision frictions in border areas. The model also incorporates trigger events that reveal the retaliation capacity of the security forces. Trigger events force the armed groups to produce violence, regardless of the enforcement capacity of the state. Hence, we expect the G5 Sahel mission to make state violence more responsive to trigger events. This feature of the model motivates an empirical exercise in which we evaluate whether the G5 Sahel mission has increased the responsiveness of security forces in border areas.

### 3.3 Hypotheses

Our empirical approach will not enable a fine distinction between all the mechanisms that we identified earlier, but the sign of the net effects we estimate, in combination with a detailed analysis of different types of violence, will help us to narrow down the

mechanisms underlying our findings. In particular, if the G5 mission was successful in overcoming problems of coordination and under-provision of security, we expect the following effects in terms of observed violence:

- Overall violence should decrease with the G5 in border areas.
- Reduction in violence should be more pronounced in porous border areas
- Trigger events should be associated with a greater response from security forces in border areas when the G5 mission is active.

It should be noted that our hypotheses are linked to the specific mechanisms that we incorporated in our theoretical framework, focusing on a stronger deterrent effect from resolving cooperation failures in border areas.

We can refine our hypotheses further in terms of the actors that generate violence. We expect the reduction of violence to be most pronounced for jihadist groups. These groups are the main source of insecurity in the Sahel, their targeting was the main mandate of the G5 Sahel mission, and their objective function corresponds best to the one described in the model (i.e., their strategic objectives require the use of violence). Taking into account that part of the violence perpetrated by jihadist groups could be a direct response to military operations (which may increase as a result of the G5 mission), reductions in violence could be particularly pronounced for one-sided violence by jihadist groups against civilians. In contrast, communal militias were not the primary target of the G5 mission, and their main objective is self-protection. For both reasons, violence from these actors is less directly affected by the G5 mission. Of course, the distinction between communal militias and jihadist groups is not always clear-cut (from the G5's operational perspective or in our data). We could still expect violence from communal militias to decrease, both because they may be directly targeted alongside jihadist groups and through spillovers that reduce the need for self-defense. But we expect this decrease to be less marked than for the violence from jihadist groups.

The expected effect of the G5 mission on observed military operations is ambiguous. On the one hand, the deterrence effect reduces the frequency of armed group attacks requiring retaliation. On the other hand,the intensity of retaliation by the security forces increases when attacks do occur. In addition, the G5 mission may increase the number offensive operations against armed groups. As a result, the reduction in military operations may be less pronounced than the reduction in armed group violence. The trigger-response analysis will test the hypothesis that the G5 mission has increased the responsiveness of security forces (for a given level of violence). When it comes to the difference in military violence against actors that are not directly included in the G5 mandate (civilians and communal militias) versus military violence against jihadists, our predictions are not clear-cut. Security forces could still target civilians and communal militias alongside jihadist groups (mistakenly or deliberately). But, they might reduce attacks on these groups if they respect their mandate and substitute enforcement efforts toward jihadist groups.

More broadly, while our hypotheses point toward a general reduction of violence (through enforcement), an alternative mechanism could still dominate. If retaliation is the main driver of violence for armed groups, the deterrence mechanisms illustrated in our model may be less relevant. What could instead dominate is the escalation of the cycles of retaliation between different actors. As such, violence reduction is not the only possible outcome of increased enforcement through the G5 mission, which makes our empirical analysis even more relevant.

# 4 Data

Our main source of violence data is ACLED (Armed Conflict Location Event Data, Raleigh et al. (2010)). ACLED tracks and records information on armed conflicts and political violence around the world. The data are sourced from a variety of sources, in-

cluding traditional media, social networks, NGOs, international organizations, and local partners. For each violent event, ACLED records the number of fatalities that occurred. Events are also geo-coded, at different levels of precision. This coding precision is important for our study, as our regression discontinuity approach exploits fine geographical variation. In addition to its location, each ACLED event is precisely dated. Further sub-categories are created based on the actors involved in each event, which helps to differentiate between types of violence. The ACLED data may be subject to biases and limitations. While it relies on various sources, there can be underreporting or overreporting of casualties, particularly in areas with limited media coverage or access. Even if the reported fatalities are likely to be measured with error, this measure still contains important information about conflict intensity.[14] To avoid sensitivity to outliers, we top-code the 1% events with the highest number of fatalities in the raw ACLED database before computing cell-level measures of conflict intensity. As a robustness check, we also use binary measures of fatalities.

We map the ACLED data and use information on the operation zones of the G5-Sahel mission that we obtained from official documents (see figure A 2) . To this violence data, we add granular data on nighttime lights (Elvidge et al., 2021) and geographical features such as road access (Jedwab and Moradi, 2016), urbanization (Bird and Brandily, 2018), ruggedness (Shaver et al., 2019) and proximity to rivers (African Rivers dataset available on the World Agroforestry Centre's landscape portal: `http://landscapeportal.org/layers/geonode:africa_rivers_1#more`). These additional variables will be used to support the validity of our empirical approach.

Table A1 reports descriptive statistics on the intensity and nature of violent events recorded by ACLED within 50 to 250 kilometers of the "central operation zone", i.e. the Mali–Burkina Faso, Mali–Niger, and Niger–Burkina Faso borders, between September 2017 and January 2020. The table summarizes the distribution of conflict events and

[14] It has been shown to correlate strongly with climatic shocks (e.g. Ferrara and Harari, 2018), population displacement (e.g. Tai et al., 2022) and child health (e.g. Tapsoba, 2023).

fatalities across 0.25° × 0.25° grid cells, distinguishing between military operations, attacks by armed groups, and attacks targeting civilians, while excluding riots, protests, and low-precision events. In the raw ACLED data for Mali, Burkina Faso, and Niger between 2017 and 2020, we record 7,979 fatalities and 3,085 events in the G5 area. Figure A 1 shows the trends in violence, based on this data. Violence is clearly trending upwards from early 2017 onward. This increase is particularly pronounced in areas very close (within 15 km) to the international borders, while the broader operation zone of the G5 mission follows a trend that is similar to the one observed for the areas outside of the G5 operation zone. While this graph illustrates the overall conflict dynamics and the context of our study, we do not think it allows us to identify the effect of the G5-Sahel mission. The low levels of violence before the launch of the G5-Sahel force in September 2017 make the setting ill-suited for a difference-in-difference approach. Moreover, the G5-mission was created in anticipation of the conflict becoming more gradually intense in the border areas, and the strategies of various actors may have contributed to this intensification. Hence, estimating the effect of cooperation between national armies necessitates a more granular approach, as we develop in this paper.

To characterize borders porosity as well as the logistic support available to the Joint Force, we use three additional data sources: (i) the spatial distribution of ethnic groups from Desmet et al. (2020), (ii) major rivers from the World Agroforestry Centre's landscape portal (available at `http://landscapeportal.org/layers/geonode:africa_rivers_1#more`), and (iii) the location of UN-Peacekeeping Missions in Mali using The Geo-PKO dataset (Cil et al., 2020).

# 5 Empirical strategy

We will study the effect of the G5 Sahel mission through the lens of two empirical exercises.

## 5.1 Discontinuity around G5 operation zones.

First, we will use a regression discontinuity design to assess whether violence levels are different in the operation zones of the G5-mission. We are interested in comparing areas where national armies cooperate as part of the G5 mission to areas that are under the sole responsibility of the national armies. The precise delimitation of the operation zone of the G5 mission offers a plausibly exogenous assignment to these two security environments. In particular, the limitation of the G5-Sahel operation zone within 50 km of G5-Sahel countries' borders creates a spatial discontinuity:

$$\begin{aligned} y_i = \alpha + \beta Border_i + \delta\left(Distance_i - z_0\right) \\ + \delta' Border_i \cdot \left(Distance_i - z_0\right) + \delta_b + \eta_c + \epsilon_i \end{aligned} \tag{1}$$

In this specification, the outcome $y_i$ is our measure of conflict at the grid-cell $i$ level. $z_0$ refers to the limit of the buffer zone, at 50 km. $Distance_i$ measures the distance to the 50km buffer limit. We could expect this running variable to correlate with conflict outcomes - for example, conflict could be systematically more intense when we are closer to the international border. In our empirical approach, we want to control for such impacts, and evaluate instead whether the operation zone of the G5 creates a discontinuous change in conflict outcomes. The discontinuity is captured in the equation by $\beta$, which shows the effect of the variable $Border_i$, a dummy variable which indicates whether grid-cell is less than 50km from the border. We also include border segment fixed effects $\delta_b$ [15] and country fixed effects $\eta_c$. We allow for a data-driven choice of two bandwiths for optimal mean squared error (MSE) point estimation with Calonico-Cattaneo-Titiunik robust procedure (Calonico et al., 2014). As the RD approach relies on a fine coding of

[15] To construct the border-segment fixed effects, we divide the treated border into smaller, contiguous pieces of roughly equal length. The segmentation is carried out separately for each dyad (Mali–Burkina Faso, Mali–Niger, and Burkina Faso–Niger), ensuring that no segment straddles more than two countries. The resulting grid consists of 26 border segments, each measuring approximately 100 km. The same border segments are used in heterogeneity analysis.

conflict events, we use granular gridcells (0.025 by 0.025 degrees, about 2.5 squared kilometers), and we focus on ACLED events with the highest precision level for our main results, that is events that occur in a place for which exact coordinates are available. We top-code the 1% events with the highest number of fatalities in ACLED. We show findings for alternative coding as robustness checks. To support the validity of the RD approach, we will show continuity of geographical characteristics and pre-G5 levels of violence around the border of the operation zone. we consider the period of activity of the G5 Sahel between September 2017 and January 2020 within 50 km of border areas.[16].

## 5.2 Response to trigger events

To shed further light on mechanisms, we rely on a second empirical exercise. This exercise is motivated by our theoretical framework, and it tests if security forces became more responsive in border areas when the G5 mission was active. More precisely, we study how the response of violence to trigger events differs in border areas and depending on whether the G5 mission is active or not. For trigger events, we focus on major French operations against jihadist groups, which we identify as operations that claim at least 5 fatalities. These events are followed by a marked intensification of conflict, as shown in figure A 8 in the online appendix. Our main hypothesis, in line with the theoretical framework, is that the escalation of security force violence is more marked in border areas when the G5 mission is active. Our empirical strategy boils down to a triple difference approach, in which we compare the response to trigger events between border and non-border areas, and when the G5-Sahel mission is active versus not active.

As for the RD analysis, we use 0.025 by 0.025 degree grid-cells. We focus on ACLED events with the precision level 1 and 2, that is events that occur in or near a place for which exact coordinates are available, and exclude events that can only be located

[16] As discussed in the background section, the precise operation zone of operation of the Joint Mission after January 2020 as well as the exact date of the end if its activities cannot be defined clearly

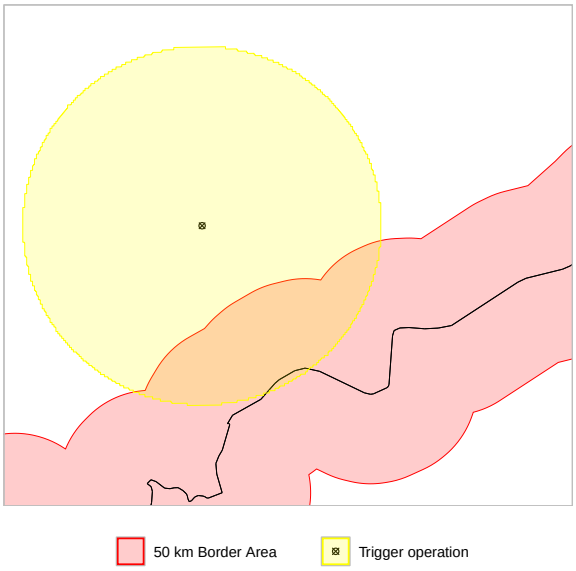



Figure 2: Definition of trigger response areas and border areas

within a broader region. We top-code the 1% events with the highest number of fatalities in ACLED. We restrict ourselves to trigger operations that are less than 250km from the three-border area. Then, we construct a window of 8 weeks,[17] and a geographical circle of a 100km radius, around each trigger operation. Figure 2 illustrates the spatial definition of trigger operations and border areas. When gridcells are part of multiple event windows, we keep only the first window for that gridcell.[18] In total, our sample has 48 trigger operations, and 20 of these take place when the G5-Sahel mission is not active.

The resulting estimating equation is:

$$y_{i,p,t} = \zeta Border_i * Post_{t,p} + \chi Border_i * Post_{t,p} * G5_t + \eta_i + \gamma_{p,t} + \epsilon_{i,p,t} \tag{2}$$

In this equation, $y_{i,p,t}$ is a measure of conflict at time $t$ in gridcell $i$ for a window around

[17] We exclude the day of the trigger event and the day after, to avoid mechanical effects.

[18] This approach prevents us from using already treated gridcells as a control in future comparisons. As has been highlighted by the recent literature on difference-in-difference methods, such comparisons could introduce negative weights in the estimated treatment effect (de Chaisemartin and D'Haultfoeuille, 2022).

operation $p$. $t$ is measured in two-week periods. The outcome $Border_i$ indicates whether grid-cell is less than 50km from the international border, so within the operation zone of the G5-Sahel force. $Post_{t,p}$ is one in the time periods after the trigger operation. $G5_t$ is an indicator for when the G5 is active. As we are interested in immediate response patterns, we will consider the period in which the G5 mission was incapacitated by a suicide attack on its headquarters as a period in which the G5 is not active, between June 2018 and January 2019.[19] We also include operation by time fixed effects ($\gamma_{p,t}$), as well as gridcell level fixed effects ($\eta_i$). We cluster standard errors at the gridcell-level. While our main interest is in the triple difference specification above, we also show results where we estimate time-to-operation effects in event study graphs. The identification assumption we need to make for a causal interpretation of $\zeta$ is that the difference in escalation patterns between border and non-border areas would have been similar in the absence of the G5 mission. This assumption is relatively weak, and it does not require the French attacks that we use as trigger events to be fully exogenous to conflict processes.

# 6 Results

## 6.1 RD results

### 6.1.1 Main RD results

Figure 3 compares fatalities in gridcells within the G5-Sahel central operation zone to those in gridcells just outside the operation zone during the period of activity of the G5 mission within 50km of international borders. The local linear regressions in Panel A and B shows a clear discontinuity in the number of total conflict fatalities at the border of the operation. There are less fatalities where the G5 mission is active, in line with our key hypothesis. This result is even more marked for events involving civilian fatalities

[19] As a robustness check, we show that the findings are qualitatively similar when we consider the G5 as active in this period.

caused by jihadist groups – whose containment was the priority of the G5 mission. The discontinuity appears stronger with the data-driven optimal bandwidth (Calonico-Cattaneo-Titiunik procedure to minimize bias and variance of the RD estimator).

Figure 3 compares fatalities in gridcells within the G5-Sahel central operation zone to those in gridcells just outside the operation zone during the period of activity of the G5 mission within 50km of international borders. The local linear regressions in Panel A and B show a clear discontinuity in the number of total conflict fatalities and civilian fatalities caused by jihadist groups at the border of the operation. There are fewer fatalities where the G5 mission is active, especially for events involving jihadist groups whose containment was the priority of the G5 mission. The discontinuity appears stronger with the data-driven optimal bandwidth (Calonico-Cattaneo-Titiunik procedure to minimize bias and variance of the RD estimator), which mostly excludes cells closer to the international border.

The graphical patterns also reveal a gradual increase in conflict as one moves closer to the international border,. This pattern is consistent with the theoretical model we develop in Appendix, which incorporates these dynamics through lower returns to state retaliation in border areas (due coordination frictions), and higher rebels payoffs from violence (because of smuggling opportunities and strategic objectives). We observe both a continuous negative correlation between distance and violence within the zone and outside of the operation zone[20], and a discontinuous jump in this pattern within the operation zone of the G5. The graphical patterns also suggest that the results are not driven by symmetrical displacement, where the reduction within the operation zone is offset by increased violence just outside the operation zone — which we formally test for in the robustness analysis.

[20]The negative slope of violence with respect to distance persists within the G5 operation zone, rather than flattening out. If distance only mattered for the effectiveness of military enforcement, we might expect a flat relationship inside the operation zone of the G5 mission. The persistence of the slope could be explained by stronger returns to violence in border areas from the rebels' perspective. Alternatively, the imperfect implementation of the G5 mission may mean that some operational constraints related to the distance to the international border remain relevant.

Figure A 3 in Appendix shows the comparison for the total number of fatalities during the G5 mission period and before September 2017, when the G5 mission was not active. There is no discontinuity in the pre-treatment period, which supports the validity of the RD approach.

Panel A in table 1 shows RD estimates for different estimation approaches and outcomes. The general pattern of lower violence in the G5 operation zone holds across estimation methods and outcomes. The magnitude of the effect is large: crossing into the operation zone of the G5 mission reduces the number of fatalities in a given gridcell by 0.039. For context, the mean number of fatalities per gridcell in our estimation sample (within 250km of treated borders) is 0.024, and within 50km of the border — where our RDD estimates are most directly applicable — the mean is 0.045. The reduction in violence is observed for security operations, attacks by armed groups, and violence against civilians. The effects are a bit more marked for the number fatalities than for event counts, but they go in the same direction.

Table 2 presents important validity checks for the RD approach. It confirms the absence of discontinuities in pre-G5 conflict measures as well as geographical characteristics. Hence, we are confident that the regression discontinuity estimates are picking up the causal effect of grid-cells belonging to the operation zone of the G5 mission.

#### 6.1.2 Violence reduction by actor

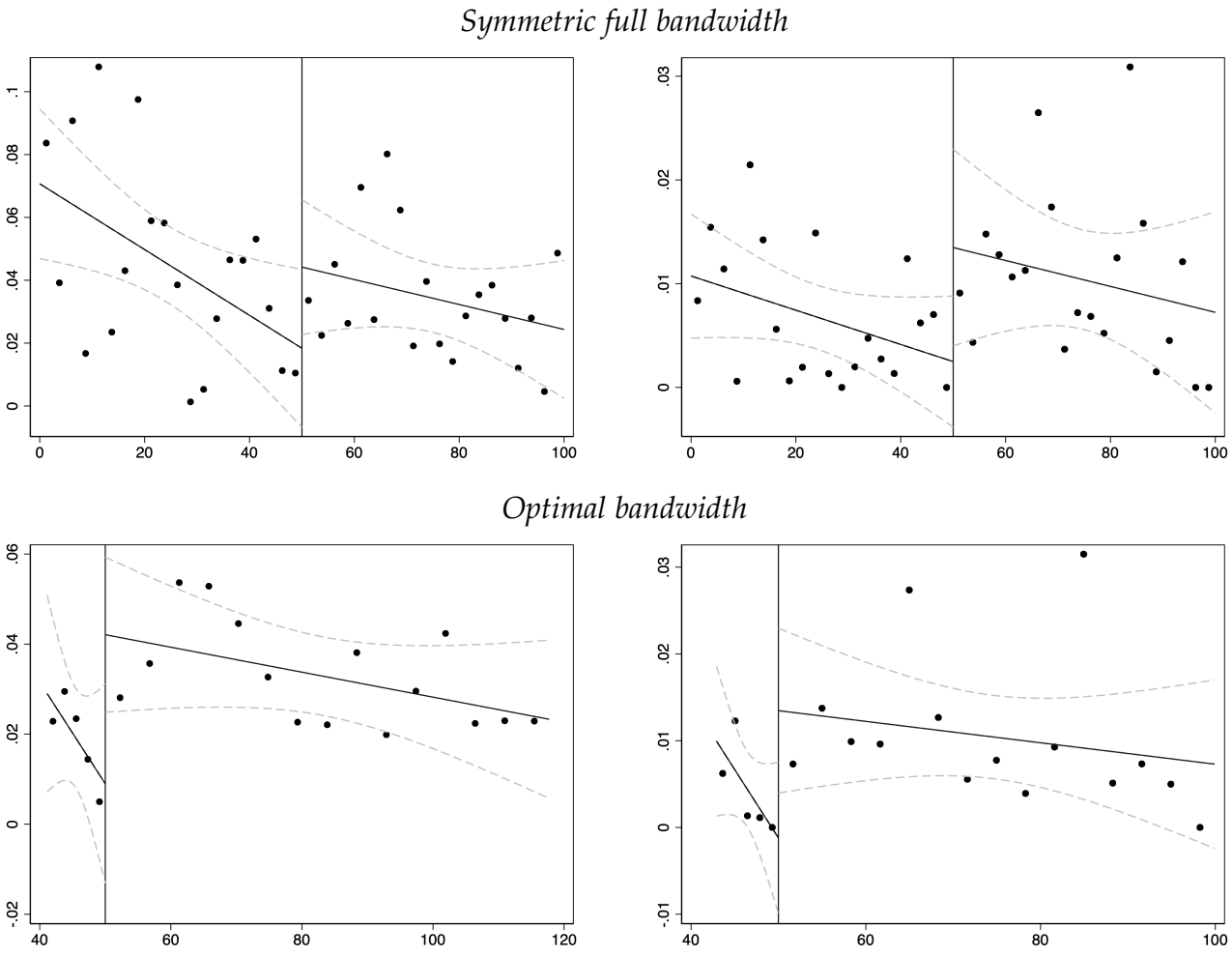
Panels B-D in table 1 show RD results for a finer classification of violent events, based on the actors involved. Panel B focuses on violence involving jihadist groups. Interestingly, security operation against jihadist groups do not decrease significantly in the operation zone of the G5 region. However, there are less attacks by armed jihadist groups, and less attacks against civilians in particular. This finding is in line with our hypotheses. In contrast, there is a pronounced reduction in security force violence against ethnic militia groups, while these ethnic militias do not reduce their violence significantly. As

the official mandate of the G5-Sahel force is focused on combating jihadist groups, these findings suggest the G5-Sahel mission reduces violence initiated by the actor it is mandated to target. In this sense, the mission appears to be effective.

Figure 3: Regression Discontinuity for G5 central operation zone

*Panel A:* All events fatalities

*Panel B:* Attacks on civilians by jihadist groups fatalities




Notes: Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. The sample comprises the central Zone (Mali-Niger-Burkina Faso three borders regions). Included events are coded with geo-precision level 1.

Table 1: Discontinuity in conflict intensity for G5 Sahel Central operation zone by actors 2017-2020.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) (1) | Events (2) | Fatalities (count) (3) | Events (4) | Fatalities (count) (5) | Events (6) | Fatalities (count) (7) | Events (8) |
| *Panel A:* All events | | | | | | | | |
| Robust | -0.0390*** | -0.0108 | -0.0054** | -0.0022*** | -0.0313** | -0.0073 | -0.0315*** | -0.0033 |
| | (0.0144) | (0.0073) | (0.0025) | (0.0007) | (0.0130) | (0.0069) | (0.0116) | (0.0051) |
| Mean DV | 0.024 | 0.011 | 0.003 | 0.001 | 0.020 | 0.010 | 0.014 | 0.007 |
| Standard Deviation | 0.748 | 0.220 | 0.203 | 0.033 | 0.687 | 0.198 | 0.474 | 0.123 |
| Observations within buffer | 5131 | 5881 | 7392 | 4865 | 5089 | 6378 | 4623 | 7668 |
| Observations untreated | 36679 | 25505 | 27652 | 42229 | 29794 | 22713 | 34645 | 22389 |
| Bandwidth untreated (km) | 67.715 | 46.514 | 50.720 | 78.387 | 54.684 | 41.264 | 64.037 | 40.734 |
| Bandwidth treated (km) | 8.874 | 10.214 | 12.775 | 8.413 | 8.790 | 11.000 | 8.003 | 13.220 |
| *Panel B:* Events involving jihadist groups | | | | | | | | |
| Robust | -0.0218*** | -0.0094*** | -0.0015 | -0.0008 | -0.0218*** | -0.0094*** | -0.0137*** | -0.0041* |
| | (0.0082) | (0.0035) | (0.0017) | (0.0005) | (0.0082) | (0.0035) | (0.0046) | (0.0021) |
| Mean DV | 0.012 | 0.006 | 0.000 | 0.000 | 0.012 | 0.006 | 0.005 | 0.003 |
| Standard Deviation | 0.527 | 0.123 | 0.067 | 0.011 | 0.527 | 0.123 | 0.266 | 0.076 |
| Observations within buffer | 6421 | 5243 | 8599 | 6298 | 6421 | 5243 | 4079 | 8771 |
| Observations untreated | 33636 | 39015 | 30246 | 28692 | 33636 | 39015 | 27234 | 45587 |
| Bandwidth untreated (km) | 62.038 | 72.389 | 55.643 | 52.692 | 62.038 | 72.389 | 49.910 | 84.874 |
| Bandwidth treated (km) | 11.085 | 9.105 | 14.864 | 10.868 | 11.085 | 9.105 | 7.090 | 15.092 |
| *Panel C:* Events involving Communal militia | | | | | | | | |
| Robust | -0.0086 | 0.0019 | -0.0033** | -0.0017*** | -0.0086 | 0.0019 | -0.0079 | 0.0035 |
| | (0.0094) | (0.0033) | (0.0017) | (0.0006) | (0.0094) | (0.0033) | (0.0083) | (0.0029) |
| Mean DV | 0.007 | 0.002 | 0.002 | 0.001 | 0.007 | 0.002 | 0.005 | 0.001 |
| Standard Deviation | 0.379 | 0.058 | 0.186 | 0.028 | 0.379 | 0.058 | 0.286 | 0.042 |
| Observations within buffer | 5576 | 11604 | 7172 | 4750 | 5576 | 11604 | 5287 | 12034 |
| Observations untreated | 39129 | 24751 | 29184 | 34175 | 39129 | 24751 | 34622 | 20710 |
| Bandwidth untreated (km) | 72.576 | 45.224 | 53.602 | 63.075 | 72.576 | 45.224 | 63.997 | 37.586 |
| Bandwidth treated (km) | 9.703 | 19.825 | 12.385 | 8.208 | 9.703 | 19.825 | 9.212 | 20.548 |
| *Panel D:* Events involving civilians | | | | | | | | |
| Robust | -0.0315*** | -0.0033 | -0.0018* | -0.0011*** | -0.0253** | -0.0004 | -0.0315*** | -0.0033 |
| | (0.0116) | (0.0051) | (0.0010) | (0.0004) | (0.0106) | (0.0046) | (0.0116) | (0.0051) |
| Mean DV | 0.014 | 0.007 | 0.002 | 0.000 | 0.012 | 0.006 | 0.014 | 0.007 |
| Standard Deviation | 0.474 | 0.123 | 0.181 | 0.024 | 0.414 | 0.112 | 0.474 | 0.123 |
| Observations within buffer | 4623 | 7668 | 7507 | 5101 | 4417 | 9994 | 4623 | 7668 |
| Observations untreated | 34645 | 22389 | 16038 | 33412 | 28114 | 21360 | 34645 | 22389 |
| Bandwidth untreated (km) | 64.037 | 40.734 | 28.872 | 61.633 | 51.525 | 38.746 | 64.037 | 40.734 |
| Bandwidth treated (km) | 8.003 | 13.220 | 12.965 | 8.807 | 7.692 | 17.149 | 8.003 | 13.220 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of borders between Burkina Faso, Mali and Niger are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Empty cells means the discontinuity could not be estimated due to lack of variability in the dependent variable. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2: Continuity in conflict intensity and geographical variables for G5 Sahel Central operation zone before G5 Sahel first operation.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conflict variables before Sept 2017 | | Geographical | | | | | | | | | |
| Variables: | Events | Fatalities(#) | GHS pop | Nightlight 2017 | Nightlight 2014 | NDVI | Road | River | City | Ruggedness | Fulani | Tuareg |
| Robust | 0.0007 | -0.0006 | -1.6822 | -0.0040 | -0.0030 | 0.2849 | -0.0237 | -0.0065 | -0.0001 | 0.1124 | -0.0004 | 0.0045 |
| | (0.0024) | (0.0028) | (4.6667) | (0.0032) | (0.0035) | (0.2688) | (0.0196) | (0.0056) | (0.0006) | (0.5587) | (0.0035) | (0.0052) |
| Mean DV | 0.004 | 0.010 | 36.676 | 0.195 | 0.009 | 131.669 | 0.203 | 0.048 | 0.001 | 13.787 | 0.035 | 0.035 |
| Standard Deviation | 0.357 | 0.920 | 214.323 | 0.262 | 0.260 | 16.791 | 0.516 | 0.234 | 0.024 | 20.645 | 0.100 | 0.132 |
| Observations within buffer | 5369 | 4476 | 7467 | 10209 | 6893 | 6289 | 5754 | 7419 | 8504 | 6627 | 8760 | 9194 |
| Observations untreated | 14332 | 6874 | 15226 | 11981 | 12014 | 14564 | 21202 | 25539 | 32359 | 8825 | 12420 | 15971 |
| Bandwidth untreated (km) | 25.662 | 12.131 | 27.367 | 21.412 | 21.479 | 26.179 | 38.388 | 46.615 | 59.555 | 15.707 | 22.214 | 28.733 |
| Bandwidth treated (km) | 9.389 | 7.804 | 12.897 | 17.550 | 11.956 | 10.846 | 10.003 | 12.811 | 14.676 | 11.451 | 15.078 | 15.806 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of borders between Burkina Faso, Mali and Niger are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. The variables road, river and city are dummy variables indicating whether a grid-cell is crossed by any road, river or city. Ruggedness measures the average ruggedness within the grid-cell. The variables Fulani and Tuareg represent the share of these ethnic groups within the grid-cell. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

### 6.1.3 Heterogeneity results

Table 3 examines heterogeneity by border characteristics that proxy border porosity. Higher border porosity implies that state retaliation is less effective and rebels' benefits of operating the border are higher. As such, we expect a larger reduction in violence due to the G5 Sahel mission where the borders are most porous. We use three measures to proxy for border porosity: (i) whether the border follows a river, (ii) the presence of a transborder ethnic group, and (iii) ruggedness. Rivers typically act as natural barriers so river-aligned segments should be less porous. By contrast, when the same ethnic group straddles both sides, kinship ties and social networks facilitate cross-border mobility and support, resulting in greater porosity. In this relatively flat region, above-median ruggedness creates opportunities for concealment and alternative routes, thereby increasing porosity.[21] As an additional heterogeneity result, we study the interaction between the G5 Joint Force and proximity to MINUSMA, which could capture complementarities between the two. Figure A 7 in the appendix illustrates the definition of border segment characteristics used for this heterogeneity analysis and table A11 shows the distribution of these characteristics by country and border.

Table 3 shows that reduction in violence is indeed most pronounced along border segments with above-median ruggedness and in segments inhabited by a shared ethnic group on both sides. By contrast, alignment of the border with a river does not significantly affect the coefficient, which may reflect the local geography.[22] Proximity to MINUSMA likewise does not appear to amplify the effect of the G5 mission, consistent with the limited logistical support that the UN mission was able to provide. Modern RD methods are not set up to estimate heterogeneous effects, so the tests presented here rely on OLS estimation with linear controls for distance to the operation zone limit. In appendix table A12, we conduct this analysis in split samples that allow us to use

[21] Although very high ruggedness can constrain movement, such terrain is rare in the Central Sahel.

[22] Aside from the Niger River crossing the Burkina Faso–Mali border, rivers in the area may be too small to constrain cross-border movement

data-driven bandwiths (Calonico et al., 2014). These results are consistent with table 3.

Table A13 in appendix further highlights the importance of the international dimension of the intervention, as it seems to only have reduced conflicts induced by armed groups operating in at least two of the three countries sharing the tri-border. These armed group operating across borders are essentially almost all jihadist groups, the priority target of the G5 Joint Force, but the results also suggest that coordinated cross-border operations are particularly well-suited to combating transnational armed groups that exploit border asymmetries and operate across multiple jurisdictions. A joint force can address precisely the organizational advantage that these groups derive from cross-border mobility – the ability to organize in one country and strike in another where individual national forces have limited reach.

Table A2 in the appendix presents subsample analyses by border and country, suggesting that the G5 Sahel is effective across each country and border examined separately. We find a negative and significant coefficient in each country sample, although the magnitude of the effect is smaller for Niger. At the border level, we observe a negative coefficient for every border and border-country subsample, though significance is achieved only for the Mali-Niger border (on both the Mali and Niger sides) and for the Niger-Burkina Faso border (on the Niger side). These patterns are consistent with the regional distribution of jihadist activity: by the start of our analysis period (2017-2020), jihadist organizations maintain operational bases across all three countries [23]. The fact that the reduction in violence is not driven by a particular country and border is consistent with our theoretical framework, as the enforcement mechanism should be relevant in all these settings.

[23]While violence initially emanates from Mali, where rebel groups exploit state weakness following the Tuareg-led rebellion in the north, armed groups expand their operations into Burkina Faso and Niger prior to our study period. Following the French military intervention in Mali in 2013, jihadist commanders gravitate toward areas in central and southern Mali and near the borders with Burkina Faso, while Ansaroul Islam emerges in Burkina Faso in December 2016 with close operational ties to al-Qaeda's Sahelian network. There is also evidence that northern Burkina Faso serves as a rear base for attacks into Mali (Nsaibia and Weiss, 2018).

Table 3: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, heterogeneity by border segment characteristics.

| | Ruggedness | | Alignment Border with River | | Close MINUSMA | | Transborder ethnic group | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (1) | Events (2) | Fatalities (3) | Events (4) | Fatalities (5) | Events (6) | Fatalities (7) | Events (8) |
| *50-50 km bandwidth* | | | | | | | | |
| G5S operation zone | -0.0018 | 0.0030 | -0.0234 | -0.0045 | -0.0040 | -0.0040 | -0.0040 | 0.0003 |
| | (0.0227) | (0.0062) | (0.0196) | (0.0054) | (0.0324) | (0.0089) | (0.0215) | (0.0059) |
| G5S operation zone x Medium rugged | -0.0563* | -0.0180* | | | | | | |
| | (0.0342) | (0.0094) | | | | | | |
| Medium rugged | 0.0675 | 0.0277** | | | | | | |
| | (0.0462) | (0.0127) | | | | | | |
| G5S operation zone x River segment | | | -0.0144 | -0.0014 | | | | |
| | | | (0.0393) | (0.0108) | | | | |
| River segment | | | 0.0132 | -0.0084 | | | | |
| | | | (0.0661) | (0.0181) | | | | |
| G5S operation zone x Close MINUSMA | | | | | -0.0311 | -0.0013 | | |
| | | | | | (0.0380) | (0.0104) | | |
| Close MINUSMA | | | | | 0.0272 | 0.0195 | | |
| | | | | | (0.0475) | (0.0130) | | |
| G5S operation zone x Transborder group | | | | | | | -0.0606* | -0.0134 |
| | | | | | | | (0.0351) | (0.0096) |
| Transborder group | | | | | | | 0.3422*** | 0.1053*** |
| | | | | | | | (0.0517) | (0.0142) |
| Mean DV | 0.040 | 0.018 | 0.040 | 0.018 | 0.040 | 0.018 | 0.040 | 0.018 |
| Standard Deviation | 1.019 | 0.280 | 1.019 | 0.280 | 1.019 | 0.280 | 1.019 | 0.280 |
| Observations within buffer | 58343 | 58343 | 58343 | 58343 | 58343 | 58343 | 58343 | 58343 |

*Notes :* Discontinuity estimated at 50 km. Symetrical bandwidth of 50km on each side of the G5 operation zone boundary. Only estimate of coefficient of interest "Cell within G5 operation zone" and the border segment characteristic and their interaction are reported. Control variables include distance to the G5 central border, allowed a different slope within and outside of the operation zone. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Segments in "medium rugged" areas are segments for which the average ruggedness of cells crossed by the segments is above the median ruggedness of cells crossed by the other segments; border segments aligned with rivers are border segments within 5 km of a river for at least 40% of their length; border segments close to MINUSMA are those with average distance to UN Peacekeeping missing stations below the median; border segments with a transborder group are those with at least 10% of population on both side of the border - within a 50km buffer - from the same ethnic group. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

#### 6.1.4 Robustness of the RD results

In the appendix, we present RD plots for a wider range of outcomes in figures A 5 and A 6.[24] Table A9 offers a detailed comparison of alternative coding approaches for the main violence outcomes. It includes results where the fatality numbers are subject to an inverse hyperbolic sine transformation. It also considers measures that include violence events that are coded less precisely (level 2 in ACLED). Including these less precisely coded violence events tends to makes the RD estimates less precise too. However, the broad patterns we found in our main results are generally robust to these alternative measurement approaches. Table A3 replicates the main RD results over the Western and Easter operations zones and finds no discontinuity in any outcome, which is consistent with the lower treatment intensity in these areas.

Table A4 further shows that the results are also robust to dropping cells crossed by the 50km buffer line, which addresses concerns of events being miss-categorized within the treated area due to measurement error in the ACLED coordinates, or to our coding within 0.025 degree cells. Table A4 also show robustness of the RDD results to removing the top-coding the 1% top fatalities and transforming the fatalities variable to a dummy indicating any fatality. Finally, we verify that our initial restriction of the sample to 250 km around the 50 km buffer line for data management purposes does not drive the results, as extending the maximum potential bandwidth to 300 km in Panel D of table A4 leaves the coefficients unchanged.

Although allowing for different bandwidths on each side of the cutoff is better suited to estimations where the variance of the treatment and control group differ substantially (Cattaneo et al., 2019), we show the results for symmetrical bandwidths for completeness in table A6. When imposing a symmetrical bandwidth, the trade-off between variance and bias limits precision of the estimates. The coefficient remains significant only for

[24]The graphs in figure A 5 show a small number of security operations against jihadist groups in the optimal RD bandwidth. Figure A 6 shows this number increases when including less precisely coded events. Table A9 provides results for coarser geographical precision levels.

fatalities resulting from attacks on civilians and for events involving jihadist groups. Table A7 shows that the results are further robust to using local polynomial of order 2 and 3. Results are completely stable with the inclusion of the quadratic polynomial, but for the cubic the coefficient remains significant only for fatalities resulting from attacks on civilians and for events involving jihadist groups, as for the symmetrical bandwidths. Table A8 presents the RDD results using several asymmetrical bandwidths, applying a standard linear estimation of the G5 area effect. The model controls for linear distance to the border and includes flexible controls for longitude and latitude, with stable coefficients across specifications.

The results are further robust to dropping the period in which the G5- Sahel mission was incapacitated by a suicide attack on its headquarters, between June 2018 and January 2019, as displayed in table A5 in appendix. We also find that the conflict is lower in the G5 operation zone during this period specifically, suggesting that the deterrent effect of the G5 Sahel mission exhibits persistence over such disruptions.

#### 6.1.5 Strategic relocation of armed groups

A potential concern is that our results may be over-estimated because of the reallocation of rebels from the G5 operation zone to neighboring areas just outside the intervention boundary. The estimated coefficients would then combine the effect of direct treatment effect—a reduction of violence within the operation zone—with a spillover effect, i.e. an escalation of violence immediately outside the treated area (Auerbach et al., 2024). However, there could also be positive externalities of G5 operations beyond the official perimeter, which would bias our estimates downward. We explicitly test for both possibilities—negative and positive externalities—for all types of conflict, as well as specifically for events involving jihadist groups, for which our main results are strongest. We find no evidence consistent with either in the immediate neighborhood of the G5 operation zone.

The patterns in figure 3 appear to rule out symmetrical displacement - where the reduction within the operation zone is offset by increased violence just outside the operation zone. We formally test this possibility in Table A10. The table reproduces the main RDD results for all fatalities and all events after excluding observations within several buffers up to 3.5 km on each side of the cutoff [25] We then extend these tests by progressively excluding wider stretches (up to 15 km) of control cells beyond the boundary, where contamination is most plausible. If rebel groups relocate, they are most likely to position themselves just outside the operation zone, close enough to benefit from cross-border opportunities while avoiding G5 enforcement. By contrast, there is no theoretical or empirical reason to expect a systematic reduction in violence immediately inside the treated zone. Excluding control observations located within narrow bands (5, 10, and 15 km) outside the cutoff therefore provides a focused test for such spillovers while retaining all treated observations to preserve identification [26]. The estimated discontinuities remain highly stable across all specifications in Table A10, with a slight increase in magnitude in the symmetric donut analysis excluding 2.5 and 3.5 km on each side of the cutoff. These results confirm that the estimated effects are not driven by local relocation of violence. It remains possible that displacement affects larger areas, potentially spanning over the complete untreated bandwidth. Such a reallocation would not affect the sign of our effect, nor the conclusion that cooperation between national armies reduces conflict locally.

Finally, both our theoretical framework and the empirical evidence indicate that rebel groups derive higher payoffs from operating near international borders. Proximity to borders lowers the expected retaliation by state forces and provides direct benefits—such

[25] About a third of the optimal bandwidth on the treated side (8.9 km for fatalities, 10.2 km for events).

[26] From an econometric perspective, optimal bandwidth selection in local-linear RD involves a bias–variance trade-off (Cattaneo et al., 2019), which implies that trimming near-cutoff observations (donut analysis) simultaneously increases bias (by forcing greater extrapolation) and variance (by reducing the effective sample size) (Noack and Rothe, 2023). Given that the running variable has limited support on the treated side (0–50 km) and that conflict intensity varies sharply within this range—so that optimal bandwidths often retain only observations between 40 and 50 km—dropping treated observations near the cutoff would likely distort local identification.

as access to smuggling routes and the ability to project influence across multiple jurisdictions. Our empirical results confirm that border proximity amplifies violence. Relocating armed groups away from these zones would therefore reduce their strategic and economic advantages and could yield a positive overall security effect.

## 6.2 Trigger analysis results

**Main results.** We now turn to our second empirical exercise, which compares responses of violence events to French trigger operations. This second exercise highlights one mechanism through which this reduction operated. Figure 4 shows the differential violence in border areas when the G5 mission is active, split up in 2-week time periods around each trigger event. Panel A shows that relatively more violence events occur in border areas (so, within the G5-Sahel operation zone) when the G5-Sahel force is active. The split-up by type of violence in Panels B to D suggests that it is mostly the violence initiated by security forces that is driving this intensification. Focusing on panel B alone, this intensification is visible relatively soon after the trigger event. Table 4 confirms these patterns. Interestingly, it also shows that when the G5 mission is not active, there are less security operations following a trigger event in border areas.[27] This finding supports the hypothesis that security forces are hampered in their operations when the G5-Sahel mission is not active. However, this relative reduction in the intensity of operations is entirely off-set when the G5 mission is active. This result suggests that the G5-Sahel mission did achieve its goal of facilitating operations in border areas. This pattern is mirrored by violence against civilians. Additional analysis in table A14 suggests that this effect is mostly coming from violence by security forces against the civilian population.[28] In the main results, based on the RD approach, we found reductions in violence by militant groups. The response analysis does not show such reductions, but it is important to keep in mind that the response estimates are not set up to capture the longer-term

[27] Figure A 9 presents event studies around trigger events, comparing border and non-border areas, and showing these patterns separately for periods in which the G5-Sahel mission is active or not. Panel C shows the relative reduction in security operations in border areas after trigger events, and Panel D shows how this pattern reverses when the G5-Sahel mission is active.

[28] In this table, military operations against jihadist groups and communal militia respond in a similar way, unlike the RD results, where security force attacks against militias declined more than against jihadist groups. Given that trigger events always involve jihadist groups, the nature of security force operations against communal militias may be different in trigger analysis. Indeed, the ethnic and religious dimensions of the conflict cannot be disentangled fully. In addition, there are limitations to the coding of actors (a substantial share of events involves unknown actors).

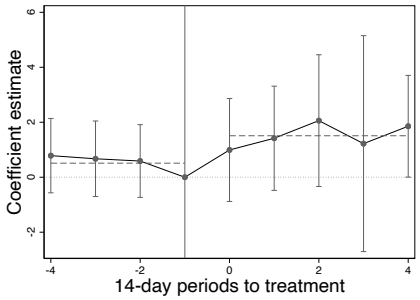
dynamic impacts of security operations in border areas, while our earlier RD results can capture these effects. Indeed, our theoretical framework (and the sequential model in particular) allows us to rationalize these findings – the higher responsiveness of the security forces that we observe in the trigger analysis can deter and reduce the violence we measure in the RD results.

**Robustness of the trigger event analysis.** In the appendix, we test the sensitivity of the results to an alternative criterion for the trigger event, where we focus on operations in which more than 10 (instead of at least 5) people died (table A15). These results are noisier, as the more selective criterion reduces the sample, but the pattern on military operations is the same and significant (at 10%) for the event measures. In table A16, we present results for an alternative coding of the G5 operation period, treating the entire period from September 2017 onwards as "active". In this coding, we ignore the incapacitation of the G5 mission after the 2018 suicide attack. Compared to table 4, we find similar patterns for military operations.[29] In table A17, we show a version of the response analysis where we include all grid cells in the sample, including those that were included in earlier event windows. The main results are robust to using this larger sample. Table A18 shows the response analysis for binary violence outcomes. These findings confirm that the G5 mission changes response patterns on the extensive margin. Finally, tables A19 and A20 confirm that the response results are robust to changing the radius of the circles and the size of the time windows around the trigger events.

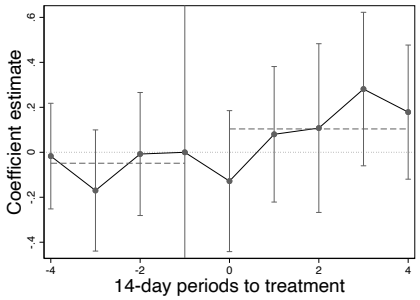
[29]In contrast to the main results, the coefficient on attacks against civilians becomes significantly positive before the G5 is active. Low levels of violence before September 2017 hamper the comparability of violence patterns between the pre- and post-periods, so we do not want to emphasize this result. However, it is possible that the nature of violence against civilians changes over time.

Figure 4: Reaction to trigger events - border areas under G5

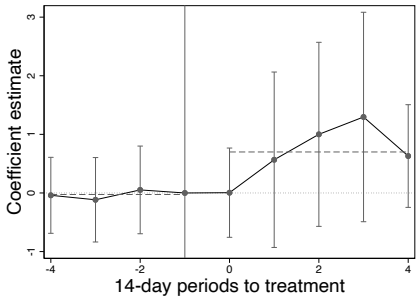
*Panel A:* All events - Fatalities



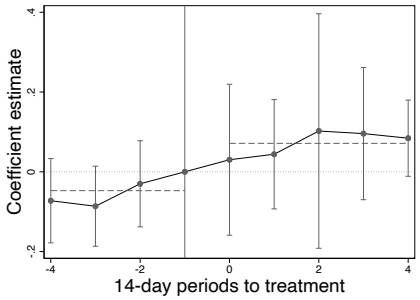

*Panel B:* All events



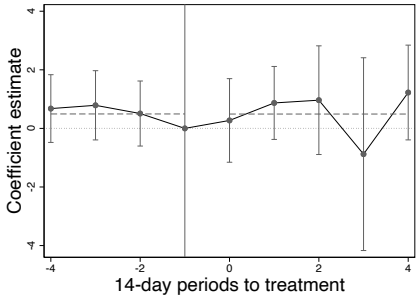

*Panel C:* Military Operations - Fatalities



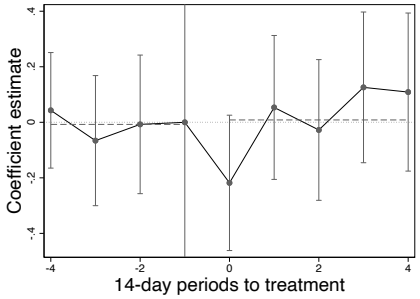

*Panel D:* Military Operations - Events



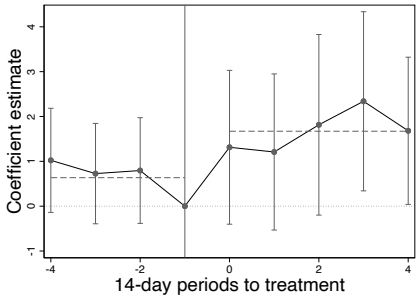

*Panel E:* Attacks by armed groups - Fatalities



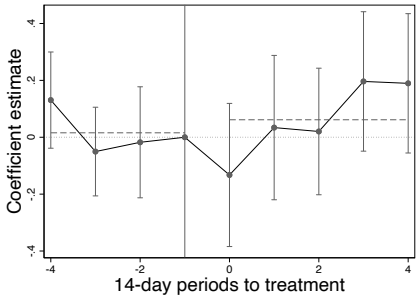

*Panel F:* Attacks by armed groups - Events




*Panel G:* Attacks on civilians - Fatalities




*Panel H:* Attacks on civilians - Events




Notes: Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2021). The graph shows coefficients on time-to-treatment dummies around the trigger operation, interacted with indicators for when the G5 mission is active and for the border area. The model includes border area by time-to-treatment effects, as well as trigger operation by time-to-treatment effects. Standard errors are clustered at the grid-cell level, and grey bars represent 95% confidence intervals.

Table 4: Reaction to trigger events

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Border x Post | -0.53 | -0.15** | -0.51** | -0.10** | -0.02 | -0.05 | -0.68*** | -0.07 |
| | (0.40) | (0.07) | (0.21) | (0.04) | (0.36) | (0.06) | (0.21) | (0.04) |
| Border x Post x G5 | 1.00* | 0.15* | 1.00*** | 0.14*** | - | 0.02 | 1.04*** | 0.05 |
| | (0.51) | (0.08) | (0.32) | (0.05) | (0.42) | (0.07) | (0.34) | (0.05) |
| Mean DV | 0.677 | 0.178 | 0.298 | 0.054 | 0.380 | 0.125 | 0.359 | 0.099 |
| Standard Deviation | 4.148 | 0.576 | 2.809 | 0.372 | 2.635 | 0.387 | 2.412 | 0.332 |
| Observations | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 |
| Clusters | 352 | 352 | 352 | 352 | 352 | 352 | 352 | 352 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2020). Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

# 7 Conclusion

This paper examines how the establishment of an international armed force capable of crossing borders, known as the G5-Sahel, influenced the intensity and spatial distribution of conflict in the region's porous border areas. Our analysis indicates that the G5 mission reduced the intensity of conflict, at least locally, within its operation zone. By studying how the spatial distribution of violence responds to trigger events, we also find that the mission facilitated security operations in border areas. In this sense, our results offer a coherent narrative, whereby improved cooperation between national armies strengthens local enforcement capacity and contributes to a reduction in equilibrium levels of violence. Still, it should be kept in mind that the armies that are part of the G5-Sahel mission are regularly accused of human rights abuses, and we see that fatal violence against civilians mirrors their activities in our data. Hence, the welfare implications of our findings are far from clear in the context we study. In addition, the local effects that we estimate do not allow us to evaluate whether the G5 mission has helped to reduce levels of conflict at the aggregate level. The geographical spread of jihadist groups and the ongoing security challenges in the Sahel region put the local improvements we document in sharp perspective.

In spite of these limitations, it is important to document that establishing zones in which national armies share security responsibilities can change conflict dynamics. Our findings are particularly relevant for the many border regions in which armed groups exploit coordination frictions between national security forces. The resulting threats can lead to a financial and military mobilization of international actors, as was the case for the Sahel region after 2012. In such a context, the active promotion of military cooperation between national armies could offer improved security, at a relatively low cost to these international actors. Our results provide some evidence supporting this approach, but we also point at crucial caveats in terms of the respect for human rights and the difficulty of measuring aggregate effects.

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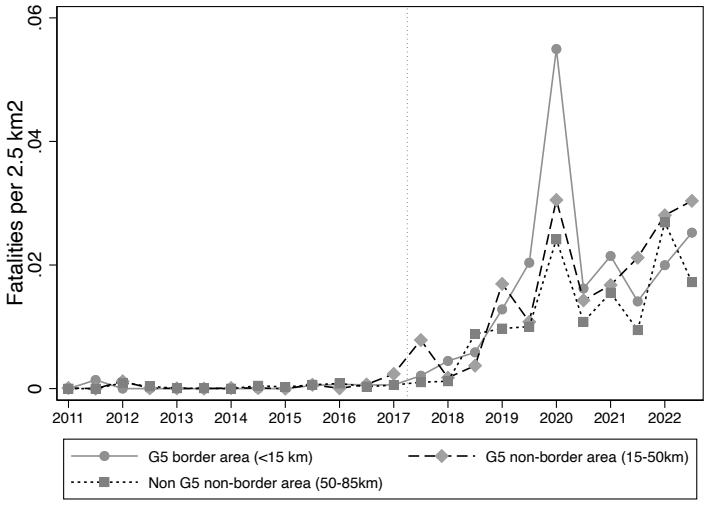
# Appendix to **Cooperation between National Armies**

For Online Publication

# A Descriptive statistics

Figure A 1: Time trends in conflict intensity in G5 Sahel central operation zone




Notes: Observations at the grid-cell level, binned in six months periods (2011-2022). The sample comprises the central Zone (Mali-Niger-Burkina Faso three borders regions). Included events coded with geo-precision level 1 only.

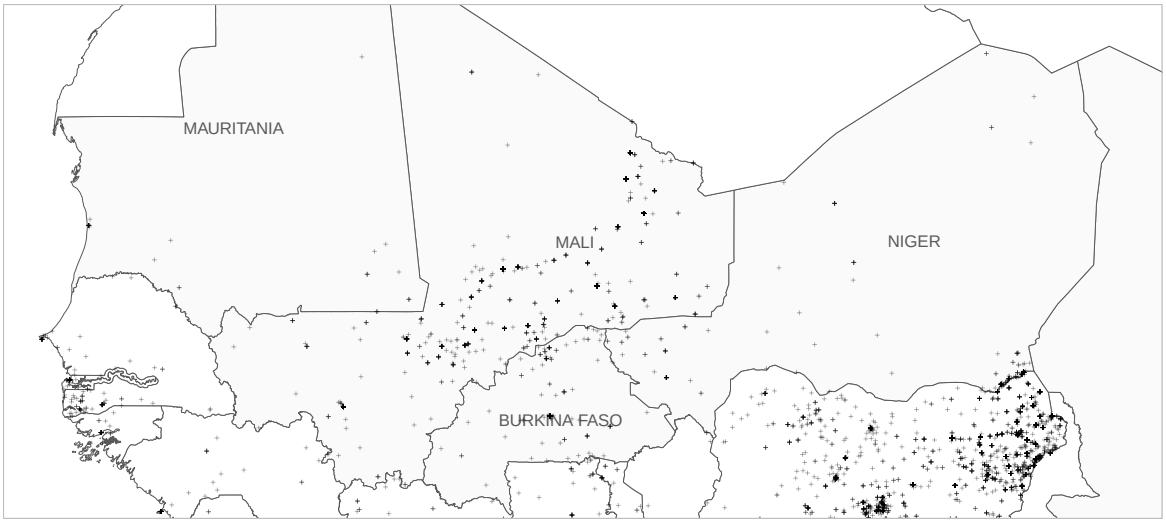
Table A1: Descriptive statistics: ACLED conflict events and fatalities reported in border areas in Mali, Niger and Burkina Faso.

| | Border $< 50$ km | | Border $< 100$ km | | Border $< 250$ km | |
|---|---|---|---|---|---|---|
| | mean | sd | mean | sd | mean | sd |
| Fatalities – All events | 0.045 | (1.103) | 0.040 | (1.019) | 0.024 | (0.748) |
| Events – All events | 0.019 | (0.253) | 0.018 | (0.280) | 0.011 | (0.220) |
| Fatalities – Military operations | 0.007 | (0.334) | 0.005 | (0.260) | 0.003 | (0.203) |
| Events – Military operations | 0.001 | (0.047) | 0.001 | (0.044) | 0.001 | (0.033) |
| Fatalities – Attacks by armed groups | 0.039 | (1.011) | 0.034 | (0.943) | 0.020 | (0.687) |
| Events – Attacks by armed groups | 0.017 | (0.223) | 0.016 | (0.250) | 0.010 | (0.198) |
| Fatalities – Attacks on civilians | 0.024 | (0.589) | 0.024 | (0.617) | 0.014 | (0.474) |
| Events – Attacks on civilians | 0.012 | (0.159) | 0.011 | (0.157) | 0.007 | (0.123) |
| Observations | 31062 | | 58343 | | 129025 | |

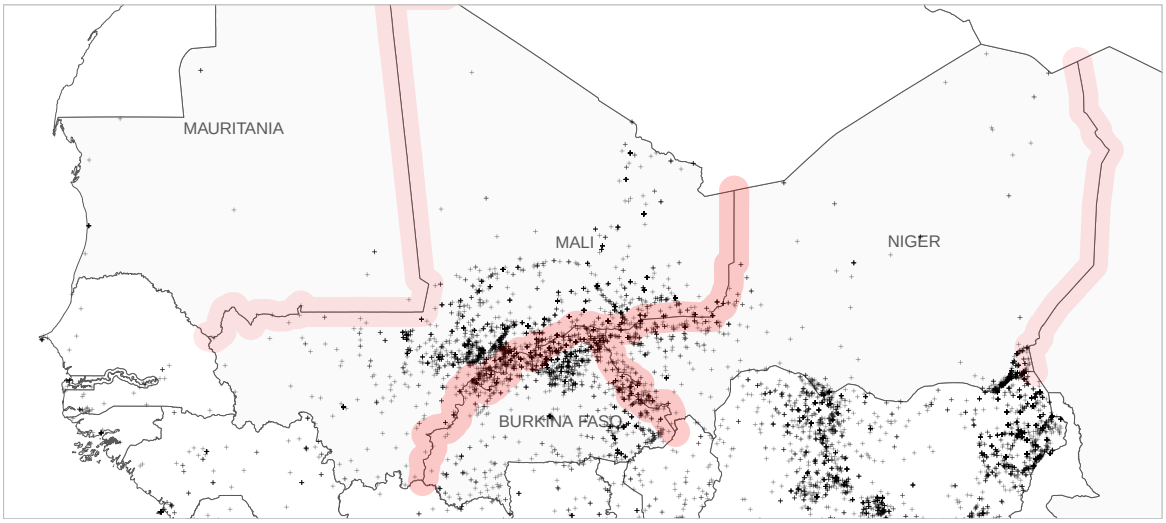
*Notes:* All conflict events occurring within 50 km, 100 km, and 250 km of treated G5 Sahel borders (Mali–Burkina Faso, Mali–Niger, and Niger–Burkina Faso) are included for the period between September 2017 and January 2020. The sample includes ACLED events coded with geo-precision 1 only and excludes riots and protests. Fatalities are winsorized at the 1st and 99th percentiles. "Military operations" involve state military forces or police; "attacks by armed groups" exclude such actors; "attacks on civilians" target civilians. Means and standard deviations are computed across $0.25° \times 0.25°$ grid-cell observations within each distance band.

Figure A 2: Foreign Military Operations in Sahel regions

*Panel A:* Attack by armed groups before G5-Sahel Joint Force Creation




*Panel B:* Attack by armed groups during G5-Sahel period



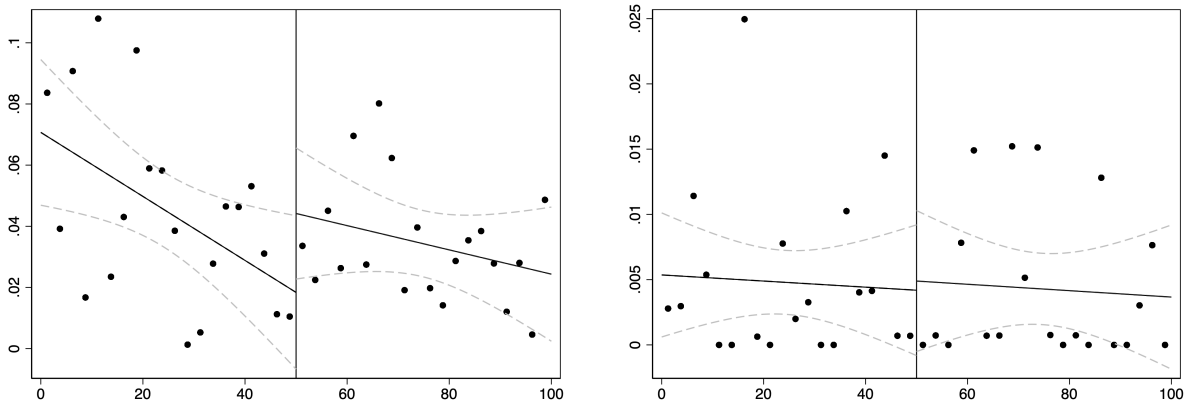

Notes: The red shaded areas represent the 50 km operation zones around borders where the G5-Sahel operated officially between January 2017 and January 2020.

# B RDD Analysis Additional Results

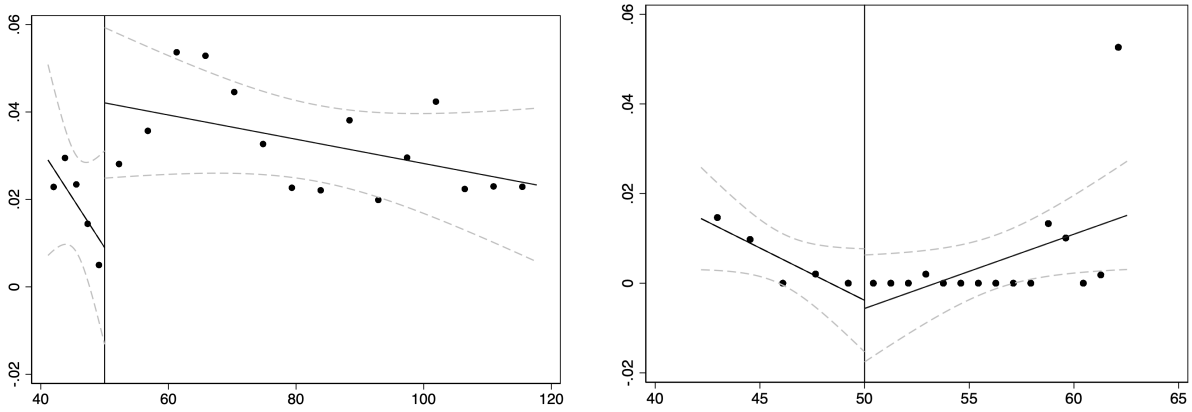
Figure A 3: Regression Discontinuity for G5 operation zone

*Panel A:* All events (after Sept 2017) *Panel B:* All events (before Sept 2017)

*Symmetric full bandwidth*




*Optimal bandwidth*

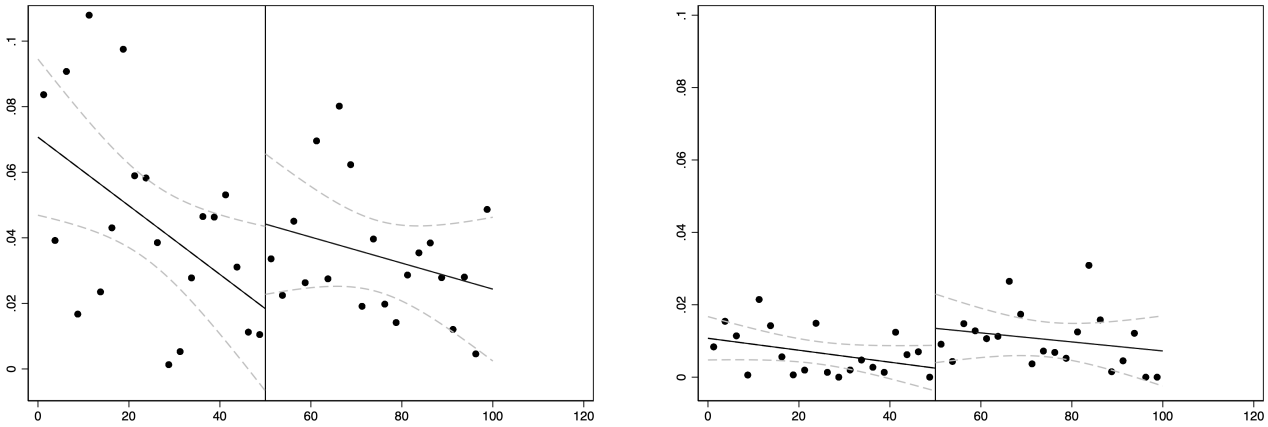



Notes: Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 200km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. The sample comprises the central Zone (Mali-Niger-Burkina Faso three borders regions). Included events are coded with geo-precision level 1.

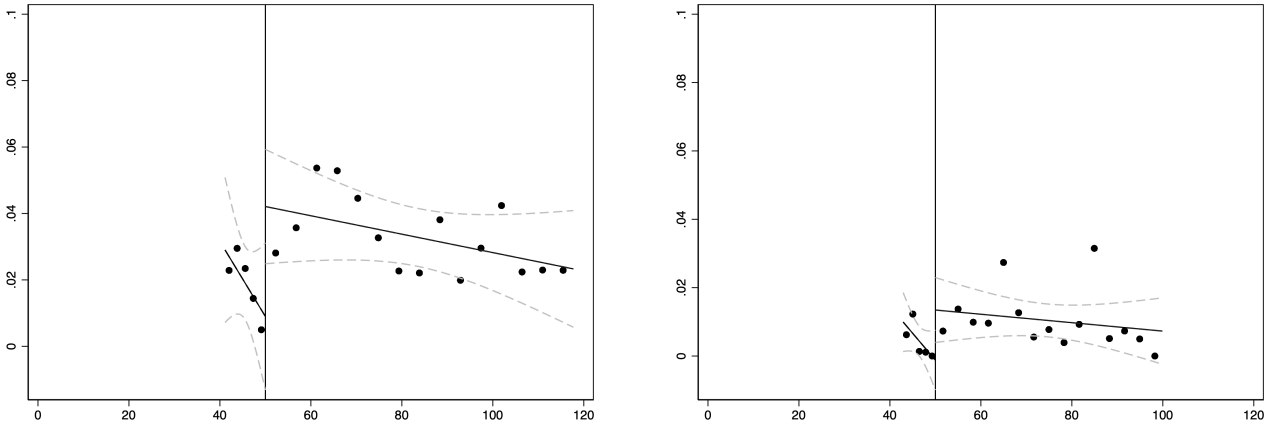
Figure A 4: Regression Discontinuity for G5 central operation zone, rescaled

*Panel A:* All events fatalities *Panel B:* Attacks on civilians by jihadist groups

*Symmetric full bandwidth*




*Optimal bandwidth*

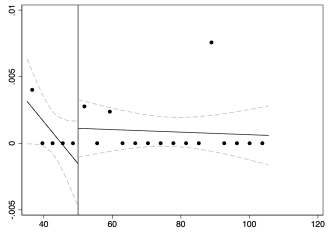



Notes: Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. The sample comprises the central Zone (Mali-Niger-Burkina Faso three borders regions). Included events are coded with geo-precision level 1.

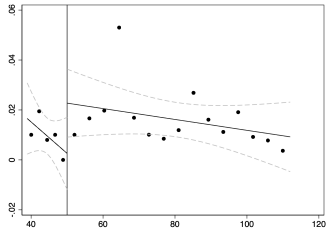
Figure A 5: RDD plots with optimal buffer for sub-groups, geo-precision level 1

*Panel A:* Events involving jihadist groups

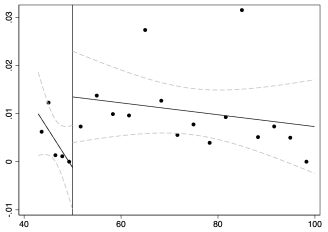
*Panel A1:* Military Operations



*Panel A2:* Attacks by armed groups

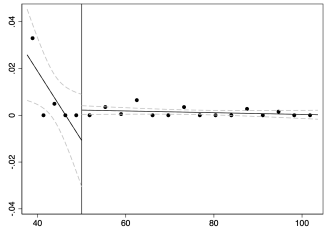


*Panel A3:* Attacks on Civilians

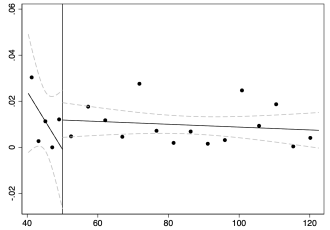


*Panel B:* Events involving communual militias

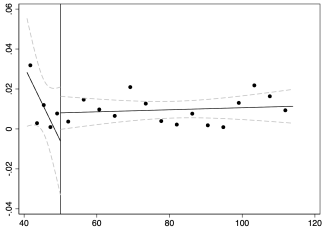
*Panel B1:* Military Operations



*Panel B2:* Attacks by armed groups

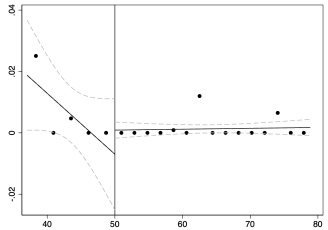


*Panel B3:* Attacks on Civilians

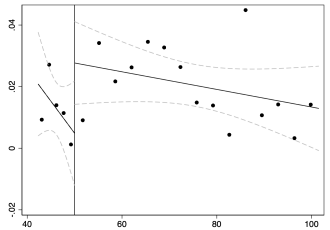


*Panel C:* Events involving civilians

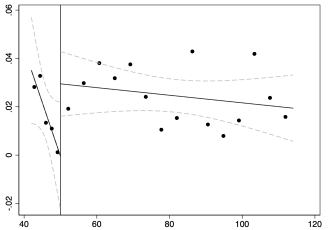
*Panel C1:* Military Operations



*Panel C2:* Attacks by armed groups



*Panel C3:* Attacks on Civilians

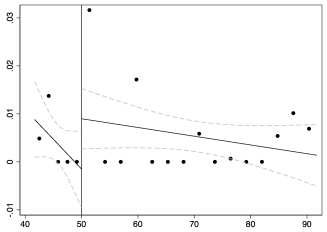


Notes: Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. All conflict events occurring for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only.

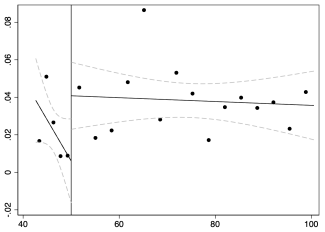
Figure A 6: RDD plots with optimal buffer for sub-groups, geo-precision level 1 and 2

*Panel A:* Events involving jihadist groups

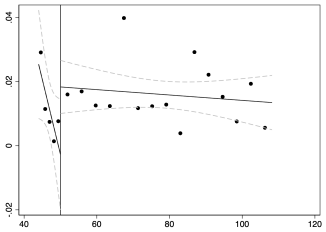
*Panel A1:* Military Operations



*Panel A2:* Attacks by armed groups

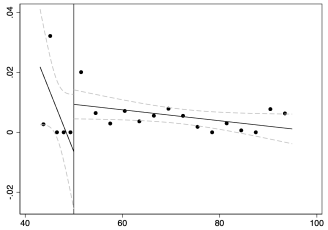


*Panel A3:* Civilians

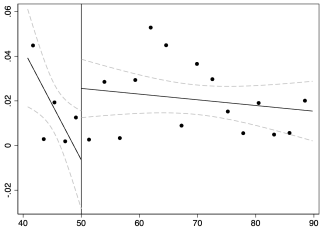


*Panel B:* Events involving communual militias

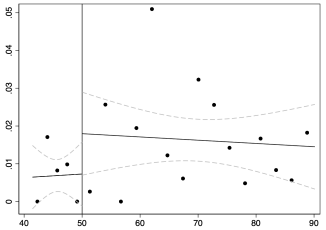
*Panel B1:* Military Operations



*Panel B2:* Attacks by armed groups

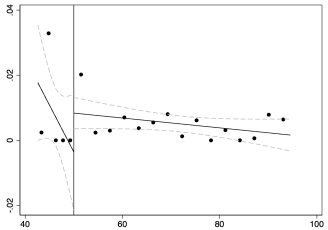


*Panel B3:* Civilians

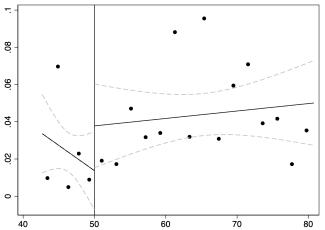


*Panel C:* Events involving civilians

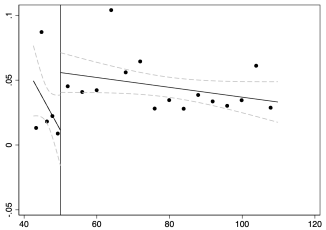
*Panel C1:* Military Operations



*Panel C2:* Attacks by armed groups



*Panel C3:* Civilians



Notes: Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. All conflict events occurring for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 and 2.

Table A2: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, by country/border.

**Panel A : By country and border**

| | Mali | | Burkina Faso | | Niger | | MLI-BFA | | MLI-NER | | NER-BFA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Robust | -0.0448* | -0.0078 | -0.0689** | -0.0270** | -0.0049** | -0.0053** | -0.0493 | -0.0149 | -0.0156** | -0.0069 | -0.0026 | -0.0071 |
| | (0.0241) | (0.0125) | (0.0328) | (0.0137) | (0.0022) | (0.0021) | (0.0315) | (0.0140) | (0.0076) | (0.0068) | (0.0124) | (0.0083) |
| Mean DV | 0.024 | 0.011 | 0.042 | 0.020 | 0.006 | 0.004 | 0.031 | 0.014 | 0.017 | 0.008 | 0.024 | 0.012 |
| Standard Deviation | 0.754 | 0.243 | 0.984 | 0.270 | 0.391 | 0.085 | 0.845 | 0.253 | 0.643 | 0.199 | 0.742 | 0.198 |
| Observations within buffer | 2292 | 4352 | 1672 | 1496 | 1370 | 1485 | 3122 | 3113 | 4804 | 3543 | 3864 | 3364 |
| Observations untreated | 17062 | 14354 | 8568 | 8084 | 10709 | 9980 | 41492 | 28399 | 27062 | 33538 | 7779 | 12877 |
| Bandwidth untreated (km) | 74.422 | 62.452 | 55.053 | 51.667 | 67.423 | 62.787 | 149.641 | 104.595 | 112.625 | 137.723 | 61.742 | 101.940 |
| Bandwidth treated (km) | 9.642 | 18.062 | 9.605 | 8.651 | 8.250 | 9.033 | 11.541 | 11.479 | 21.324 | 15.706 | 30.189 | 26.318 |

**Panel A : By border-country**

| | MLI-BFA | | | | MLI-NER | | | | BFA-NER | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MLI | | BFA | | MLI | | NER | | BFA | | NER | |
| | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Robust | -0.0282 | 0.0001 | -0.0966 | -0.0382* | -0.0314* | -0.0127 | -0.0065* | -0.0066** | -0.0016 | -0.0098 | -0.0167* | -0.0084 |
| | (0.0279) | (0.0141) | (0.0660) | (0.0215) | (0.0172) | (0.0159) | (0.0037) | (0.0026) | (0.0217) | (0.0143) | (0.0098) | (0.0051) |
| Mean DV | 0.024 | 0.011 | 0.042 | 0.020 | 0.024 | 0.011 | 0.006 | 0.004 | 0.042 | 0.020 | 0.006 | 0.004 |
| Standard Deviation | 0.754 | 0.243 | 0.984 | 0.270 | 0.754 | 0.243 | 0.391 | 0.085 | 0.984 | 0.270 | 0.391 | 0.085 |
| Observations within buffer | 2420 | 2790 | 1726 | 1315 | 2661 | 2909 | 1475 | 1436 | 2086 | 1671 | 2392 | 2117 |
| Observations untreated | 25625 | 17788 | 12113 | 12138 | 12730 | 14768 | 9007 | 11504 | 4368 | 6926 | 13261 | 14241 |
| Bandwidth untreated (km) | 148.500 | 108.232 | 112.950 | 113.192 | 115.048 | 131.775 | 70.551 | 89.397 | 63.882 | 102.804 | 280.466 | 308.767 |
| Bandwidth treated (km) | 16.066 | 18.549 | 14.355 | 11.006 | 25.261 | 27.345 | 12.676 | 12.081 | 31.046 | 24.901 | 38.161 | 34.281 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Cells that intersect with the limit of the 50km buffer of intervention are dropped from the sample. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Discontinuity in conflict intensity for all G5-Sahel operation zones 2017-2020, all regions.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Panel A:* Central Zone (Mali-Niger-Burkina Faso three borders regions) | | | | | | | | |
| Robust | -0.0390*** | -0.0108 | -0.0054** | -0.0022*** | -0.0313** | -0.0073 | -0.0315*** | -0.0033 |
| | (0.0144) | (0.0073) | (0.0025) | (0.0007) | (0.0130) | (0.0069) | (0.0116) | (0.0051) |
| Mean DV | 0.024 | 0.011 | 0.003 | 0.001 | 0.020 | 0.010 | 0.014 | 0.007 |
| Standard Deviation | 0.748 | 0.220 | 0.203 | 0.033 | 0.687 | 0.198 | 0.474 | 0.123 |
| Observations within buffer | 5131 | 5881 | 7392 | 4865 | 5089 | 6378 | 4623 | 7668 |
| Observations untreated | 36679 | 25505 | 27652 | 42229 | 29794 | 22713 | 34645 | 22389 |
| Bandwidth untreated (km) | 67.715 | 46.514 | 50.720 | 78.387 | 54.684 | 41.264 | 64.037 | 40.734 |
| Bandwidth treated (km) | 8.874 | 10.214 | 12.775 | 8.413 | 8.790 | 11.000 | 8.003 | 13.220 |
| *Panel B:* Eastern Zone (Niger-Chad border) | | | | | | | | |
| Robust | -0.0264 | -0.0005 | -0.0029 | -0.0008 | -0.0136 | -0.0003 | -0.0160* | 0.0012 |
| | (0.0162) | (0.0047) | (0.0019) | (0.0005) | (0.0117) | (0.0047) | (0.0093) | (0.0046) |
| Mean DV | 0.004 | 0.002 | 0.001 | 0.000 | 0.003 | 0.002 | 0.002 | 0.002 |
| Standard Deviation | 0.335 | 0.102 | 0.150 | 0.016 | 0.256 | 0.089 | 0.155 | 0.085 |
| Observations within buffer | 2581 | 6694 | 2083 | 2369 | 3986 | 8146 | 2581 | 6810 |
| Observations untreated | 14774 | 21434 | 9610 | 8230 | 19398 | 20230 | 12461 | 16312 |
| Bandwidth untreated (km) | 47.914 | 69.060 | 31.218 | 26.675 | 62.617 | 65.270 | 40.404 | 52.763 |
| Bandwidth treated (km) | 8.424 | 21.981 | 6.830 | 7.734 | 13.047 | 26.746 | 8.437 | 22.346 |
| *Panel C:* Western Zone (Mali-Mauritania border) | | | | | | | | |
| Robust | | -0.0002 | | | -0.0003 | | -0.0002 | |
| | | (0.0003) | | | (0.0003) | | (0.0002) | |
| Mean DV | 0.500 | 0.002 | 0.500 | 0.500 | 0.002 | 0.500 | 0.001 | |
| Standard Deviation | 0.289 | 0.062 | 0.289 | 0.289 | 0.059 | 0.289 | 0.040 | |
| Observations within buffer | 30965 | 2777 | 30965 | 30965 | 2777 | 30965 | 2631 | |
| Observations untreated | 30941 | 11995 | 30941 | 30941 | 12458 | 30941 | 12843 | |
| Bandwidth untreated (km) | 0.081 | 21.823 | 0.081 | 0.081 | 22.809 | 0.081 | 23.380 | |
| Bandwidth treated (km) | 0.081 | 4.829 | 0.081 | 0.081 | 4.829 | 0.081 | 4.581 | |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Empty cells means the discontinuity could not be estimated due to lack of variability in the dependent variable. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

# C RDD Analysis Robustness Checks

Table A4: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, Robustness checks.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) (1) | Events (2) | Fatalities (count) (3) | Events (4) | Fatalities (count) (5) | Events (6) | Fatalities (count) (7) | Events (8) |
| *Panel A:* Split cells dropped | | | | | | | | |
| Robust | -0.0590*** | -0.0278*** | -0.0031 | -0.0031*** | -0.0520*** | -0.0226*** | -0.0507*** | -0.0138*** |
| | (0.0191) | (0.0090) | (0.0045) | (0.0009) | (0.0182) | (0.0082) | (0.0171) | (0.0046) |
| Mean DV | 0.024 | 0.011 | 0.003 | 0.001 | 0.021 | 0.010 | 0.014 | 0.007 |
| Standard Deviation | 0.751 | 0.220 | 0.204 | 0.033 | 0.691 | 0.198 | 0.475 | 0.123 |
| Observations within buffer | 3039 | 3086 | 2940 | 4002 | 2977 | 3288 | 2681 | 4205 |
| Observations untreated | 44287 | 38093 | 41040 | 47092 | 34674 | 32257 | 37184 | 34140 |
| Bandwidth untreated (km) | 84.258 | 72.520 | 78.107 | 89.673 | 65.973 | 61.404 | 70.670 | 64.885 |
| Bandwidth treated (km) | 6.921 | 6.976 | 6.754 | 8.471 | 6.824 | 7.304 | 6.201 | 8.801 |
| *Panel B:* Non-Top-coded fatalities (0.01) | | | | | | | | |
| Robust | -0.0449*** | -0.0108 | -0.0050** | -0.0022*** | -0.0359** | -0.0073 | -0.0319*** | -0.0033 |
| | (0.0165) | (0.0073) | (0.0025) | (0.0007) | (0.0151) | (0.0069) | (0.0113) | (0.0051) |
| Mean DV | 0.027 | 0.011 | 0.003 | 0.001 | 0.024 | 0.010 | 0.016 | 0.007 |
| Standard Deviation | 1.115 | 0.220 | 0.211 | 0.033 | 1.073 | 0.198 | 0.646 | 0.123 |
| Observations within buffer | 3726 | 5881 | 7285 | 4865 | 3609 | 6378 | 3285 | 7668 |
| Observations untreated | 38392 | 25505 | 27652 | 42229 | 32315 | 22713 | 34083 | 22389 |
| Bandwidth untreated (km) | 71.101 | 46.514 | 50.720 | 78.387 | 59.485 | 41.264 | 62.884 | 40.734 |
| Bandwidth treated (km) | 6.499 | 10.214 | 12.582 | 8.413 | 6.280 | 11.000 | 5.684 | 13.220 |
| *Panel C:* Any fatality | | | | | | | | |
| Robust | -0.0048** | -0.0108 | -0.0010*** | -0.0022*** | -0.0041* | -0.0073 | -0.0041** | -0.0033 |
| | (0.0023) | (0.0073) | (0.0004) | (0.0007) | (0.0023) | (0.0069) | (0.0020) | (0.0051) |
| Mean DV | 0.004 | 0.011 | 0.000 | 0.001 | 0.003 | 0.010 | 0.003 | 0.007 |
| Standard Deviation | 0.060 | 0.220 | 0.020 | 0.033 | 0.058 | 0.198 | 0.051 | 0.123 |
| Observations within buffer | 5617 | 5881 | 6337 | 4865 | 5645 | 6378 | 5186 | 7668 |
| Observations untreated | 35839 | 25505 | 40894 | 42229 | 32887 | 22713 | 34653 | 22389 |
| Bandwidth untreated (km) | 66.278 | 46.514 | 75.807 | 78.387 | 60.652 | 41.264 | 64.055 | 40.734 |
| Bandwidth treated (km) | 9.747 | 10.214 | 10.926 | 8.413 | 9.784 | 11.000 | 9.000 | 13.220 |
| *Panel D:* Extended maximum buffer to 300k | | | | | | | | |
| Robust | -0.0449*** | -0.0108 | -0.0050** | -0.0022*** | -0.0359** | -0.0073 | -0.0319*** | -0.0033 |
| | (0.0165) | (0.0073) | (0.0025) | (0.0007) | (0.0151) | (0.0069) | (0.0113) | (0.0051) |
| Mean DV | 0.027 | 0.011 | 0.003 | 0.001 | 0.024 | 0.010 | 0.016 | 0.007 |
| Standard Deviation | 1.115 | 0.220 | 0.211 | 0.033 | 1.073 | 0.198 | 0.646 | 0.123 |
| Observations within buffer | 3726 | 5881 | 7285 | 4865 | 3609 | 6378 | 3285 | 7668 |
| Observations untreated | 38392 | 25505 | 27652 | 42229 | 32315 | 22713 | 34083 | 22389 |
| Bandwidth untreated (km) | 71.101 | 46.514 | 50.720 | 78.387 | 59.485 | 41.264 | 62.884 | 40.734 |
| Bandwidth treated (km) | 6.499 | 10.214 | 12.582 | 8.413 | 6.280 | 11.000 | 5.684 | 13.220 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Cells that intersect with the limit of the 50km buffer of intervention are dropped from the sample in Panel A. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, separating period during which G5 was incapacitated by suicide attack.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) (1) | Events (2) | Fatalities (count) (3) | Events (4) | Fatalities (count) (5) | Events (6) | Fatalities (count) (7) | Events (8) |
| *Panel A:* Excluding suicide attack period | | | | | | | | |
| Conventional | -0.0331** | -0.0076 | -0.0027 | -0.0015*** | -0.0292** | -0.0057 | -0.0211** | -0.0018 |
| | (0.0141) | (0.0056) | (0.0017) | (0.0005) | (0.0134) | (0.0052) | (0.0087) | (0.0038) |
| Bias-corrected | -0.0336** | -0.0079 | -0.0029* | -0.0016*** | -0.0297** | -0.0060 | -0.0231*** | -0.0026 |
| | (0.0141) | (0.0056) | (0.0017) | (0.0005) | (0.0134) | (0.0052) | (0.0087) | (0.0038) |
| Robust | -0.0336** | -0.0079 | -0.0029 | -0.0016** | -0.0297** | -0.0060 | -0.0231** | -0.0026 |
| | (0.0153) | (0.0064) | (0.0022) | (0.0006) | (0.0143) | (0.0060) | (0.0099) | (0.0044) |
| Mean DV | 0.025 | 0.009 | 0.002 | 0.001 | 0.022 | 0.008 | 0.013 | 0.005 |
| Standard Deviation | 1.084 | 0.184 | 0.204 | 0.029 | 1.053 | 0.168 | 0.623 | 0.103 |
| Observations within buffer | 3658 | 5700 | 6774 | 4453 | 3574 | 6237 | 3205 | 7545 |
| Observations untreated | 35452 | 24387 | 21327 | 40565 | 31207 | 22418 | 30818 | 23933 |
| Bandwidth untreated (km) | 65.444 | 44.507 | 38.636 | 75.288 | 57.379 | 40.780 | 56.688 | 43.588 |
| Bandwidth treated (km) | 6.373 | 9.881 | 11.708 | 7.761 | 6.198 | 10.748 | 5.573 | 13.026 |
| *Panel B:* Only suicide attack period | | | | | | | | |
| Conventional | -0.0088*** | -0.0028** | -0.0016 | -0.0006** | -0.0046* | -0.0016 | -0.0078** | -0.0009 |
| | (0.0034) | (0.0014) | (0.0011) | (0.0003) | (0.0027) | (0.0013) | (0.0032) | (0.0011) |
| Bias-corrected | -0.0100*** | -0.0032** | -0.0017 | -0.0007** | -0.0052* | -0.0018 | -0.0086*** | -0.0009 |
| | (0.0034) | (0.0014) | (0.0011) | (0.0003) | (0.0027) | (0.0013) | (0.0032) | (0.0011) |
| Robust | -0.0100** | -0.0032** | -0.0017 | -0.0007** | -0.0052* | -0.0018 | -0.0086** | -0.0009 |
| | (0.0041) | (0.0016) | (0.0012) | (0.0003) | (0.0030) | (0.0014) | (0.0039) | (0.0013) |
| Mean DV | 0.003 | 0.002 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 | 0.001 |
| Standard Deviation | 0.163 | 0.059 | 0.054 | 0.012 | 0.131 | 0.052 | 0.139 | 0.043 |
| Observations within buffer | 7318 | 8104 | 5899 | 5548 | 6071 | 8440 | 8437 | 7854 |
| Observations untreated | 44353 | 32660 | 41167 | 33861 | 31430 | 28367 | 46464 | 23908 |
| Bandwidth untreated (km) | 82.548 | 60.149 | 76.413 | 62.360 | 57.843 | 51.966 | 86.490 | 43.553 |
| Bandwidth treated (km) | 12.646 | 13.946 | 10.245 | 9.673 | 10.508 | 14.549 | 14.534 | 13.526 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020, excluding the period between June 2018 and January 2019. Include events coded with geo-precision level 1 only. Cells that intersect with the limit of the 50km buffer of intervention are dropped from the sample in Panel A. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, symmetrical bandwidths.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) (1) | Events (2) | Fatalities (count) (3) | Events (4) | Fatalities (count) (5) | Events (6) | Fatalities (count) (7) | Events (8) |
| *Panel A:* All events | | | | | | | | |
| Robust | -0.0324 | -0.0060 | -0.0068 | -0.0014 | -0.0076 | -0.0015 | -0.0307* | -0.0010 |
| | (0.0208) | (0.0085) | (0.0050) | (0.0014) | (0.0121) | (0.0077) | (0.0184) | (0.0059) |
| Mean DV | 0.024 | 0.011 | 0.003 | 0.001 | 0.020 | 0.010 | 0.014 | 0.007 |
| Standard Deviation | 0.748 | 0.220 | 0.203 | 0.033 | 0.687 | 0.198 | 0.474 | 0.123 |
| Observations within buffer | 6442 | 7419 | 8178 | 8518 | 7514 | 7886 | 6102 | 8580 |
| Observations untreated | 6297 | 7199 | 7918 | 8320 | 7304 | 7655 | 5946 | 8368 |
| Bandwidth untreated (km) | 11.128 | 12.810 | 14.068 | 14.711 | 12.979 | 13.564 | 10.555 | 14.830 |
| Bandwidth treated (km) | 11.128 | 12.810 | 14.068 | 14.711 | 12.979 | 13.564 | 10.555 | 14.830 |
| *Panel B:* Events involving jihadist groups | | | | | | | | |
| Robust | -0.0106 | -0.0100* | -0.0033 | -0.0009 | -0.0106 | -0.0100* | -0.0070 | -0.0039 |
| | (0.0082) | (0.0056) | (0.0034) | (0.0010) | (0.0082) | (0.0056) | (0.0055) | (0.0030) |
| Mean DV | 0.012 | 0.006 | 0.000 | 0.000 | 0.012 | 0.006 | 0.005 | 0.003 |
| Standard Deviation | 0.527 | 0.123 | 0.067 | 0.011 | 0.527 | 0.123 | 0.266 | 0.076 |
| Observations within buffer | 9018 | 6810 | 10401 | 13295 | 9018 | 6810 | 7320 | 10805 |
| Observations untreated | 8719 | 6719 | 10012 | 12673 | 8719 | 6719 | 7113 | 10361 |
| Bandwidth untreated (km) | 15.520 | 11.792 | 17.818 | 22.633 | 15.520 | 11.792 | 12.651 | 18.492 |
| Bandwidth treated (km) | 15.520 | 11.792 | 17.818 | 22.633 | 15.520 | 11.792 | 12.651 | 18.492 |
| *Panel C:* Events involving Communal militia | | | | | | | | |
| Robust | -0.0015 | 0.0035 | -0.0040 | -0.0006 | -0.0015 | 0.0035 | -0.0048 | 0.0033 |
| | (0.0096) | (0.0035) | (0.0029) | (0.0006) | (0.0096) | (0.0035) | (0.0089) | (0.0030) |
| Mean DV | 0.007 | 0.002 | 0.002 | 0.001 | 0.007 | 0.002 | 0.005 | 0.001 |
| Standard Deviation | 0.379 | 0.058 | 0.186 | 0.028 | 0.379 | 0.058 | 0.286 | 0.042 |
| Observations within buffer | 7963 | 10894 | 8275 | 7419 | 7963 | 10894 | 7996 | 12568 |
| Observations untreated | 7706 | 10438 | 7991 | 7197 | 7706 | 10438 | 7737 | 11984 |
| Bandwidth untreated (km) | 13.674 | 18.637 | 14.223 | 12.807 | 13.674 | 18.637 | 13.729 | 21.416 |
| Bandwidth treated (km) | 13.674 | 18.637 | 14.223 | 12.807 | 13.674 | 18.637 | 13.729 | 21.416 |
| *Panel D:* Events involving civilians | | | | | | | | |
| Robust | -0.0307* | -0.0010 | -0.0017 | -0.0004 | -0.0112 | 0.0016 | -0.0307* | -0.0010 |
| | (0.0184) | (0.0059) | (0.0019) | (0.0006) | (0.0112) | (0.0053) | (0.0184) | (0.0059) |
| Mean DV | 0.014 | 0.007 | 0.002 | 0.000 | 0.012 | 0.006 | 0.014 | 0.007 |
| Standard Deviation | 0.474 | 0.123 | 0.181 | 0.024 | 0.414 | 0.112 | 0.474 | 0.123 |
| Observations within buffer | 6102 | 8580 | 8103 | 7461 | 6488 | 10111 | 6102 | 8580 |
| Observations untreated | 5946 | 8368 | 7844 | 7238 | 6337 | 9803 | 5946 | 8368 |
| Bandwidth untreated (km) | 10.555 | 14.830 | 13.942 | 12.888 | 11.223 | 17.384 | 10.555 | 14.830 |
| Bandwidth treated (km) | 10.555 | 14.830 | 13.942 | 12.888 | 11.223 | 17.384 | 10.555 | 14.830 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of symmetric bandwidth for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of borders between Burkina Faso, Mali and Niger are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, local polynomial of order 2 and 3.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) (1) | Events (2) | Fatalities (count) (3) | Events (4) | Fatalities (count) (5) | Events (6) | Fatalities (count) (7) | Events (8) |
| | | | | **Local quadratic polynomial** | | | | |
| *Panel A:* All events | | | | | | | | |
| Robust | -0.0350** | -0.0069 | -0.0046 | -0.0020** | -0.0305** | -0.0018 | -0.0330** | -0.0018 |
| | (0.0154) | (0.0080) | (0.0030) | (0.0008) | (0.0128) | (0.0075) | (0.0136) | (0.0059) |
| Mean DV | 0.024 | 0.011 | 0.003 | 0.001 | 0.020 | 0.010 | 0.014 | 0.007 |
| Standard Deviation | 0.748 | 0.220 | 0.203 | 0.033 | 0.687 | 0.198 | 0.474 | 0.123 |
| Observations within buffer | 7492 | 9800 | 9383 | 6806 | 7759 | 9724 | 8576 | 9860 |
| Observations untreated | 51957 | 31067 | 34064 | 55407 | 37004 | 27871 | 48999 | 34403 |
| Bandwidth untreated (km) | 97.265 | 57.066 | 62.846 | 104.180 | 68.473 | 51.112 | 91.466 | 63.534 |
| Bandwidth treated (km) | 12.934 | 16.818 | 16.107 | 11.780 | 13.365 | 16.670 | 14.820 | 16.901 |
| *Panel B:* Events involving jihadist groups | | | | | | | | |
| Robust | -0.0209*** | -0.0088** | -0.0016 | -0.0007 | -0.0209*** | -0.0088** | -0.0145*** | -0.0041 |
| | (0.0072) | (0.0044) | (0.0019) | (0.0006) | (0.0072) | (0.0044) | (0.0051) | (0.0028) |
| Mean DV | 0.012 | 0.006 | 0.000 | 0.000 | 0.012 | 0.006 | 0.005 | 0.003 |
| Standard Deviation | 0.527 | 0.123 | 0.067 | 0.011 | 0.527 | 0.123 | 0.266 | 0.076 |
| Observations within buffer | 8121 | 9622 | 6702 | 9190 | 8121 | 9622 | 7024 | 12907 |
| Observations untreated | 39794 | 40185 | 47999 | 43802 | 39794 | 40185 | 36206 | 43409 |
| Bandwidth untreated (km) | 73.786 | 74.606 | 89.484 | 81.356 | 73.786 | 74.606 | 67.008 | 80.680 |
| Bandwidth treated (km) | 13.977 | 16.457 | 11.564 | 15.801 | 13.977 | 16.457 | 12.202 | 21.943 |
| *Panel C:* Events involving Communal militia | | | | | | | | |
| Robust | -0.0097 | 0.0030 | -0.0010 | -0.0014** | -0.0097 | 0.0030 | -0.0117 | 0.0025 |
| | (0.0109) | (0.0040) | (0.0021) | (0.0006) | (0.0109) | (0.0040) | (0.0113) | (0.0036) |
| Mean DV | 0.007 | 0.002 | 0.002 | 0.001 | 0.007 | 0.002 | 0.005 | 0.001 |
| Standard Deviation | 0.379 | 0.058 | 0.186 | 0.028 | 0.379 | 0.058 | 0.286 | 0.042 |
| Observations within buffer | 9170 | 12394 | 9159 | 6552 | 9170 | 12394 | 10517 | 12314 |
| Observations untreated | 31887 | 29337 | 20504 | 37977 | 31887 | 29337 | 31283 | 33230 |
| Bandwidth untreated (km) | 58.777 | 53.874 | 37.188 | 70.276 | 58.777 | 53.874 | 57.523 | 61.344 |
| Bandwidth treated (km) | 15.770 | 21.142 | 15.752 | 11.325 | 15.770 | 21.142 | 18.051 | 20.997 |
| *Panel D:* Events involving civilians | | | | | | | | |
| Robust | -0.0330** | -0.0018 | 0.0005 | -0.0011** | -0.0289** | 0.0011 | -0.0330** | -0.0018 |
| | (0.0136) | (0.0059) | (0.0011) | (0.0005) | (0.0120) | (0.0057) | (0.0136) | (0.0059) |
| Mean DV | 0.014 | 0.007 | 0.002 | 0.000 | 0.012 | 0.006 | 0.014 | 0.007 |
| Standard Deviation | 0.474 | 0.123 | 0.181 | 0.024 | 0.414 | 0.112 | 0.474 | 0.123 |
| Observations within buffer | 8576 | 9860 | 9409 | 6005 | 8603 | 10122 | 8576 | 9860 |
| Observations untreated | 48999 | 34403 | 17874 | 41052 | 38622 | 31218 | 48999 | 34403 |
| Bandwidth untreated (km) | 91.466 | 63.534 | 32.264 | 76.125 | 71.591 | 57.398 | 91.466 | 63.534 |
| Bandwidth treated (km) | 14.820 | 16.901 | 16.152 | 10.396 | 14.873 | 17.410 | 14.820 | 16.901 |
| | | | | **Local cubic polynomial** | | | | |
| *Panel A:* All events | | | | | | | | |
| Robust | -0.0232 | 0.0043 | -0.0023 | -0.0017* | 0.0006 | 0.0058 | -0.0342** | -0.0004 |
| | (0.0193) | (0.0093) | (0.0045) | (0.0010) | (0.0174) | (0.0087) | (0.0148) | (0.0063) |
| Mean DV | 0.024 | 0.011 | 0.003 | 0.001 | 0.020 | 0.010 | 0.014 | 0.007 |
| Standard Deviation | 0.748 | 0.220 | 0.203 | 0.033 | 0.687 | 0.198 | 0.474 | 0.123 |
| Observations within buffer | 8041 | 9771 | 9201 | 11604 | 8255 | 10208 | 12388 | 13981 |
| Observations untreated | 38818 | 33188 | 44051 | 49822 | 29898 | 31744 | 52543 | 41040 |
| Bandwidth untreated (km) | 72.014 | 61.277 | 81.929 | 93.109 | 54.941 | 58.523 | 98.461 | 76.095 |
| Bandwidth treated (km) | 13.832 | 16.741 | 15.812 | 19.820 | 14.195 | 17.547 | 21.132 | 23.732 |
| *Panel B:* Events involving jihadist groups | | | | | | | | |
| Robust | -0.0209*** | -0.0088** | -0.0016 | -0.0007 | -0.0209*** | -0.0088** | -0.0145*** | -0.0041 |
| | (0.0072) | (0.0044) | (0.0019) | (0.0006) | (0.0072) | (0.0044) | (0.0051) | (0.0028) |
| Mean DV | 0.012 | 0.006 | 0.000 | 0.000 | 0.012 | 0.006 | 0.005 | 0.003 |
| Standard Deviation | 0.527 | 0.123 | 0.067 | 0.011 | 0.527 | 0.123 | 0.266 | 0.076 |
| Observations within buffer | 8121 | 9622 | 6702 | 9190 | 8121 | 9622 | 7024 | 12907 |
| Observations untreated | 39794 | 40185 | 47999 | 43802 | 39794 | 40185 | 36206 | 43409 |
| Bandwidth untreated (km) | 73.786 | 74.606 | 89.484 | 81.356 | 73.786 | 74.606 | 67.008 | 80.680 |
| Bandwidth treated (km) | 13.977 | 16.457 | 11.564 | 15.801 | 13.977 | 16.457 | 12.202 | 21.943 |
| *Panel C:* Events involving Communal militia | | | | | | | | |
| Robust | -0.0073 | 0.0034 | 0.0011 | -0.0008 | -0.0073 | 0.0034 | -0.0121 | 0.0022 |
| | (0.0107) | (0.0042) | (0.0036) | (0.0007) | (0.0107) | (0.0042) | (0.0115) | (0.0037) |
| Mean DV | 0.007 | 0.002 | 0.002 | 0.001 | 0.007 | 0.002 | 0.005 | 0.001 |
| Standard Deviation | 0.379 | 0.058 | 0.186 | 0.028 | 0.379 | 0.058 | 0.286 | 0.042 |
| Observations within buffer | 10852 | 16924 | 9152 | 12158 | 10852 | 16924 | 14438 | 15928 |
| Observations untreated | 45138 | 34117 | 40874 | 35323 | 45138 | 34117 | 44388 | 43641 |
| Bandwidth untreated (km) | 83.934 | 62.954 | 75.768 | 65.159 | 83.934 | 62.954 | 82.624 | 81.081 |
| Bandwidth treated (km) | 18.565 | 28.510 | 15.739 | 20.767 | 18.565 | 28.510 | 24.475 | 26.899 |
| *Panel D:* Events involving civilians | | | | | | | | |
| Robust | -0.0342** | -0.0004 | 0.0025 | -0.0006 | -0.0229* | 0.0022 | -0.0342** | -0.0004 |
| | (0.0148) | (0.0063) | (0.0028) | (0.0006) | (0.0129) | (0.0061) | (0.0148) | (0.0063) |
| Mean DV | 0.014 | 0.007 | 0.002 | 0.000 | 0.012 | 0.006 | 0.014 | 0.007 |
| Standard Deviation | 0.474 | 0.123 | 0.181 | 0.024 | 0.414 | 0.112 | 0.474 | 0.123 |
| Observations within buffer | 12388 | 13981 | 9091 | 10356 | 12909 | 14116 | 12388 | 13981 |
| Observations untreated | 52543 | 41040 | 26475 | 38893 | 41173 | 38981 | 52543 | 41040 |
| Bandwidth untreated (km) | 98.461 | 76.095 | 48.439 | 72.148 | 76.428 | 72.317 | 98.461 | 76.095 |
| Bandwidth treated (km) | 21.132 | 23.732 | 15.640 | 17.733 | 21.945 | 23.956 | 21.132 | 23.732 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of symmetric bandwidth for MSE-optimal point estimation. Local polynomial of order 2 or 3. Additional country and border controls. All conflict events occurring within 250km of borders between Burkina Faso, Mali and Niger are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

Table A8: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, OLS estimations with flexible controls for coordinates.

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) (1) | Events (2) | Fatalities (count) (3) | Events (4) | Fatalities (count) (5) | Events (6) | Fatalities (count) (7) | Events (8) |
| *Panel a:* 50-50 km bandwidth | | | | | | | | |
| Linear distance ctrl | -0.0266 | -0.0049 | -0.0003 | -0.0008 | -0.0231 | -0.0039 | -0.0230** | -0.0007 |
| | (0.0170) | (0.0047) | (0.0043) | (0.0007) | (0.0157) | (0.0042) | (0.0103) | (0.0026) |
| Linear dist. lat. lon. ctrl | -0.0264 | -0.0048 | -0.0003 | -0.0008 | -0.0229 | -0.0039 | -0.0229** | -0.0007 |
| | (0.0170) | (0.0047) | (0.0043) | (0.0007) | (0.0157) | (0.0042) | (0.0103) | (0.0026) |
| Linear dist. sq lat. lon. ctrl | -0.0263 | -0.0048 | -0.0003 | -0.0008 | -0.0228 | -0.0039 | -0.0228** | -0.0007 |
| | (0.0170) | (0.0047) | (0.0043) | (0.0007) | (0.0157) | (0.0042) | (0.0103) | (0.0026) |
| Linear dist. lat. lon. & flex. lat. lon. ctrl | -0.0266 | -0.0048 | -0.0003 | -0.0008 | -0.0231 | -0.0039 | -0.0230** | -0.0007 |
| | (0.0170) | (0.0047) | (0.0043) | (0.0007) | (0.0157) | (0.0042) | (0.0103) | (0.0026) |
| *Panel b:* 10-100 km bandwidth | | | | | | | | |
| Linear distance ctrl | -0.0453** | -0.0159** | -0.0025 | -0.0017* | -0.0358* | -0.0119* | -0.0349** | -0.0052 |
| | (0.0204) | (0.0074) | (0.0045) | (0.0009) | (0.0190) | (0.0067) | (0.0156) | (0.0039) |
| Linear dist. lat. lon. ctrl | -0.0452** | -0.0159** | -0.0025 | -0.0017* | -0.0356* | -0.0120* | -0.0347** | -0.0052 |
| | (0.0204) | (0.0074) | (0.0045) | (0.0009) | (0.0190) | (0.0067) | (0.0156) | (0.0039) |
| Linear dist. sq lat. lon. ctrl | -0.0455** | -0.0160** | -0.0025 | -0.0017* | -0.0360* | -0.0120* | -0.0350** | -0.0052 |
| | (0.0204) | (0.0074) | (0.0045) | (0.0009) | (0.0190) | (0.0067) | (0.0156) | (0.0039) |
| Linear dist. lat. lon. & flex. lat. lon. ctrl | -0.0450** | -0.0159** | -0.0025 | -0.0017* | -0.0356* | -0.0120* | -0.0347** | -0.0052 |
| | (0.0204) | (0.0074) | (0.0045) | (0.0009) | (0.0190) | (0.0067) | (0.0156) | (0.0039) |
| *Panel c:* 15-100 km bandwidth | | | | | | | | |
| Linear distance ctrl | -0.0390** | -0.0100 | -0.0076 | -0.0016** | -0.0281* | -0.0079 | -0.0188 | -0.0026 |
| | (0.0174) | (0.0062) | (0.0050) | (0.0008) | (0.0159) | (0.0056) | (0.0131) | (0.0033) |
| Linear dist. lat. lon. ctrl | -0.0389** | -0.0100 | -0.0077 | -0.0016** | -0.0280* | -0.0079 | -0.0187 | -0.0026 |
| | (0.0174) | (0.0062) | (0.0050) | (0.0008) | (0.0159) | (0.0056) | (0.0131) | (0.0033) |
| Linear dist. sq lat. lon. ctrl | -0.0391** | -0.0101 | -0.0077 | -0.0016** | -0.0282* | -0.0080 | -0.0189 | -0.0027 |
| | (0.0174) | (0.0062) | (0.0050) | (0.0008) | (0.0159) | (0.0056) | (0.0131) | (0.0033) |
| Linear dist. lat. lon. & flex. lat. lon. ctrl | -0.0387** | -0.0100 | -0.0076 | -0.0016** | -0.0280* | -0.0079 | -0.0186 | -0.0026 |
| | (0.0174) | (0.0062) | (0.0050) | (0.0008) | (0.0159) | (0.0056) | (0.0131) | (0.0033) |

*Notes :* Manual choice of bandwidths. Additional country controls, no border segment controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Only estimate of coefficient of interest "Cell within G5 operation zone" reported. Control variables include distance to the G5 central border, latitude, longitude, and squared and cubic transformations of latitude and longitude. Distance to the border and its transformation and are allowed a different slope within and outside of the operation zone while the effect of latitude and longitude is assumed to be the same within and outside of the G5 area to avoid overfitting. Robust standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

# Table A9: Discontinuity in conflict intensity for G5 Sahel Central operation zone 2017-2020 , robustness checks.

| | Military operations | | | | | | Attacks by armed groups | | | | | | Attacks on Civilians | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Geo1 | | | Geo2 | | | Geo1 | | | Geo2 | | | Geo1 | | | Geo2 | | |
| | Events (1) | Fatalities(#) (2) | Fatalities(IHS) (3) | Events (4) | Fatalities(#) (5) | Fatalities(IHS) (6) | Events (7) | Fatalities(#) (8) | Fatalities(IHS) (9) | Events (10) | Fatalities(#) (11) | Fatalities(IHS) (12) | Events (13) | Fatalities(#) (14) | Fatalities(IHS) (15) | Events (16) | Fatalities(#) (17) | Fatalities(IHS) (18) |
| *Panel 0:* All Events | | | | | | | | | | | | | | | | | | |
| Conventional | -0.0019*** | -0.0052** | -0.0018*** | -0.0034** | -0.0282** | -0.0058*** | -0.0070 | -0.0307*** | -0.0086** | -0.0029 | -0.0244 | -0.0029 | -0.0025 | -0.0300*** | -0.0089*** | -0.0013 | -0.0516*** | -0.0090** |
| | (0.0006) | (0.0023) | (0.0007) | (0.0015) | (0.0118) | (0.0015) | (0.0060) | (0.0117) | (0.0035) | (0.0096) | (0.0179) | (0.0050) | (0.0045) | (0.0100) | (0.0030) | (0.0070) | (0.0176) | (0.0043) |
| Bias-corrected | -0.0022*** | -0.0054** | -0.0022*** | -0.0039** | -0.0356*** | -0.0067*** | -0.0073 | -0.0313*** | -0.0094*** | -0.0029 | -0.0234 | -0.0029 | -0.0033 | -0.0315*** | -0.0097*** | -0.0021 | -0.0545*** | -0.0093** |
| | (0.0006) | (0.0023) | (0.0007) | (0.0015) | (0.0118) | (0.0015) | (0.0060) | (0.0117) | (0.0035) | (0.0096) | (0.0179) | (0.0050) | (0.0045) | (0.0100) | (0.0030) | (0.0070) | (0.0176) | (0.0043) |
| Robust | -0.0022*** | -0.0054** | -0.0022** | -0.0039** | -0.0356** | -0.0067*** | -0.0073 | -0.0313** | -0.0094** | -0.0029 | -0.0234 | -0.0029 | -0.0033 | -0.0315*** | -0.0097*** | -0.0021 | -0.0545*** | -0.0093* |
| | (0.0007) | (0.0025) | (0.0009) | (0.0019) | (0.0150) | (0.0019) | (0.0069) | (0.0130) | (0.0040) | (0.0110) | (0.0202) | (0.0058) | (0.0051) | (0.0116) | (0.0035) | (0.0081) | (0.0206) | (0.0051) |
| Observations within buffer | 4865 | 7392 | 5729 | 5783 | 5018 | 4750 | 6378 | 5089 | 5021 | 6106 | 5256 | 5949 | 7668 | 4623 | 4429 | 7184 | 4894 | 5655 |
| Observations untreated | 42229 | 27652 | 36432 | 33984 | 26875 | 36204 | 22713 | 29794 | 27416 | 17179 | 19999 | 18665 | 22389 | 34645 | 32714 | 17331 | 37862 | 28284 |
| Bandwidth untreated (km) | 78.387 | 50.720 | 67.351 | 62.641 | 49.128 | 66.999 | 41.264 | 54.684 | 50.284 | 30.938 | 36.206 | 33.759 | 40.734 | 64.037 | 60.270 | 31.261 | 70.082 | 51.776 |
| Bandwidth treated (km) | 8.413 | 12.775 | 9.945 | 10.042 | 8.677 | 8.209 | 11.000 | 8.790 | 8.681 | 10.560 | 9.148 | 10.309 | 13.220 | 8.003 | 7.712 | 12.398 | 8.469 | 9.808 |
| *Panel A:* Events involving jihadist groups | | | | | | | | | | | | | | | | | | |
| Conventional | -0.0006 | -0.0013 | -0.0005 | -0.0014 | -0.0138 | -0.0024** | -0.0087*** | -0.0213*** | -0.0080*** | -0.0075 | -0.0396*** | -0.0058 | -0.0035* | -0.0129*** | -0.0058*** | -0.0030 | -0.0155* | -0.0036 |
| | (0.0004) | (0.0013) | (0.0005) | (0.0011) | (0.0092) | (0.0011) | (0.0029) | (0.0075) | (0.0016) | (0.0066) | (0.0148) | (0.0036) | (0.0018) | (0.0041) | (0.0011) | (0.0034) | (0.0087) | (0.0024) |
| Bias-corrected | -0.0008* | -0.0015 | -0.0006 | -0.0018 | -0.0173* | -0.0027** | -0.0094*** | -0.0218*** | -0.0084*** | -0.0078 | -0.0403*** | -0.0064* | -0.0041** | -0.0137*** | -0.0063*** | -0.0034 | -0.0172** | -0.0039 |
| | (0.0004) | (0.0013) | (0.0005) | (0.0011) | (0.0092) | (0.0011) | (0.0029) | (0.0075) | (0.0016) | (0.0066) | (0.0148) | (0.0036) | (0.0018) | (0.0041) | (0.0011) | (0.0034) | (0.0087) | (0.0024) |
| Robust | -0.0008 | -0.0015 | -0.0006 | -0.0018 | -0.0173 | -0.0027** | -0.0094*** | -0.0218*** | -0.0084*** | -0.0078 | -0.0403** | -0.0064 | -0.0041* | -0.0137*** | -0.0063*** | -0.0034 | -0.0172* | -0.0039 |
| | (0.0005) | (0.0017) | (0.0007) | (0.0014) | (0.0118) | (0.0014) | (0.0035) | (0.0082) | (0.0019) | (0.0077) | (0.0169) | (0.0041) | (0.0021) | (0.0046) | (0.0014) | (0.0040) | (0.0099) | (0.0029) |
| Observations within buffer | 6298 | 8599 | 28201 | 8046 | 6407 | 5387 | 5243 | 6421 | 4672 | 6102 | 5473 | 6351 | 8771 | 4079 | 4288 | 9885 | 4378 | 7063 |
| Observations untreated | 28692 | 30246 | 31724 | 36948 | 26124 | 32773 | 39015 | 33636 | 35704 | 21332 | 35169 | 30727 | 45587 | 27234 | 44452 | 26825 | 38193 | 43747 |
| Bandwidth untreated (km) | 52.692 | 55.643 | 58.493 | 68.354 | 47.821 | 60.409 | 72.389 | 62.038 | 66.018 | 38.655 | 64.918 | 56.521 | 84.874 | 49.910 | 82.740 | 49.013 | 70.674 | 81.238 |
| Bandwidth treated (km) | 10.868 | 14.864 | 45.917 | 13.846 | 11.063 | 9.418 | 9.105 | 11.085 | 8.089 | 10.554 | 9.579 | 10.958 | 15.092 | 7.090 | 7.484 | 16.956 | 7.646 | 12.254 |
| *Panel B:* Events involving Communal militia | | | | | | | | | | | | | | | | | | |
| Conventional | -0.0015*** | -0.0032** | -0.0013** | -0.0022*** | -0.0138* | -0.0030*** | 0.0011 | -0.0077 | -0.0008 | 0.0017 | -0.0166 | 0.0009 | 0.0027 | -0.0071 | -0.0009 | 0.0042 | -0.0142 | 0.0005 |
| | (0.0005) | (0.0015) | (0.0005) | (0.0007) | (0.0071) | (0.0009) | (0.0027) | (0.0081) | (0.0023) | (0.0035) | (0.0103) | (0.0027) | (0.0024) | (0.0073) | (0.0021) | (0.0029) | (0.0091) | (0.0023) |
| Bias-corrected | -0.0017*** | -0.0033** | -0.0016*** | -0.0022*** | -0.0180** | -0.0034*** | 0.0019 | -0.0086 | -0.0009 | 0.0019 | -0.0170 | 0.0007 | 0.0035 | -0.0079 | -0.0012 | 0.0044 | -0.0146 | 0.0004 |
| | (0.0005) | (0.0015) | (0.0005) | (0.0007) | (0.0071) | (0.0009) | (0.0027) | (0.0081) | (0.0023) | (0.0035) | (0.0103) | (0.0027) | (0.0024) | (0.0073) | (0.0021) | (0.0029) | (0.0091) | (0.0023) |
| Robust | -0.0017*** | -0.0033** | -0.0016** | -0.0022*** | -0.0180* | -0.0034*** | 0.0019 | -0.0086 | -0.0009 | 0.0019 | -0.0170 | 0.0007 | 0.0035 | -0.0079 | -0.0012 | 0.0044 | -0.0146 | 0.0004 |
| | (0.0006) | (0.0017) | (0.0006) | (0.0008) | (0.0095) | (0.0012) | (0.0033) | (0.0094) | (0.0027) | (0.0040) | (0.0114) | (0.0031) | (0.0029) | (0.0083) | (0.0024) | (0.0034) | (0.0102) | (0.0026) |
| Observations within buffer | 4750 | 7172 | 5448 | 5088 | 5161 | 5314 | 11604 | 5576 | 9145 | 10217 | 5192 | 7762 | 12034 | 5287 | 6727 | 10280 | 5305 | 6729 |
| Observations untreated | 34175 | 29184 | 38102 | 26921 | 29207 | 45551 | 24751 | 39129 | 30961 | 18542 | 30707 | 16091 | 20710 | 34622 | 25686 | 13563 | 29004 | 15995 |
| Bandwidth untreated (km) | 63.075 | 53.602 | 70.466 | 49.246 | 53.656 | 84.775 | 45.224 | 72.576 | 56.919 | 33.490 | 56.488 | 28.938 | 37.586 | 63.997 | 46.942 | 24.313 | 53.306 | 28.794 |
| Bandwidth treated (km) | 8.208 | 12.385 | 9.540 | 8.786 | 8.942 | 9.264 | 19.825 | 9.703 | 15.718 | 17.563 | 9.008 | 13.368 | 20.548 | 9.212 | 11.609 | 17.652 | 9.246 | 11.613 |
| *Panel C:* Events involving civilians | | | | | | | | | | | | | | | | | | |
| Conventional | -0.0010*** | -0.0016 | -0.0008** | -0.0016*** | -0.0126* | -0.0026*** | -0.0002 | -0.0232** | -0.0070** | 0.0018 | -0.0301* | -0.0048 | -0.0025 | -0.0300*** | -0.0089*** | -0.0013 | -0.0516*** | -0.0090** |
| | (0.0003) | (0.0015) | (0.0004) | (0.0005) | (0.0069) | (0.0008) | (0.0040) | (0.0095) | (0.0029) | (0.0065) | (0.0158) | (0.0041) | (0.0045) | (0.0100) | (0.0030) | (0.0070) | (0.0176) | (0.0043) |
| Bias-corrected | -0.0011*** | -0.0018 | -0.0010*** | -0.0017*** | -0.0168** | -0.0031*** | -0.0004 | -0.0253*** | -0.0078*** | 0.0010 | -0.0322** | -0.0050 | -0.0033 | -0.0315*** | -0.0097*** | -0.0021 | -0.0545*** | -0.0093** |
| | (0.0003) | (0.0015) | (0.0004) | (0.0005) | (0.0069) | (0.0008) | (0.0040) | (0.0095) | (0.0029) | (0.0065) | (0.0158) | (0.0041) | (0.0045) | (0.0100) | (0.0030) | (0.0070) | (0.0176) | (0.0043) |
| Robust | -0.0011*** | -0.0018* | -0.0010** | -0.0017** | -0.0168* | -0.0031*** | -0.0004 | -0.0253** | -0.0078** | 0.0010 | -0.0322* | -0.0050 | -0.0033 | -0.0315*** | -0.0097*** | -0.0021 | -0.0545*** | -0.0093* |
| | (0.0004) | (0.0010) | (0.0004) | (0.0007) | (0.0094) | (0.0011) | (0.0046) | (0.0106) | (0.0033) | (0.0074) | (0.0176) | (0.0048) | (0.0051) | (0.0116) | (0.0035) | (0.0081) | (0.0206) | (0.0051) |
| Observations within buffer | 5101 | 7507 | 5891 | 4990 | 5215 | 5327 | 9994 | 4417 | 4540 | 8385 | 4963 | 6078 | 7668 | 4623 | 4429 | 7184 | 4894 | 5655 |
| Observations untreated | 33412 | 16038 | 25479 | 27377 | 29092 | 47191 | 21360 | 28114 | 27001 | 16633 | 24982 | 21643 | 22389 | 34645 | 32714 | 17331 | 37862 | 28284 |
| Bandwidth untreated (km) | 61.633 | 28.872 | 46.447 | 50.185 | 53.454 | 88.040 | 38.746 | 51.525 | 49.415 | 29.979 | 45.640 | 39.362 | 40.734 | 64.037 | 60.270 | 31.261 | 70.082 | 51.776 |
| Bandwidth treated (km) | 8.807 | 12.965 | 10.225 | 8.641 | 9.042 | 9.287 | 17.149 | 7.692 | 7.883 | 14.444 | 8.606 | 10.517 | 13.220 | 8.003 | 7.712 | 12.398 | 8.469 | 9.808 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Empty cells means the discontinuity could not be estimated due to lack of variability in the dependent variable. Include events coded with geo-precision level 1 and 2 only. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

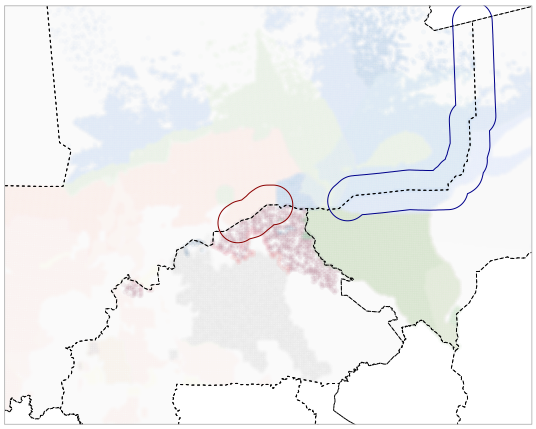
Table A10: Discontinuity in conflict intensity for the G5-Sahel Central operation zone, robustness to excluding cells near the operational boundary (2017–2020).

| | **Excluding symmetric buffer around the cutoff** | | | | | | | | **Excluding control-side buffer only** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 km buffer | | 1.5 km buffer | | 2.5 km buffer | | 3.5 km buffer | | 5 km (control side) | | 10 km (control side) | | 15 km (control side) | |
| | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events | Fatalities | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Panel A : All events** | | | | | | | | | | | | | | |
| Robust | -0.0381* | -0.0140 | -0.0353 | -0.0146 | -0.0885*** | -0.0289* | -0.0727* | -0.0352* | -0.0547** | -0.0162** | -0.0557*** | -0.0227** | -0.0494*** | -0.0184** |
| | (0.0231) | (0.0111) | (0.0276) | (0.0127) | (0.0302) | (0.0156) | (0.0403) | (0.0181) | (0.0215) | (0.0070) | (0.0185) | (0.0098) | (0.0168) | (0.0087) |
| Mean DV | 0.024 | 0.011 | 0.024 | 0.011 | 0.024 | 0.011 | 0.024 | 0.011 | 0.023 | 0.011 | 0.024 | 0.011 | 0.024 | 0.011 |
| Standard Deviation | 0.751 | 0.221 | 0.751 | 0.221 | 0.752 | 0.220 | 0.756 | 0.220 | 0.748 | 0.198 | 0.752 | 0.221 | 0.752 | 0.220 |
| Observations within buffer | 4030 | 4750 | 3639 | 4772 | 2305 | 2631 | 2416 | 2757 | 5164 | 5884 | 5145 | 5882 | 5138 | 5884 |
| Observations untreated | 43658 | 31102 | 40809 | 35291 | 35264 | 32743 | 42714 | 30087 | 89498 | 71034 | 58759 | 38439 | 49690 | 30577 |
| Bandwidth untreated (km) | 82.356 | 58.444 | 77.487 | 66.939 | 67.751 | 63.071 | 83.235 | 59.164 | 199.998 | 155.574 | 122.812 | 81.981 | 98.384 | 61.603 |
| Bandwidth treated (km) | 7.975 | 9.276 | 7.731 | 9.686 | 6.520 | 7.064 | 7.735 | 8.255 | 8.947 | 10.216 | 8.921 | 10.214 | 8.897 | 10.216 |
| **Panel B : Events involving jihadist groups** | | | | | | | | | | | | | | |
| Robust | -0.0246** | -0.0135*** | -0.0247** | -0.0122** | -0.0229 | -0.0096 | -0.0261 | -0.0131 | -0.0361** | -0.0094*** | -0.0333** | -0.0124*** | -0.0282** | -0.0110*** |
| | (0.0103) | (0.0039) | (0.0113) | (0.0049) | (0.0152) | (0.0096) | (0.0240) | (0.0156) | (0.0177) | (0.0034) | (0.0151) | (0.0041) | (0.0119) | (0.0038) |
| Mean DV | 0.012 | 0.006 | 0.013 | 0.006 | 0.013 | 0.006 | 0.013 | 0.006 | 0.012 | 0.006 | 0.012 | 0.006 | 0.012 | 0.006 |
| Standard Deviation | 0.529 | 0.124 | 0.530 | 0.124 | 0.532 | 0.123 | 0.534 | 0.123 | 0.538 | 0.118 | 0.535 | 0.121 | 0.531 | 0.122 |
| Observations within buffer | 5850 | 3647 | 5707 | 3464 | 5066 | 2810 | 4285 | 2624 | 6385 | 5265 | 6399 | 5253 | 6419 | 5247 |
| Observations untreated | 36207 | 44252 | 39229 | 46290 | 35145 | 41938 | 40551 | 33151 | 89498 | 84437 | 53432 | 37627 | 42730 | 33858 |
| Bandwidth untreated (km) | 68.028 | 83.437 | 74.490 | 88.001 | 67.575 | 80.624 | 79.058 | 64.916 | 199.998 | 187.297 | 111.689 | 80.478 | 84.753 | 67.698 |
| Bandwidth treated (km) | 11.091 | 7.371 | 11.251 | 7.433 | 11.232 | 7.412 | 10.884 | 8.031 | 11.013 | 9.161 | 11.041 | 9.139 | 11.081 | 9.122 |

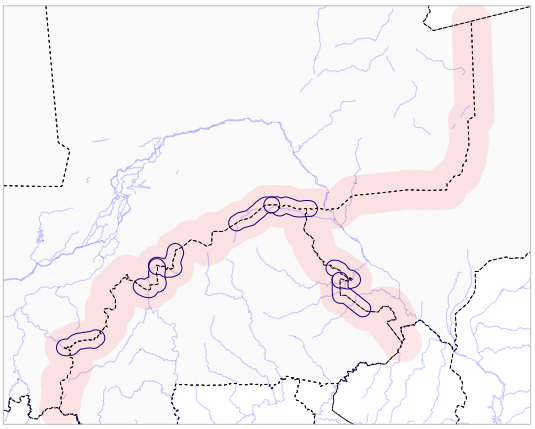
*Notes:* Each column reports a separate RDD regression excluding cells within the specified distance from the G5-Sahel operational boundary. Columns (1)–(8) exclude cells symmetrically on both sides of the border, while columns (9)–(14) exclude only control-side cells. Bandwidth selected by MSE-optimal rule. Local linear polynomial with country and border controls. Robust Calonico–Cattaneo–Titiunik standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

# D RDD Heterogeneity Analysis by Border Porosity and Cross-Border Actors

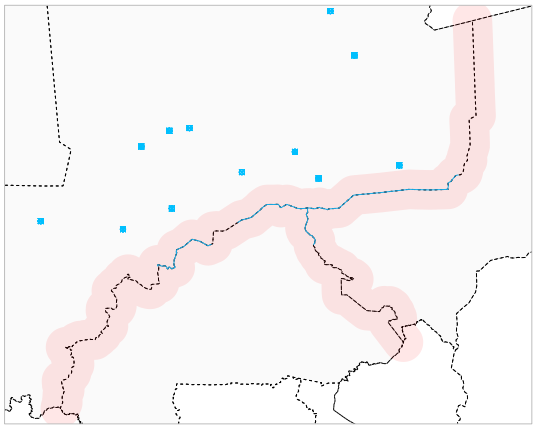
Figure A 7: Border segments characteristics



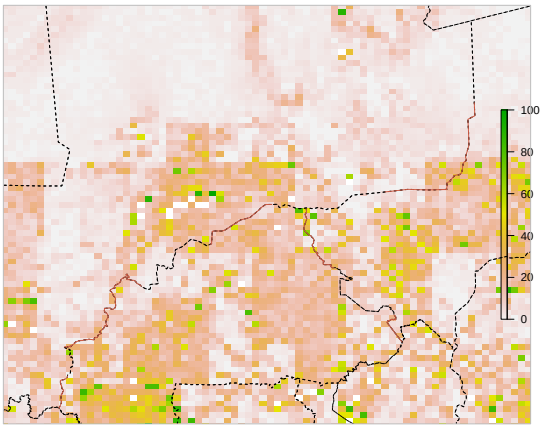
(a) Segments with transborder ethnic groups



(b) Segments following rivers



(c) Segments close to MINSUMA bases




(d) Segments in high rugged areas

Notes: Segments with transborder ethnic groups are those segments where the same ethnic group accounts for at least 10% of the population on both sides of the border - within a 50km buffer. Such segments are represented in red for the Fulani group and in blue for the Tuareg. The other groups (Songhay in green, Mossi in gray, Bambara in yellow) never represents more than 10% of the population on both sides of the border. Segments aligned with rivers are defined as those segments within five kilometers of a river over 40% of their total length. Segments "close" to MINSUMA are segments for which the minimum distance between a MINUSMA base and the segment is lower than the median distance. Segments in "high rugged" areas are segments for which the average ruggedness of cells crossed by the segments is above the median ruggedness of cells crossed by the other segments.

Table A11: Characteristics of border segments for central G5-Sahel operation zones 2017-2020, by country/border.

| | Mali | Burkina Faso | Niger | MLI-BFA | MLI-NER | NER-BFA |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Share fulani | 0.117 | 0.151 | 0.042 | 0.152 | 0.043 | 0.217 |
| | (0.165) | (0.160) | (0.088) | (0.168) | (0.095) | (0.178) |
| Border segments with transborder fulani group | 0.101 | 0.030 | 0.000 | 0.092 | 0.000 | 0.000 |
| | (0.302) | (0.170) | (0.000) | (0.289) | (0.000) | (0.000) |
| Share tuareg | 0.140 | 0.015 | 0.267 | 0.035 | 0.314 | 0.032 |
| | (0.160) | (0.026) | (0.147) | (0.048) | (0.086) | (0.058) |
| Border segments with transborder tuareg group | 0.322 | 0.000 | 0.763 | 0.000 | 0.835 | 0.000 |
| | (0.467) | (0.000) | (0.425) | (0.000) | (0.371) | (0.000) |
| Border segments with any transborder ethnic group | 0.424 | 0.030 | 0.763 | 0.092 | 0.835 | 0.000 |
| | (0.494) | (0.170) | (0.425) | (0.289) | (0.371) | (0.000) |
| Distance to MINUSMA base | 170.566 | 203.738 | 203.274 | 166.226 | 153.110 | 237.136 |
| | (93.122) | (88.597) | (94.203) | (87.805) | (87.898) | (111.973) |
| Average rugdness around border segment | 11.753 | 9.663 | 12.557 | 11.003 | 10.898 | 11.469 |
| | (7.601) | (6.638) | (8.329) | (6.829) | (8.729) | (6.703) |
| Border segment aligns with river | 0.270 | 0.439 | 0.057 | 0.384 | 0.039 | 0.328 |
| | (0.444) | (0.496) | (0.231) | (0.486) | (0.192) | (0.470) |
| Observations | 142898 | 71944 | 81068 | 29904 | 24034 | 15846 |

*Notes:* Observations at the grid-cell level in the first part of the table, and total count of interventions in the second part. Each grid-cell is defined by the closest border segment. Segments with transborder ethnic groups are those segments where the same ethnic group accounts for at least 10% of the population on both sides of the border. Segments aligned with rivers are defined as those segments within five km of a river over 40% of their total length. Segments in "high rugged" areas are segments for which the average ruggedness of cells crossed by the segments is above the median ruggedness of cells crossed by the other segments.

Table A12: Discontinuity in conflict intensity for central G5-Sahel operation zones 2017-2020, heterogeneity by border segment characteristics.- split sample robustness analysis

| | Low rugged | | Medium rugged | | River | | No river | | Close MINUSMA | | Far MINUSMA | | No common group | | Transborder group | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fatalities (1) | Events (2) | Fatalities (3) | Events (4) | Fatalities (5) | Events (6) | Fatalities (7) | Events (8) | Fatalities (9) | Events (10) | Fatalities (11) | Events (13) | Fatalities (11) | Events (14) | Fatalities (15) | Events (16) |
| Robust | -0.0323 | 0.0079 | -0.0425** | -0.0256*** | -0.0596 | 0.0022 | -0.0413*** | -0.0182** | -0.0877** | -0.0105 | -0.0086 | -0.0107** | -0.0326* | -0.0076 | -0.0659*** | -0.0208** |
| | (0.0216) | (0.0108) | (0.0172) | (0.0084) | (0.0446) | (0.0181) | (0.0133) | (0.0076) | (0.0380) | (0.0161) | (0.0062) | (0.0048) | (0.0179) | (0.0100) | (0.0239) | (0.0094) |
| Mean DV | 0.022 | 0.011 | 0.025 | 0.011 | 0.027 | 0.015 | 0.023 | 0.010 | 0.043 | 0.019 | 0.016 | 0.008 | 0.029 | 0.015 | 0.016 | 0.005 |
| Standard Deviation | 0.755 | 0.208 | 0.742 | 0.229 | 0.906 | 0.268 | 0.688 | 0.202 | 1.135 | 0.325 | 0.486 | 0.151 | 0.765 | 0.231 | 0.722 | 0.202 |
| Observations within buffer | 2407 | 3857 | 2785 | 2553 | 1756 | 2210 | 3214 | 3683 | 1965 | 3325 | 2919 | 3046 | 3063 | 3810 | 3987 | 2098 |
| Observations untreated | 15893 | 7492 | 14924 | 20661 | 9759 | 5092 | 24191 | 27036 | 13582 | 9346 | 8571 | 20683 | 17943 | 13881 | 19078 | 15822 |
| Bandwidth untreated (km) | 66.139 | 30.000 | 49.472 | 68.818 | 75.054 | 37.708 | 58.979 | 66.045 | 79.248 | 51.911 | 23.275 | 56.679 | 54.557 | 41.634 | 88.230 | 73.044 |
| Bandwidth treated (km) | 9.192 | 14.561 | 8.843 | 8.134 | 12.167 | 15.297 | 7.458 | 8.442 | 9.641 | 16.044 | 7.836 | 8.148 | 8.463 | 10.470 | 18.523 | 9.790 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of each considered G5-Sahel borders are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Segments in ″medium rugged″ areas are segments for which the average ruggedness of cells crossed by the segments is above the median ruggedness of cells crossed by the other segments; border segments aligned with rivers are border segments within 5 km of a river for at least 40% of their length; border segments close to MINUSMA are those with average distance to UN Peacekeeping missing stations below the median; border segments with a transborder group are those with at least 10% of population on both side of the border - within a 50km buffer - from the same ethnic group. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

Table A13: Discontinuity in conflict intensity for G5 Sahel Central operation zone for international and local actors 2017-2020.

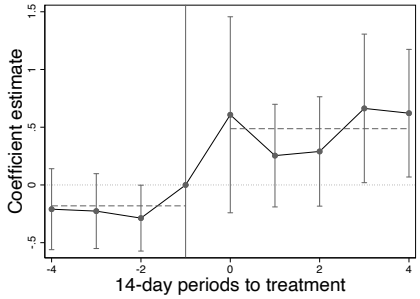
| | International actors | | | | Local actors | | | |
|---|---|---|---|---|---|---|---|---|
| | Civilians and armed groups | | Military operations | | Civilians and armed groups | | Military operations | |
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Panel A:* All events | | | | | | | | |
| Robust | -0.0179*** | -0.0064** | -0.0014 | -0.0008 | -0.0089 | 0.0023 | -0.0082* | -0.0022*** |
| | (0.0051) | (0.0026) | (0.0017) | (0.0005) | (0.0099) | (0.0031) | (0.0044) | (0.0007) |
| Mean DV | 0.007 | 0.004 | 0.000 | 0.000 | 0.006 | 0.002 | 0.003 | 0.001 |
| Standard Deviation | 0.319 | 0.091 | 0.069 | 0.017 | 0.377 | 0.051 | 0.207 | 0.035 |
| Observations within buffer | 3556 | 6911 | 8303 | 4171 | 5842 | 11552 | 5949 | 4081 |
| Observations untreated | 30388 | 40508 | 29404 | 35731 | 35662 | 25621 | 34221 | 35961 |
| Bandwidth untreated (km) | 55.932 | 75.203 | 53.985 | 66.079 | 65.929 | 46.801 | 63.172 | 66.549 |
| Bandwidth treated (km) | 6.160 | 11.981 | 14.271 | 7.286 | 10.133 | 19.714 | 10.310 | 7.099 |
| Share jihadist: | 0.953 | 0.947 | 1 | 0.559 | 0.02 | 0.009 | 0.015 | 0.019 |

*Notes :* Discontinuity estimated at 50 km. Data-driven choice of two bandwidths for MSE-optimal point estimation. Local polynomial of order 1. Additional country and border controls. All conflict events occurring within 250km of borders between Burkina Faso, Mali and Niger are included for the period between September 2017 to January 2020. Include events coded with geo-precision level 1 only. Empty cells means the discontinuity could not be estimated due to lack of variability in the dependent variable. International actors are defined as those observed in at least two of the three countries (Mali, Niger, Burkina Faso). Events involving civilans and armed groups exlude military forces. Robust Calonico-Cattaneo-Titiunik standard errors in parentheses- *** p<0.01, ** p<0.05, * p<0.1.

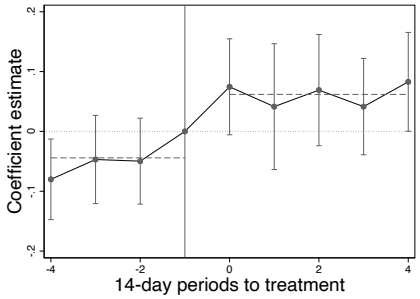
# E Additional Results Trigger Analysis

Figure A 8: Reaction to trigger events - time patterns (no differences)

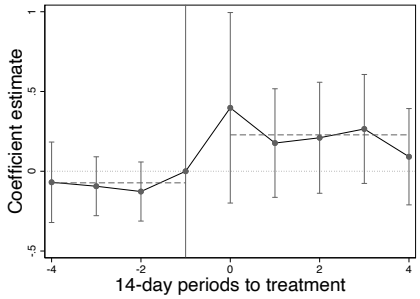
*Panel A:* All events - Fatalities



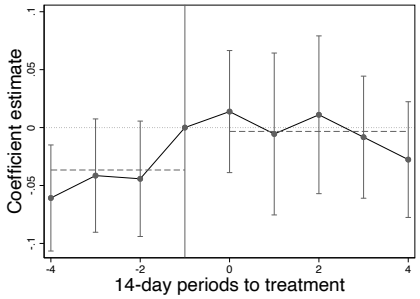

*Panel B:* All events



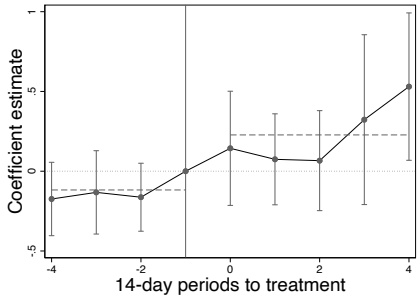

*Panel C:* Military Operations - Fatalities



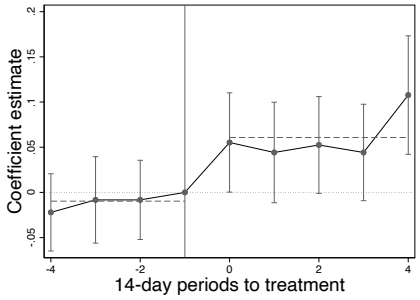

*Panel D:* Military Operations - Events



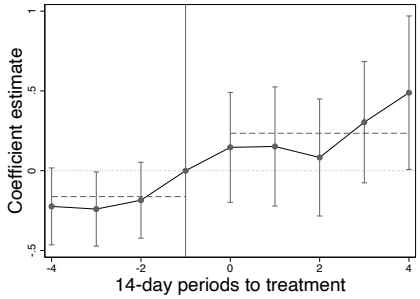

*Panel E:* Attacks by armed groups - Fatalities



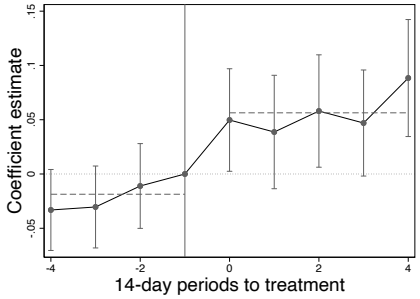

*Panel F:* Attacks by armed groups - Events




*Panel G:* Attacks by armed groups - Fatalities



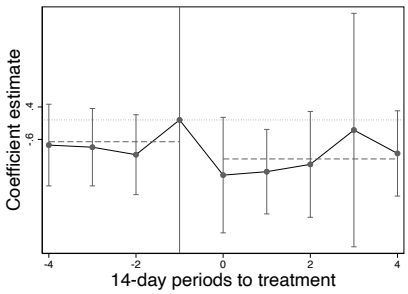

*Panel H:* Attacks by armed groups - Events



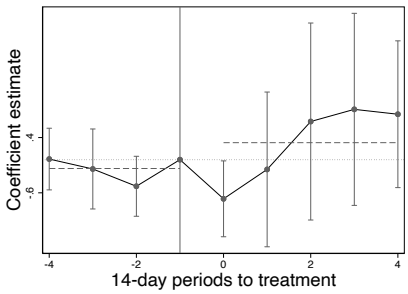

Notes: Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2021). The graph show coefficients on time-to-treatment dummies around the trigger operation. The model includes operation fixed effects. Standard errors are clustered at the grid-cell level, and grey bars represent 95% confidence intervals.

Figure A 9: Reaction to trigger events - comparison of border areas

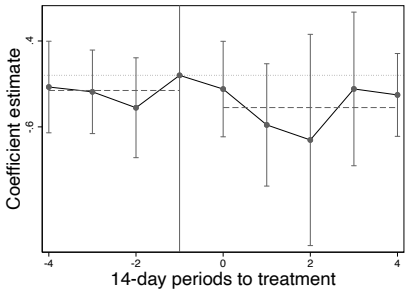
*Panel A:* All events -fatalities (no G5)



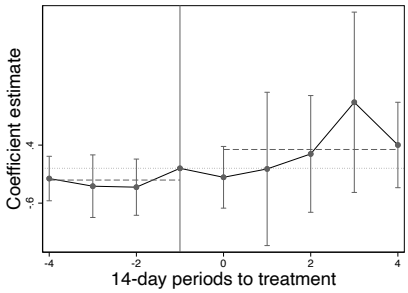

*Panel B:* All events - fatalities (G5 active)



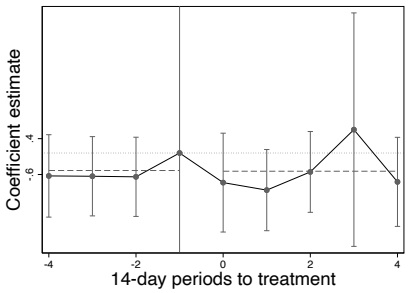

*Panel C:* Military Operations (no G5) fatalities



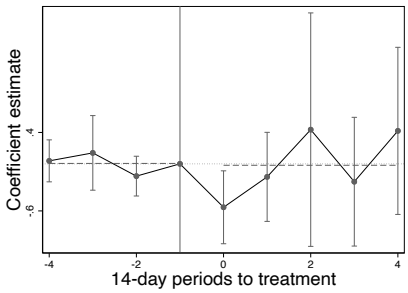

*Panel D:* Military Operations (G5 active) fatalities



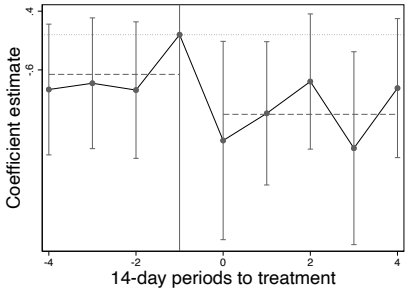

*Panel E:* Attacks by armed groups (no G5) fatalities



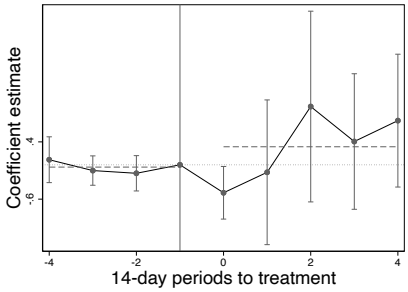

*Panel F:* Attacks by armed groups ( G5 active) fatalities




*Panel G:* Civilian Casualty fatalities (no G5)




*Panel H:* Civilian Casualty fatalities (G5 active)




Notes: Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2021). The graph show coefficients on time-to-treatment dummies around the trigger operation. The model includes trigger operation by time-to-treatment effects. Standard errors are clustered at the grid-cell level, and grey bars represent 95% confidence intervals.

Table A14: Reaction to trigger events - by Actor

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Panel A:* Events involving jihadist groups | | | | | | | | |
| Border x Post | -0.10 | -0.05 | -0.10 | -0.05 | -0.17 | -0.05 | -0.16 | -0.01 |
| | (0.16) | (0.04) | (0.16) | (0.04) | (0.15) | (0.04) | (0.13) | (0.03) |
| Border x Post x G5 | 0.40* | 0.01 | 0.39* | 0.08** | -0.01 | 0.01 | 0.15 | -0.01 |
| | (0.22) | (0.05) | (0.22) | (0.04) | (0.20) | (0.05) | (0.16) | (0.04) |
| *Panel B:* Events involving Communal militia | | | | | | | | |
| Border x Post | -0.41 | -0.01 | -0.09 | -0.03 | 0.15 | -0.01 | -0.11 | -0.02 |
| | (0.39) | (0.04) | (0.10) | (0.03) | (0.32) | (0.04) | (0.08) | (0.03) |
| Border x Post x G5 | 0.74 | 0.01 | 0.34 | 0.04 | 0.01 | 0.01 | 0.25 | 0.01 |
| | (0.47) | (0.04) | (0.21) | (0.03) | (0.37) | (0.04) | (0.20) | (0.03) |
| *Panel C:* Events involving Security Forces and civilians | | | | | | | | |
| Border x Post | | | | | | | -0.04 | -0.41*** |
| | | | | | | | (0.02) | (0.16) |
| Border x Post x G5 | | | | | | | 0.05* | 0.63** |
| | | | | | | | (0.03) | (0.24) |
| Observations | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 |
| Clusters | 352 | 352 | 352 | 352 | 352 | 352 | 352 | 352 |

Notes: Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2021). Results are based on the estimating equation presented above. Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

# F Robustness Checks Trigger Analysis

Table A15: Reaction to trigger events - alternative criterion

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Border x Post | -0.19 | -0.09 | -0.45 | -0.18* | 0.27 | 0.09 | -0.28 | 0.02 |
| | (0.99) | (0.14) | (0.37) | (0.10) | (0.92) | (0.10) | (0.38) | (0.07) |
| Border x Post x G5 | 1.08 | 0.13 | 0.74 | 0.19* | 0.34 | -0.06 | 0.78 | -0.02 |
| | (1.09) | (0.15) | (0.46) | (0.11) | (1.00) | (0.12) | (0.53) | (0.08) |
| Mean DV | 0.811 | 0.211 | 0.325 | 0.071 | 0.486 | 0.140 | 0.344 | 0.104 |
| Standard Deviation | 4.928 | 0.686 | 3.136 | 0.464 | 3.209 | 0.420 | 2.211 | 0.338 |
| Observations | 1827 | 1827 | 1827 | 1827 | 1827 | 1827 | 1827 | 1827 |
| Clusters | 203 | 203 | 203 | 203 | 203 | 203 | 203 | 203 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2020) claiming more than 10 lives. Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A16: Reaction to trigger events - alternative "G5 treatment period"

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Border x Post | 0.76 | -0.10 | -0.57 | -0.28 | 1.33 | 0.18 | 0.30** | 0.06 |
| | (1.52) | (0.23) | (0.65) | (0.18) | (1.40) | (0.16) | (0.14) | (0.09) |
| Border x Post x G5 (post Sep 2017) | -0.66 | 0.05 | 0.79 | 0.30* | -1.45 | -0.24 | -0.30 | -0.11 |
| | (1.54) | (0.24) | (0.67) | (0.18) | (1.41) | (0.16) | (0.26) | (0.09) |
| Mean DV | 0.677 | 0.178 | 0.298 | 0.054 | 0.380 | 0.125 | 0.359 | 0.099 |
| Standard Deviation | 4.148 | 0.576 | 2.809 | 0.372 | 2.635 | 0.387 | 2.412 | 0.332 |
| Observations | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 |
| Clusters | 352 | 352 | 352 | 352 | 352 | 352 | 352 | 352 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2020) claiming at least 10 lives. Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A17: Reaction to trigger events - allowing for repetition of grid cells

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events | Fatalities (count) | Events |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Border x Post | -0.73* | -0.14** | -0.43** | -0.08** | -0.31 | -0.06 | -0.86*** | -0.07* |
| | (0.38) | (0.06) | (0.18) | (0.03) | (0.34) | (0.05) | (0.26) | (0.04) |
| Border x Post x G5 | 1.34*** | 0.19*** | 0.60*** | 0.10*** | 0.74* | 0.09* | 1.05*** | 0.08* |
| | (0.45) | (0.06) | (0.20) | (0.03) | (0.39) | (0.05) | (0.28) | (0.04) |
| Mean DV | 0.850 | 0.211 | 0.363 | 0.063 | 0.487 | 0.148 | 0.382 | 0.104 |
| Standard Deviation | 4.587 | 0.668 | 3.055 | 0.446 | 2.987 | 0.432 | 2.522 | 0.347 |
| Observations | 7155 | 7155 | 7155 | 7155 | 7155 | 7155 | 7155 | 7155 |
| Clusters | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2020) claiming at least 10 lives. Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A18: Reaction to trigger events - Dummy outcomes

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Border x Post | -0.09** | -0.11** | -0.05** | -0.07** | -0.05 | -0.05 | -0.07** | -0.07* |
| | (0.04) | (0.05) | (0.02) | (0.03) | (0.04) | (0.05) | (0.03) | (0.04) |
| Border x Post x G5 | 0.07 | 0.11* | 0.06** | 0.10*** | 0.01 | 0.03 | 0.06 | 0.06 |
| | (0.05) | (0.06) | (0.03) | (0.03) | (0.04) | (0.06) | (0.04) | (0.05) |
| Mean DV | 0.097 | 0.141 | 0.027 | 0.037 | 0.074 | 0.110 | 0.063 | 0.090 |
| Standard Deviation | 0.296 | 0.349 | 0.161 | 0.189 | 0.262 | 0.313 | 0.244 | 0.287 |
| Observations | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 | 3168 |
| Clusters | 352 | 352 | 352 | 352 | 352 | 352 | 352 | 352 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2020). Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A19: Reaction to trigger events - Alternative circles around triggers

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Panel A: 125km circle | | | | | | | | |
| Border x Post | -0.51 | -0.11* | -0.45** | -0.08** | -0.06 | -0.03 | -0.56*** | -0.05 |
| | (0.33) | (0.06) | (0.18) | (0.04) | (0.28) | (0.05) | (0.19) | (0.04) |
| Border x Post x G5 | 0.63 | 0.10 | 0.67*** | 0.10** | -0.04 | | 0.77*** | 0.03 |
| | (0.40) | (0.07) | (0.25) | (0.04) | (0.32) | (0.06) | (0.25) | (0.04) |
| Mean DV | 0.630 | 0.163 | 0.252 | 0.044 | 0.377 | 0.120 | 0.345 | 0.093 |
| Standard Deviation | 3.875 | 0.522 | 2.530 | 0.326 | 2.607 | 0.366 | 2.357 | 0.314 |
| Observations | 4365 | 4365 | 4365 | 4365 | 4365 | 4365 | 4365 | 4365 |
| Clusters | 485 | 485 | 485 | 485 | 485 | 485 | 485 | 485 |
| Panel B: 75km circle | | | | | | | | |
| Border x Post | -1.12*** | -0.21** | -0.85*** | -0.15** | -0.27 | -0.06 | -0.98*** | -0.11* |
| | (0.37) | (0.09) | (0.32) | (0.06) | (0.22) | (0.07) | (0.31) | (0.06) |
| Border x Post x G5 | 2.16*** | 0.24** | 1.36** | 0.20*** | 0.81** | 0.04 | 1.18* | 0.10 |
| | (0.71) | (0.11) | (0.63) | (0.07) | (0.35) | (0.09) | (0.61) | (0.08) |
| Mean DV | 0.646 | 0.179 | 0.313 | 0.054 | 0.333 | 0.126 | 0.382 | 0.097 |
| Standard Deviation | 3.137 | 0.499 | 2.313 | 0.304 | 2.135 | 0.382 | 2.524 | 0.336 |
| Observations | 1935 | 1935 | 1935 | 1935 | 1935 | 1935 | 1935 | 1935 |
| Clusters | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in two-month windows around major French operations (2010-2020). Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A20: Reaction to trigger events - Alternative event windows

| | All events | | Military operations | | Attacks by armed groups | | Attacks on Civilians | |
|---|---|---|---|---|---|---|---|---|
| | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) | Fatalities (any) | Events (any) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Panel A: 6-week window | | | | | | | | |
| Border x Post | -0.94 | -0.22** | -0.73** | -0.13** | -0.21 | -0.09 | -1.19*** | -0.10 |
| | (0.64) | (0.09) | (0.30) | (0.06) | (0.59) | (0.08) | (0.37) | (0.06) |
| Border x Post x G5 | 1.18 | 0.15 | 1.07** | 0.15** | 0.11 | - | 1.36** | 0.04 |
| | (0.80) | (0.11) | (0.47) | (0.07) | (0.66) | (0.09) | (0.54) | (0.08) |
| Mean DV | 0.893 | 0.232 | 0.406 | 0.074 | 0.487 | 0.158 | 0.479 | 0.130 |
| Standard Deviation | 4.848 | 0.666 | 3.308 | 0.447 | 2.969 | 0.424 | 2.741 | 0.376 |
| Observations | 2114 | 2114 | 2114 | 2114 | 2114 | 2114 | 2114 | 2114 |
| Clusters | 302 | 302 | 302 | 302 | 302 | 302 | 302 | 302 |
| Panel B: 12-week window | | | | | | | | |
| Border x Post | -0.38 | -0.10* | -0.39** | -0.07* | 0.01 | -0.03 | -0.42*** | -0.05 |
| | (0.26) | (0.05) | (0.16) | (0.04) | (0.21) | (0.04) | (0.14) | (0.03) |
| Border x Post x G5 | 0.66* | 0.11* | 0.79*** | 0.10*** | -0.12 | 0.01 | 0.64** | 0.04 |
| | (0.36) | (0.06) | (0.25) | (0.04) | (0.28) | (0.05) | (0.25) | (0.04) |
| Mean DV | 0.466 | 0.124 | 0.207 | 0.038 | 0.259 | 0.086 | 0.241 | 0.068 |
| Standard Deviation | 3.591 | 0.505 | 2.426 | 0.325 | 2.248 | 0.331 | 1.993 | 0.280 |
| Observations | 3978 | 3978 | 3978 | 3978 | 3978 | 3978 | 3978 | 3978 |
| Clusters | 442 | 442 | 442 | 442 | 442 | 442 | 442 | 442 |

*Notes:* Observations at the grid-cell level, binned in two-week periods, in time windows around major French operations (2010-2020). Results are based on estimating equation (2). Include events coded with geo-precision level 1 and 2 only. Standard errors are clustered at the grid-cell level and presented in parentheses; stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

# G Sequential model of state enforcement and rebel violence

We model the strategic interaction between the state and the rebels, assuming that the rebels move first and the state needs to choose its level of retaliation. The players in the game are:

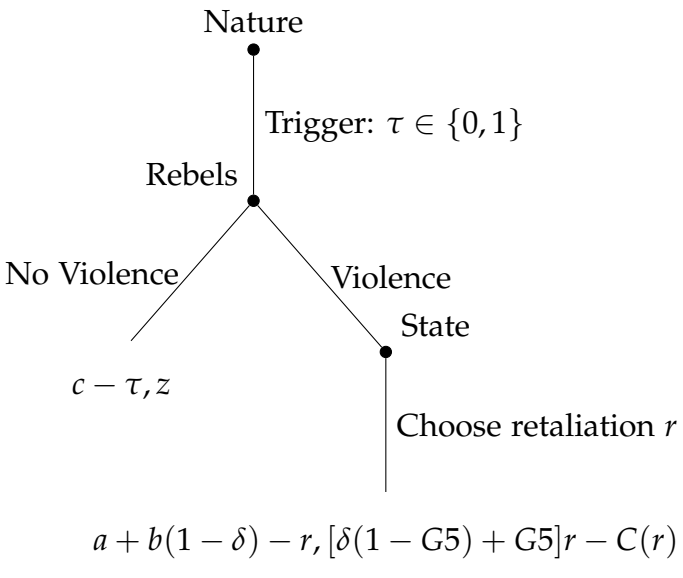
- **Nature**: Chooses a trigger event.
- **Rebels**: Decide whether to generate violence or not, after observing the trigger.
- **State**: Decides the optimal level of retaliation, after observing the rebels' action.

The pay-offs of violence for rebels and the state will depend on: (i) whether a trigger event has taken place, (ii) whether the area is close to the border, and (iii) whether the G5 mission is active in border areas. Rebels can be understood as hybrid terrorist-criminal groups, which best correspond to the jihadist groups operating in the Sahel (Nsaibia and Weiss, 2018). These groups use violence to gain control of territory, secure access to resources, or mobilize through terror attacks (de Mesquita and Dickson, 2007), and have positive payoffs from generating violence. If the rebels engage in violence, they need to to confront the state's army, which can retaliate with varying intensity ($r$) - subject to a convex cost function $C(r)$.[30] The pay-off will depend on whether the state is constraint in its operations or not, and these constraints are stronger when the state operates close to an international border. $\delta \in [0, 1]$ represents the (normalized) distance to the international border, with 0 being at the border and 1 being far. In particular, we assume that the return to retaliation is higher as the distance to the border ($\delta$) increases. In border areas, the state will be constrained in the absence of coordination with its neighbors, and the return to retaliation will be smaller as a result. However, when the

[30] We assume $C'(0) = 0$, and $C'(r) \to \infty$ as $r \to \infty$.

G5 mission is active ($G5 = 1$), the coordination problems in border areas are overcome, and the return to retaliation becomes maximal for the state.

The rebels move first in the game, anticipating the retaliation from the state. Their pay-off from violence depends negatively on the level of retaliation $r$. It also depends on whether they operate in border areas. We assume that violence in border areas generates higher pay-offs (so, $1 - \delta$ enters positively). This captures the idea that operating close to the border delivers advantages in terms of income from smuggling and opportunities for expansion in multiple countries. Finally, the rebels pay-offs also depend on whether they respond to a trigger event or not. The logic of the trigger events is that they force the rebels to relocate, which makes it necessary for them to engage in violence. In the empirical application, we use major aerial attacks on jihadist groups as a trigger event, and we document that these events systematically lead to an escalation of violence. In the model, the trigger event ( $\tau \in \{0, 1\}$) will lower the pay-off from choosing "no violence" for the rebels (from $c$ to $c - 1$), making violence relatively more attractive.
The following game tree summarizes the game:




In this game tree, the first pay-off refers to the one of the rebels, the second to the one of state. We assume $a, b, c \geq 0$.
We first define the optimal level of retaliation as follows:

- If $G5 = 1$, $r^*_{G5}$ satisfies $C'(r^*_{G5}) = 1$
- If $G5 = 0$, $r^*_0$ satisfies $C'(r^*_0) = \delta$

Because of the convexity of $C$ and if we consider a location $\delta < 1$, we know that:

$$r^*_0(\delta) < r^*_{G5} \tag{3}$$

In other words, retaliation is higher when the G5 mission is active. We use the notation $r^*_0(\delta)$ to indicate the implicit function that defines the optimal level of retaliation as a function of $\delta$. We now define $\hat{\delta}$ as the distance from the international border at the limit of operation zone, that is the G5 operates if $\delta < \hat{\delta}$. We assume that:

$$c - 1 < a + b(1 - \hat{\delta}) - r^*_{G5} < c \tag{4}$$

$$c < a + b(1 - \hat{\delta}) - r^*_0(\hat{\delta}) \tag{5}$$

Hence, in the vicinity of the operation zone limit, the rebels prefer violence when the G5 mission is not active (equation 5). In contrast, when the G5 mission is active, the rebels choose to abstain from violence to avoid retaliation (their pay-off is lower than $c$), unless they are faced with a trigger event (lowering their pay-off to $c - 1$, see equation 4).
From the state's perspective, we know that:[31]

$$\hat{\delta} r^*_0 - C(r^*_0) < r^*_{G5} - C(r^*_{G5}) \tag{6}$$

In other words, if the rebels generate violence, the state is best off when the G5 mission is active.
The subgame perfect Nash equilibrium of this game can be described as follows:

- If $G5 = 0$ and $\delta = \hat{\delta}$: The State uses retaliation level $r^*_0(\hat{\delta})$. The rebels always choose

[31] $\delta r^*_0 - C(r^*_0)$ is increasing in $\delta$ by the envelope theorem, and $r^*_{G5} = r^*_0(1)$.

violence.

- If $G5 = 1$: The State uses retaliation level $r^*_{G5}$. The rebels choose violence if and only if they face a trigger event.

These results can **rationalize the empirical findings** of our paper:

- When the G5 is not active, we observe a weaker security force response to trigger events in the G5 operation zone ($\delta < \hat{\delta}$) compared to locations farther away from the border ($\delta > \hat{\delta}$). When the G5 becomes active, the state response to trigger events becomes larger in the operation zone (both compared to pre-G5 patterns but and compared to areas that are further away from the border). These findings are consistent with the assumption in the model that the retaliation capacity of the army increases when the G5 is active.

- Because of the high retaliation threat when and where the G5 is active, the rebels engage in less violence in the absence of trigger events. This logic can account for the RDD results that find lower levels of violence in the operation zone of the G5 compared to localities that are just outside of the operation zone.

- The stronger returns to violence in border areas (captured by $1 - \delta$ in the model) is consistent with the gradual rise in violence as the distance to the border declines.

The model also lends itself to an extension to help us think about **heterogeneous impacts of border porosity**. We can replace the distance to the border $\delta$ with a measure of effective distance that combines two elements: (1) the difficulty of crossing borders, $\rho$, which can take values between 0 and 1, with lower $\rho$ corresponding to higher porosity; (2) the physical distance $\phi$. So, $\delta = \rho\phi$. For the same physical distance $\phi$, a lower $\rho$ (more porosity) implies that retaliation is less effective and the benefits of operating the border are higher from the rebel's perspective. When the G5 is active (at the limit of the operation zone $\hat{\delta} = \rho\hat{\phi}$), the gain in retaliation capacity ($r^*_{G5} - r^*_0(\hat{\delta})$) is higher when the

border is more porous, because $r_0^*(\hat{\delta})$ is increasing in $\rho$. Therefore, it becomes possible that for high border porosity $\rho < \overline{\rho}$, we have:[32]

- If $G5 = 0$ and $\delta = \rho\hat{\phi}$: The State uses $r_0^*(\rho\hat{\phi})$ in response to violence, the rebels always choose violence.
- If $G5 = 1$: The State uses $r_{G5}^*$ in response to violence. Rebels choose violence only if they face a trigger event.

For sufficiently high effective difficulty of crossing the border (i.e. low porosity, $\rho > \overline{\rho}$), we could have:[33]

- If $G5 = 0$ and $\delta = \rho\hat{\phi}$: The State uses $r_0^*(\rho\hat{\phi})$ in response to violence. The rebels choose violence only if they face a trigger event
- If $G5 = 1$: The State uses $r_{G5}^*$ in response to violence. Rebels choose violence only if they face a trigger event.

So, we expect a larger reduction in violence when the G5 is active (comparing $G5 = 1$ to $G5 = 0$), if the border is more porous ($\rho < \overline{\rho}$). This finding is in line with what we find in the heterogeneity analysis.

[32] This assumes $c < a + b(1 - \rho\hat{\phi}) - r_0^*(\rho\hat{\phi})$ for $\rho < \overline{\rho}$.
[33] This assumes $c - 1 < a + b(1 - \rho\hat{\phi}) - r_0^*(\rho\hat{\phi}) < c$ for $\rho > \overline{\rho}$.