Less Guns, More Violence: Evidence from Disarmament in Uganda *

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Abstract

This paper studies the effect of Uganda's 2006 disarmament policy in the Karamoja region in East Africa, a traditional tribal area that is one of the most violent places in the world. The disarmament policy greatly reduced the guns of tribes in the Ugandan districts of the region but not in the Kenyan districts. The theoretical impact of the disarmament is ambiguous, however, since guns can be used for deterrence as well as helping aggressors carry out violent crimes, such as livestock raiding. For example, the disarmament could reduce the advantage of heavily armed tribes over weakly armed tribes and lower the number of tribes willing to carry out raids. At the same time, it will also lower the expected cost of confrontations for all tribes, which may lead to more tribes initiating raids, particularly if weakly armed tribes begin to raid. Empirically, I find that the disarmament campaign had the unintended effect of increasing the frequency of raids in Uganda by about 40%, while, consistent with the idea that disarmament reduced the costs of raiding, I find no impact on the monthly death rate. Moreover, this increase in raids in Uganda was driven by an increase in Ugandan initiated raids on other Ugandans, not an increase in Kenyan initiated raids on Ugandans. This suggests that within Uganda the deterrent effect of guns outweighs their impact as a tool of aggression.

JEL codes: D74, K42, Q34, N47, N57

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Introduction

The Karamoja region of East Africa is arguably one of the most violent places in the world as it has a homicide rate that exceeds 50 per 100,000. This is more than ten times as high as the rate in the United States and about three times as high as the Mexican rate (2008 UNODC Homicide Statistics) [20]. The combination of geographical remoteness and hostile environmental conditions make it a difficult area to police and prone to lawlessness, such that violent conflicts tend to escalate. For example, as of August 2006 there were only 137 police officers in the Ugandan part of the region, resulting in a police to civilian ratio of less than 1:7,300, and in March 2004 a total of 300 deaths occurred when a single livestock raid escalated into larger scale conflict between two Ugandan tribes.[1] For comparison, the rest of Uganda has a ratio of about 1:1,800 and the United States has a police to civilian ratio of about 1:450.[2] The Karamoja's proximity to South Sudan and the Democratic Republic of Congo (DRC) has provided the local tribes access to guns, since illegal firearms are trafficked through the region from these countries. At the same time, extreme poverty is prevalent, with an estimated 82% of the population in Uganda and 74% of the population in Kenya living below the respective national poverty lines. The predominant form of violence is livestock raids, where a group of tribesmen attack another group with the intention of stealing their livestock - which is the primary source of food in the region. This setting, therefore provides an opportunity to address the role of firearms in a high conflict, insecure and deprived region. In particular, the objective of this paper is to examine whether reducing the number of guns alleviates or exacerbates conflict and instability in this poorly policed environment.

In May 2006, the government of Uganda made a significant forceful effort to confiscate guns, in an attempt "to contribute to human security and promote conditions for recovery and development in the Karamoja" [28]. At this point in time, President Museveni directed the national army to begin "cordon and search" disarmament operations, and guns were forcefully obtained from Karamojan tribesmen. This partial disarmament campaign caused a sharp decrease in the level of firearms in circulation or in use in the Ugandan part of the Karamoja region, as well as an increase in military presence to carry out the campaign. At the same time, there was no comparable policy in the adjacent Kenyan part of the region, despite the two countries sharing a 850 km border, with over 450 km of this border dividing the Karamoja Cluster region.

[1] Human Rights Watch committee draft report quoted in Get the Gun [34], CEWARN 2004-2009.

[2] Ugandan Official Statistics [21], U.S. Department of Justice [19]

To analyze the impact of this gun control policy, I first set out a simple model that demonstrates that the impact of the campaign within Uganda is theoretically ambiguous. On the one hand, if conflict is primarily due to an unbalanced distribution of firearms that leads to stronger tribes having a predatory advantage, the disarmament policy could help level the playing field by reducing the number of dominant tribes and therefore reduce the volume of livestock raiding. On the other hand, reducing the aggregate number of firearms in circulation will lower the expected costs of raiding for all tribes since any tribe will be less likely to confront a highly armed tribe when they initiate a raid. This will increase the incentive to participate in livestock raiding and could lead to an overall increase in raiding, outweighing the previous effect, particularly if tribes who were initially not raiding start to raid.

To examine this empirically, I evaluate the impact of the disarmament campaign on violence, comparing sublocations in Uganda to non-border sublocations in Kenya over time. I find that the disarmament campaign led to an increase in the frequency of raids in Uganda by at least 40%. At the same time the number of deaths caused per raid decreased so that the total number of deaths was not significantly affected by the campaign. These findings suggest that the disarmament campaign led to a decrease in the costs of raiding, as measured through costs to human life, but that in this setting the deterrent role of guns dominated their role in facilitating violence so that an unintended consequence of the campaign was to increase participation in raiding, rather than reduce it.

Furthermore, with the detailed tribe-level conflict data I have obtained, I am able to examine whether the campaign had any impact on violence occurring across the Kenya-Uganda border. For example, I can address whether or not it influenced either Kenyan raids on Ugandans or Ugandan raids on Kenyans in border sublocations. Interestingly, I find no evidence that the campaign increased Kenyan raids on Ugandans, but I do find that after the campaign there was a decrease in the frequency of cross-border raids by Ugandans on Kenyans by about 60%. The first finding that there was no increase in Kenyan attacks on Ugandans, coupled with the earlier results, shows that the increase in raids in Uganda was not driven by any spillover effects the campaign may have had on Kenyans, while the second finding that there was a decrease to Ugandan attacks on Kenyans shows the campaign may have encouraged Ugandans close to the border to raid other Ugandans, rather than Kenyans, providing further evidence of the use of guns for deterrence at least among Ugandan tribes.

There are several appealing features to this study. First, the control group (Kenyan Karamojans) share many common characteristics with the treatment group (Ugandan Karamojans). These tribesmen come from the same ethnolinguistic groups - the Aketer subdivision of the Eastern Nilotic linguistic group, and follow the same methods of nomadic pastoralism as their primary livelihood. It was only during colonization at the turn of the 20th century that national borders were formalized and these tribes were separated between the two countries. Second, survey measures of firearms clearly demonstrate that after the disarmament campaign, there was a weapons reduction and the circulation of bullets decreased in Uganda but not Kenya. Third, as well as examining the impact of a reduction in firearms, the results from this paper can help us learn about the effectiveness of military and government interventions in a high conflict environment with weak institutions.

Few papers have looked directly at the impact of gun control on violence in developing countries. Dube et al. (2011) [4], studies the impact of more lenient gun sales laws in Texas and Arizona on homicide rates in Mexico border municipios. They find an increase in firearm deaths in the Mexican municipios, which they attribute to a rise in gun supply. However, there is no indication of what might have happened if the government of Mexico had attempted to intervene, nor is it obvious that a reduction in the supply of guns would have had the opposite effect. To my knowledge this paper is the first to directly study a disarmament effort in a developing country.

There is a developed literature on the impact of gun control laws in the US. While there is not complete consensus on whether allowing people to carry guns increases or decreases crime, most recent work has indicated that guns tend to facilitate violence in the US rather than deter it. For example, empirical studies using proxy measures for gun ownership, such as the regional sales variation in gun magazines (Duggan 2001) [15]) or suicide rates (Cook and Ludwig 2005) [11], suggest there is a positive causal relationship between gun ownership and the homicide rate, with this result being mostly driven by an increase in murders in which a gun is used, lending evidence to the argument that an increased availability of firearms facilitates the ability of criminals to carry out violent crime. Other studies by Dezhbakhsh and Rubin (1998) [12], Dezhbakhsh and Rubin (2003) [13], Black and Nagin (1998) [8], Ludwig (1998) [26], and Ayres and Donahue (2003) [14] have similarly concluded that allowing people to carry guns increases crime.[3] While this paper relates to this literature, it asks a rather different question, since this paper questions what impact gun policies have when there is a much higher risk that an individual will need to defend themselves from a violent attack and in a situation where there is limited capacity of the state to protect individuals, or to retribute offenders. Given these differences, it is not obvious that my results should match the results of studies based on gun policies in the US.

This paper also relates to the literature on civil conflict in developing countries in that it focuses on intranational

[3]There are a few studies that assert the opposite: Lott and Mustard (1997) [25], Bronars and Lott (1999) [9], Benson and Mast (2001) [5], Plassmann and Tideman (2001) [29] and Lott (2003) [24].

conflict in a weak institutional environment. That literature has identified a strong correlation between negative income shocks and the onset or continuation of civil conflict, and attributed this correlation to both limited state capacity to contain violence and lower opportunity costs of participating in violence (Fearon and Laitin 2003 [17], Collier and Hoeffler 1998 [10]). This paper enhances this area of research by addressing a new question: given that conflict is prevalent, do guns lead to more or less violence? Thus it speaks to the more nuanced question: how much conflict will there be, rather than asking: will there be conflict?

The remainder of this paper is organized as follows. The first section discusses in more detail the background of the Karamoja Cluster region, the type of violence prevalent in the region, and how the disarmament campaign was carried out. The second section describes the conflict data. The third section outlines a theoretical model to frame the analysis. The fourth section outlines the empirical strategy and presents the results. Section five, discusses the findings and outlines some implications of this study.

1 Background

This section provides background information on the Karamoja region to illustrate both the importance of livestock in the region and to highlight the evolution of violence that has led to it becoming an extremely insecure environment. I also discuss similarities between the Kenyan and Ugandan parts of the region and how they were only recently separated during the British colonization of East Africa, before describing the details of the disarmament campaign that is the focus of this paper.

1.1 Physical and Human Geography

The Karamoja Cluster is located across the borders of Uganda, Sudan, Ethiopia and Kenya, covering an area of 25,000 square miles and has a human population estimated to be between 1 and 1.6 million (see Figure 1). The region is described as arid or semi-arid savannah, with high average daytime temperatures, low and unpredictable rainfall and pronounced seasonality. Tribal communities populate the region: in Uganda, most tribes belong to the Karamojong ethnic group, which can be further divided into the Dodoth, Jie, Pian, Matheniko and Bokora; in Kenya, the predominant tribal group are the Turkana; and an ethnic group known as the Pokot live in the southern parts of the Cluster across the Kenya-Uganda border (see Figure 2) (Gartell 1985 [18], Quam 1997 [31], Gray et al. 1999 [32], Powell 2010 [30]). All these tribes are closely ethno-linguistically related and come from the same

Aketer subdivision of the Eastern Nilotic linguistic group (Ethnologue 2011) [2]. Thus, they are linguistically intelligible to each other, and share much history and culture.

Statistical indicators for the region are suggestive of extreme poverty and deprivation. An estimated 82% of the population in Uganda and 74% of the population in Kenya live below the corresponding national poverty lines. Less than half the population have access to safe drinking water, less than a third have access to sanitation units, and most of the region surpasses the World Food Organization's emergency threshold for malnutrition rates. Similarly, statistics on other health indicators and literacy rates are very low (see Table 1).

The traditional livelihood, and that which is still practised today, is nomadic pastoralism whereby cattle and livestock are raised to provide a diet of meat, milk and blood to their owners. While some grain, such as sorghum and millet, may be grown in small amounts to supplement their diet, the pastoralists rely heavily on their livestock as their primary source of nutrition. Livestock also provides a measure of wealth, and bride prices are denominated in livestock. For many years this practice of transhumance pastoralism was the most effective method of subsistence in the region, but population growth, longer and more severe drought periods, and restrictions on the movement of pastoral groups due to the encroachment of commercial agriculture, have made the pastoral livelihood more difficult to sustain (Gray et al. 1999 [32]; Little 1999 [23]).

1.2 Historical Context

While the British established their influence over the most productive regions of East Africa in the 1890s, the Karamoja Cluster was largely left untouched as the remote and inhospitable region offered few benefits to the colonists. However, due to the risk of livestock diseases spreading and the unauthorized presence of Ethiopian ivory traders in the Karamoja Cluster, which until then had been creating a buffer between British East Africa and the Ethiopian empire, the British decided to establish a military administration in Karamoja in 1911. These colonial borders formalized the separation between the Kenyan Karamoja and the Ugandan Karamoja and also created borders within the countries that arbitrarily assigned permanent territorial rights based on whichever tribe was predominant in the area when the boundary was set. This triggered an increase in hostility between the Turkana, Pokot and Karamojong tribes that has grown over time, and isolated the region from the rest of Kenya and Uganda, generating "closed" districts where movement within and outside was restricted without a valid pass (Quam 1997 [31], Knighton 2003 [22], Gray et al. 1999 [32]).

In 1954, the British launched an accelerated program of agrarian reform and tried to transform the traditional livelihood into Western ranching schemes. However, the effect of this intervention intensified overgrazing and desertification, and further aggravated inter- and intra-tribal tensions. After independence settlement policies were still pursued, since settlement was perceived to be the most suitable solution to the problems of environmental degradation. However, the region was excluded from road communication and infrastructure projects that pervaded the rest of Uganda and Kenya, and so the communities continued to prioritise their prior tribal identities rather than identifying with the newly formed states. From the 1970s a series of droughts and livestock disease epidemics have plagued the region, and detrimentally impacted livestock and human populations [32], [30]. [4]

1.3 Conflict and Arms

The earliest records of arms in the region date to 1900s when the pastoralists engaged in trade with Ethiopian ivory poachers, who supplied guns in return for ivory, or safe passage across the region. These weapons were used for livestock raiding - a traditional activity whereby groups of young men would attack a neighboring tribe, after obtaining a blessing from the elders of their tribe, with the intention of bringing back additional livestock. These raids were part of the pastoralists' culture, as they were often used to mark the coming of age of a young boy into manhood, and were activities under the control of the tribal elders. It was convention for the elders to forewarn the target community of an impending raid, and deaths to women and children were deplored. Some anthropologists have claimed that the raids helped redistribute an unequal distribution of livestock when one tribe had been more severely affected by a drought or a disease epidemic, and that there was an implicit understanding between tribes that this aggression could be expected (Hendrickson, Armon and Mearns 1998) [16]. However, in more recent years the social structure of the tribes appears to have broken down, and the decision to raid is made unilaterally by bands of young men who have guns. While they still identify with their ethnic tribal group (i.e., they call themselves the Dodoth, or the Jie warriors), and they do not raid from their own tribe, they no longer seek permission from their tribe's elders, and spend much time away from the tribal communities, effectively as roaming criminals (Akabwai and Ateyo 2007) [3].

More guns entered the region when the British recruited the Karamojong and Turkana tribesmen to fight in the East African Brigade during the Second World War and inadvertently provided them with guns to use when they

[4] The most notable multi-year droughts occurred in 1967-68, 1974-75, 1979-81, and 2010-2011.

returned to their tribal communities. A second influx of weapons occurred when the Amin regime collapsed in 1979 and the Matheniko were able to loot the government amory in Moroto, obtaining large quantities of small arms and ammunition. Current regional gun flows operate through the Sudan-Uganda and Sudan-Kenya border, where the Didinga and Toposa pastoralists of Southern Sudan have obtained small arms through a variety of means related to the Sudanese Civil War.[5] There are also claims that raiders in the west of the Karamoja obtained weapons by either trading them with the Lord's Resistance Army (LRA) rebels, or through overcoming the LRA during raids and appropriating their guns (Small Arms Survey 2006) [1].

It is difficult to put a precise figure on the number of firearms in the region, given the illegality that most weapons have entered the region illegally. Estimates range from 30,000 to 200,000 around 2005 (the period before the disarmament policy was introduced).[6] To summarize the current situation in the region, the steady rise of firearms in the region, coupled with environmental pressures and degradation of natural resources, as well as isolation from human development initiatives, such as health care facilities and roads, has left the region marginalized and in a state of insecurity and chaos. Predatory raiding where groups of young tribal warriors initiate raids are common.

1.4 Disarmament

The first attempt since independence to reduce the number of guns in the Karamoja Cluster began with a voluntary disarmament campaign initiated by the Government of Uganda in December 2001. The intention of this campaign was to increase security to pastoralists by limiting the ability of each tribe to participate in raiding activities. The campaign involved the voluntary hand over of guns in return for sheets of corrugated iron roofing and certificates noting the surrender of weapons by an individual or family. This campaign had mixed success. The Government of Uganda claimed to obtain nearly 10,000 guns within a two month period (KIDDP 2007) [28], but the gifts of iron sheets made compliant tribesman vulnerable to attack, as they became readily identifiable as people who had disarmed. In response to the targeted raiding on the disarmed tribemen, the Uganda People's Defence Force (UPDF) chose to re-arm some communities and form so-called Local Defence Units (LDUs), so it is ambiguous how many weapons were physically removed from the region. Between March 2002 and June 2003, the Lord's

[5]For example, by the alleged direct transfer by the Government of Sudan (GoS) in order for the Didinga and Toposa to help destabilize the Sudan's Peoples Liberation Army (SPLA) during years of the Sudanese Civil War, or from gun sales by deserters of both the GoS or SPLA forces, or from looting border garrisons as they repeatedly changed hands between the two forces (Mkutu 2007 [27], Akabwai and Ateyo 2007 [3]).

[6]The UPDF (2007) [33] claims a figure of 30,000 weapons. As Mkutu (2007) [27] notes, most estimates range from 40,000 to 80,000 with some (media) suggesting as many as 200,000.

Resistance Army attacks intensified in the northern districts of Uganda to the west of the Karamoja Cluster. This forced the UPDF to withdraw from the region and rapid re-armament occurred with young men being sent into Southern Sudan to purchase more guns and ammunition (Akabwai and Ateyo 2007) [3].

The subsequent raids and counter raids that erupted following the failed 2001-2002 disarmament initiative resulted in the Ugandan government discussing the launch of another attempt at disarmament. Local civil society organizations, international NGOs, and the Karamojong themselves asked the government to address not only the quantity of guns in circulation, but the other causes of insecurity, such as the marginalization of traditional livelihoods and the increased environmental pressures. However, following the presidential elections in February 2006, when Museveni gained power for a third term, the Government of Uganda disarmament strategy took an unexpected and wholly military character. While there had been discussions on how to address insecurity in the region, the general view gathered from firsthand interviews with member of parliaments, opposition leaders and the Karamojong themselves was that the reason for staging these discussions was an attempt by the Museveni regime to buy votes, and tribesmen reported, "Recovery of guns is in theory. There is nothing going on." [3]. However, starting in May 2006, the UPDF introduced what they termed "Cordon and Search Operations", and communities were effectively occupied by the military until the UPDF were satisfied with the number of guns that had been surrendered [3].[7] By 2008, the UPDF announced they had recovered 30,000 guns from the region, although their activities were concentrated in the months immediately after May 2006. Ugandan media reports suggest that the price of AK-47s and bullets increased fivefold during this disarmament campaign (Bevan 2008a) [7]. Over the same period, there was no active disarmament in Kenya.[8]

I focus on the disarmament that occurred in Uganda starting in May 2006 because it was unexpected in its timing, and it had a significant immediate impact on the number of firearms in circulation due to the nature in which it was implemented. Specifically, I compare the 12 months prior to May 2006 and the 12 months afterwards in both Uganda and Kenya, to examine the impact of the disarmament campaign on the frequency of livestock raids and the lethality of violence.

[7]The international donor community has shown concern over the brutality of the UPDF's actions, and there have been allegations of abuse and torture to civilians in the region.

[8]Instead, if anything, there was informal arming of local tribesmen by the Kenyan government on a small scale to form the Kenya Police Reserves (KPR), which were supposed to play a similar role to the Local Defence Units (LDUs) in Uganda. In this case, the KPR are supposed to protect local communities against raids by the Sudanese Toposa and the Ugandan Karamojong tribes (Bevan 2008b) [6].

2 Data

The conflict data comes from CEWARN (Conflict Early Warning and Response Mechanism), a recent initiative that was set up by the Intergovernmental Authority on Development (IGAD) to monitor, prevent escalation or mitigate the worst effects of violent conflicts. CEWARN collects detailed accounts of all episodes of pastoral conflict and crime in the Karamoja Cluster by using field monitors to record reports of these incidents.[9] These incident reports are coded by the level at which the information was obtained, and over 90% of the reports have either the field monitor as a direct observer, or the informant to the field monitor as a direct observer. The remainder are compiled based on police, newspaper, or radio reports.

The incident reports are extremely detailed and record the type of crime (cattle raid, livestock theft, banditry, assault, abduction, murder or rape), the date each crime occurs, the number of people involved, the outcomes to human life and property (such as the number of livestock taken), the tribes involved (who was the initiator and who was the target), and the location of the crime (up to the village level).[10] Therefore, using this data I am able to undertake a micro-level approach to understanding conflict and disarmament. I focus on the livestock thefts and raids, because they are the most salient form of violent crime in the region.

As well as the incident reports, I have access to survey data on the level of bullets in circulation and the impact of the disarmament policy. This is because the field monitors complete a 55 question survey at a weekly frequency to aid CEWARN in its ability to forecast outbreaks of violence and the survey contains questions relating to bullets and disarmament. Between May 2005 to April 2007, the 12 months before and after the disarmament campaign, there were 5 field monitors in Kenya and 7 in Uganda. The incident reports can also be used to trace the movements of the UPDF during their disarmament operations, since the reports record incidents where the military used excessive force to disarm communities, or when the operations led to deaths or injuries to either the military or civilians.[11] Based on firsthand interviews by researchers in the area [3], the majority of the disarmament operations were described to involve excessive force by the UPDF.

I have matched the incident reports to the International Livestock Research Institute's detailed administrative

[9] Field monitors are CEWARN employees and must be able to speak the local dialects in the region they are deployed. However, they must be literate and are not natives of the region.

[10] Within Kenya, the taxonomy of geography is: country, province, district, division, location, sublocation, village; while in Uganda the taxonomy is: country, district, county, subcounty, village. For this study, I use sublocations in Kenya and subcounties in Uganda, as my geographic unit of analysis, and I adopt the Kenyan term "sublocation" for this geographic unit.

[11] A total of 93 disarmament operations can be traced through the incident reports, of which 29 led to deaths, and of these 3 led to more than 10 deaths.

maps for the region to obtain the rate of raids, deaths and livestock stolen per month per sublocation. A map of the sublocations in Kenya and Uganda can be seen in Figure 3, and descriptive statistics on selected conflict and pastoral indicators are covered in Table 2.

3 Theoretical Framework

This section formalizes the intuition that the disarmament campaign could have an ambiguous impact on conflict within Uganda using a simple model. The model describes a setting in which tribes are either heavily armed or weakly armed, and the purpose of the campaign is to reduce the arms level of heavily armed tribes in order to eliminate their predatory advantage over the weakly armed tribes. However, if the campaign is effective in this goal, the expected costs of participating in conflict for both tribes will also change and this may inadvertently cause an increase in raiding. In other words, fewer tribes will be deterred from raiding. Thus, this model gives rise to multiple outcomes, where different levels of raiding occur dependent on the proportion of heavily armed to weakly armed tribes in the region.

The model description matches some basic features of the conflict data that will be discussed in more detail in the section four. But for now, to illustrate why I chose this model set-up, consider that there is geographic variation in the proximity of tribes to the Sudanese border - a potential source of weapons, that some tribes raid far more than others and that the military carried out more cordon and search operations on these tribes.[12]

In the remainder of this section, I will provide details on the set-up to the model and then show several predictions.

3.1 Set-up

The structure of the model is as follows. There are two levels of arms in Uganda. A proportion p of tribes have a high level of arms $\overline{G}$, while $(1-p)$ have a low level of arms $\underline{G}$. For notational convenience I will refer to these tribes as H-types and L-types. When a tribe makes the decision to raid they know their own arms level but not the level of arms of the opponent they will meet. The proportion of H-types in the population, p, is common knowledge.

Each period one randomly selected tribe will decide whether or not to raid. The geographic dispersion of tribes makes it unlikely that a tribe could strategically choose to raid another tribe when that tribe is also raiding, leaving

[12] Figure 4 illustrates this targeting by the military, while Figure 1 demonstrates the proximity of the Karamoja region to South Sudan.

their livestock less well guarded. In addition, the frequency of raiding observed in the data is low enough that it is rare to observe more than one raid per day in the region.[13] Given this, I choose not to allow for raids to occur simultaneously, whether strategic or non-strategic, in the model.

When a tribe is attacked they always attempt to resist the aggressor, so initiating a raid is never costless for either type of tribe. This is observed in the data, since the textual accounts of raids almost always describe resistance by the target and about 25% of all raids lead to at least one death. The spoils to raiding are denoted by B and can be thought of as the average number of livestock obtained. If a tribe initiates and wins a raid they obtain B, but they obtain nothing if they are unsuccessful. If a tribe is attacked and unsuccessfully defends a raid, they lose B, while they retain B if they successfully resist the attack.

The cost of raiding is incurred by both the aggressor and the defendant, and it depends on both parties' arms level: $C(G_1, G_2)$, where the first argument denotes the tribe's own arms level and the second argument denotes the opponent's arms level. The cost function is not symmetric unless $G_1 = G_2$ as when tribe 1 attacks tribe 2 they incur cost $C(G_1, G_2)$, while tribe 2 incurs cost $C(G_2, G_1)$ when defending against this attack. The cost of fighting decreases in a tribe's own arms level ($\partial C(G_1, G_2)/\partial G_1 < 0$), increases in the arms level of the opponent ($\partial C(G_1, G_2)/\partial G_2 > 0$), and increases in the aggregate amount of arms. This implies: $C(\underline{G}, \overline{G}) > C(\overline{G}, \overline{G}) > C(\underline{G}, \underline{G}) > C(\overline{G}, \underline{G})$.[14]

I assume that the probability the initiating tribe makes a successful raid is determined by the ratio of the two tribes' gun levels. Explicitly, the probability tribe 1 is successful against tribe 2 is: $G_1/(G_1 + G_2)$, and the probability tribe 2 successfully defends themself from tribe 1 is: $G_2/(G_1 + G_2)$.

I also assume that $\frac{\overline{G}}{\underline{G}+\overline{G}}B - C(\overline{G}, \underline{G}) > 0$, so that the H-types will always be willing to fight L-types if they could observe their type, and $\frac{\underline{G}}{\underline{G}+\overline{G}}B - C(\underline{G}, \overline{G}) < 0$, so that the L-types will never choose to fight H-types, again, if they could observe their type.

The disarmament campaign is assumed to target the heavily armed tribes and lower their arms level to that of a L-type.[15] This implies that it reduces p, the proportion of H-types in the population. I can now state the first result:

[13] About 10% of recorded raids between 2004-2009 in Uganda occur on the same day.

[14] Most of the conflict costs recorded in the data match this ranking. Using the level of raiding in the 12 months before the campign to classify tribes as H-types and L-types, I find that the average number of deaths reported when a L-type is attacked by a H-type is 1.35, while it is 0.93 when a L-type attacks a H-type. Raids between two H-types incur on average 1.07 deaths, while it about 0.8 for L-types. Given that it is easier to monitor the number of deaths to targets, these statistics are consistent with the conflict cost ranking that I suggest in the model.

[15] It seems plausible that the tribes can either keep hidden a small number of guns or restock to the low level so I assume the arms level of L-types is maintainable.

Proposition 1

There is a threshold, $\chi_1(B,\overline{G},\underline{G})$, such that no raiding occurs if $p > min(\chi_1, 1)$.

Proof. H-types' incentive to raid requires that their expected net gains to raiding are positive:

$$p\left(\frac{1}{2}B - C(\overline{G},\overline{G})\right) + (1-p)\left(\frac{\overline{G}}{\underline{G}+\overline{G}}B - C(\overline{G},\underline{G})\right) \geq 0$$

If $\frac{1}{2}B - C(\overline{G},\overline{G}) \geq 0$, then H-types will always raid, since $\frac{\overline{G}}{\underline{G}+\overline{G}}B - C(\overline{G},\underline{G}) > \frac{1}{2}B - C(\overline{G},\overline{G})$.
If $\frac{1}{2}B - C(\overline{G},\overline{G}) < 0$, then H-types will not raid if p is above the threshold χ_1, where:

$$\chi_1 = \frac{\frac{\overline{G}}{\overline{G}+\underline{G}}B - C(\overline{G},\underline{G})}{\left(\frac{\overline{G}}{\overline{G}+\underline{G}}B - C(\overline{G},\underline{G})\right) - \left(\frac{1}{2}B - C(\overline{G},\overline{G})\right)}$$

□

As p decreases the probability that an initiating tribe meets an H-type when they raid decreases, while the probability they meet with an L-type increases. This increases the expected gains to raiding for both tribes, and may lead to L-types raiding as well as H-types. This effect is outlined in my second result:

Proposition 2

There is another threshold, $\chi_2(B,\overline{G},\underline{G})$, such that once $p \leq max(0, \chi_2)$, L-types will raid as well as H-types.

Proof. For L-types to choose not to raid, their expected net gains to raiding must be negative:

$$p\left(\frac{\underline{G}}{\underline{G}+\overline{G}}B - C(\underline{G},\overline{G})\right) + (1-p)\left(\frac{1}{2}B - C(\underline{G},\underline{G})\right) < 0$$

If $\frac{1}{2}B - C(\underline{G},\underline{G}) < 0$, then L-types will never raid for any value of p as $\frac{1}{2}B - C(\underline{G},\underline{G}) > \frac{\underline{G}}{\underline{G}+\overline{G}}B - C(\underline{G},\overline{G})$.

If $\frac{1}{2}B - C(\underline{G},\underline{G}) \geq 0$, then L-types will raid once p is below the threshold χ_2, where[16]:

$$\chi_2 = \frac{\frac{1}{2}B - C(\underline{G},\underline{G})}{\left(\frac{1}{2}B - C(\underline{G},\underline{G})\right) - \left(\frac{\underline{G}}{\underline{G}+\overline{G}}B - C(\underline{G},\overline{G})\right)}$$

□

These two propositions show that the level of raiding in Uganda depends on the proportion of heavily armed to weakly armed tribes in the region as well as the relative benefits and costs of raids. If $\frac{1}{2}B - C(\overline{G},\overline{G}) < 0$, there will be a region, $\chi_1 < p \leq 1$, where even H-types will be unwilling to raid and no raiding occurs, while if $\frac{1}{2}B - C(\overline{G},\overline{G}) > 0$, H-types will always be willing to raid even though L-types are not. However, as p decreases L-types will start raiding, as long as they anticipate a net benefit when raiding each other ($\frac{1}{2}B - C(\underline{G},\underline{G}) > 0$).

This demonstrates that disarmament could be an appropriate policy if the H-types were raiding but the L-types were not (i.e., $\chi_2 < p \leq \chi_1$) because lowering the number of H-types in the population will mechanically lower the number of tribes willing to initiate raids. The predatory advantage of H-types is eliminated and guns are no longer available to facilitate raids by H-types. However, this policy will simultaneously alter the payoff to initiating a raid for either type, since the probability that either type encounters an L-type will increase and L-types are less costly to fight. That is, the expected net gains to raiding are decreasing in p for both types. In particular, lowering p below the threshold χ_2 will lead to L-types raiding as well as H-types, as the deterrence effect of potentially interacting with a H-type is much weaker.

3.2 Deaths and Livestock

The model can also be used to make predictions on the impact of disarmament on other conflict outcomes such as deaths and livestock stolen, using the measure of conflict costs to proxy for deaths and the measure for spoils to proxy for livestock losses.

When only H-types raid the conflict cost of a raid will be determined by the frequency an H-type meets with another H-type (p), the frequency they meet with an L-type ($1-p$) and the costs associated with these different

[16] It is easy to show $\chi_1 > \chi_2$ when $\frac{1}{2}B - C(\overline{G},\overline{G}) < 0$ and $\frac{1}{2}B - C(\underline{G},\underline{G}) > 0$. See Appendix for proof.

interactions, which are $2C(\overline{G},\overline{G})$ and $C(\overline{G},\underline{G})+C(\underline{G},\overline{G})$, respectively:

$$p2C(\overline{G},\overline{G})+(1-p)(C(\overline{G},\underline{G})+C(\underline{G},\overline{G}))$$

As p decreases H-types are more likely to meet with L-types, which will led to a decrease in the average cost of a raid, as long as $2C(\overline{G},\overline{G}) > C(\overline{G},\underline{G})+C(\underline{G},\overline{G})$. In addition, as there are fewer H-types to initiate raids, the total conflict cost will also decrease.[17]

Once L-types raid as well as H-types, the average conflict cost of a raid is likely to be lower still, since it is now possible that two L-types will interact, which is less costly than when two H-types interact. In fact, as long as $2C(\overline{G},\overline{G}) > C(\overline{G},\underline{G})+C(\underline{G},\overline{G}) > 2C(\underline{G},\underline{G})$, implying that cross-type interactions are less costly than H-type interactions but more costly than L-type interactions, the average conflict cost of a raid strictly decreases when L-types also raid.[18] Therefore, even though the disarmament may lead to an increase in the frequency of raiding, which will have a direct positive impact on total conflict cost, the average conflict cost per raid is likely to decrease.[19]

Similarly, I can consider the impact of the disarmament on livestock losses. When only H-types raid, the average amount of livestock stolen per raid will increase as p decreases, since the remaining H-types that raid are more likely to meet an L-type and they can obtain more livestock from these tribes. However, the total livestock stolen will decrease as their are fewer H-types to undertake raids.[20]

[17] The total conflict cost when only H-types raid is computed as the average cost of a raid multiplied by frequency of raids (p):

$$p^2 2C(\overline{G},\overline{G})+p(1-p)(C(\overline{G},\underline{G})+C(\underline{G},\overline{G}))$$

and this decreases in p.

[18] See Appendix for proof.

[19] The total conflict cost when both types raid is computed as the average cost when each type raids multiplied by the frequency each type raids:

$$p^2 2C(\overline{G},\overline{G})+2p(1-p)(C(\overline{G},\underline{G})+C(\underline{G},\overline{G}))+(1-p)^2 2C(\underline{G},\underline{G})$$

and so immediately after L-types start raiding, once p is just less than χ_2, the total conflict cost will discretely increase.

[20] The average livestock obtained when only H-types raid is:

$$p\frac{1}{2}B+(1-p)\frac{\overline{G}}{\overline{G}+\underline{G}}B$$

and this decreases in p, while the total amount taken is:

$$p\left(p\frac{1}{2}B+(1-p)\frac{\overline{G}}{\overline{G}+\underline{G}}B\right)$$

and this increases in p, given that $p \leq 1$.

Once the L-types raid as well as the H-types, there will be a discrete increase in the amount of livestock stolen and then no further changes for decreases in p.[21]

3.3 Cross-Border Raids

It is possible to adapt this framework to obtain predictions of the impact of the disarmament policy on cross-border raids as well. For example, since the disarmament campaign did not affect Kenya, Kenyan tribes should become stronger relative to the Ugandans, and their incentive for cross-border raids should increase ceteris paribus. At the same time, the incentive for Ugandans to raid Kenyans should decrease. Therefore, an additional impact of the disarmament policy could be to increase cross-border raids by Kenyans, while decreasing cross-border raids by Ugandans.

3.4 Model Simulation

To illustrate the predictions of the model I simulate the model using the following parameterization:

$$\overline{G} = \gamma \underline{G}$$

$$C(G_1, G_2) = G_2^{\alpha_2} G_1^{-\alpha_1}$$

The parameters are set such that the H-types have twice as many guns as the L-types: $\gamma = 2, \underline{G} = 1$; the elasticity of costs with respect to your own guns is half that of your opponent's guns: $\alpha_1 = 0.5, \alpha_2 = 1$; and I vary the spoils to raiding to show a situation where H-types always raid and a situation when this is not the case: $B = 3$ or 2.5.

Figure 5 shows the predicted frequency of livestock raids when either $0 < \chi_2 < \chi_1 < 1$ or $0 < \chi_2 < 1 < \chi_1$ (alternatively, when $B = 2.5$ or 3, respectively). Once p falls below χ_2 there are more raids since both types raid, while the number of raids falls with $p \in (\chi_2, \chi_1]$. There are no raids when $p > \chi_1$, since then even the H-types are not willing to raid.

Figure 6 demonstrates that both the total conflict cost and the livestock losses will discretely increase once p

[21] The average livestock obtained per raid and the total amount taken when both types raid is:

$$p\left(p\frac{1}{2}B + (1-p)\frac{\overline{G}}{\overline{G}+\underline{G}}B\right) + (1-p)\left(p\frac{\underline{G}}{\overline{G}+\underline{G}}B + (1-p)\frac{1}{2}B\right) = \frac{1}{2}B$$

which exceeds the total amount taken when just H-types raid and $p = \chi_2$, but is invariant to further changes in p.

falls below χ_2 and both types raid, due to the scale effect of an increase in the volume of raiding, while Figure 7 shows the average conflict cost of a raid will decrease during this transition, due to the composition effect of L-types participating in raids.

4 Empirical Approach and Results

This section describes the econometric approach employed to assess the impact of the disarmament campaign in Uganda. I start by verifying that the campaign had an impact on the level of firearms in Uganda and whether the military targeted the strongest tribes, which is an assumption of the model. Then I examine the impacts of the campaign on the frequency of livestock raids, the death rate and the livestock theft rate in Uganda. I check whether the costs of raiding decrease by examining the number of deaths caused per raid and whether the campaign caused any cross-border spillovers. Lastly, I estimate the longer term impacts of the campaign.

4.1 Impact on Guns

The first part of my analysis examines the impact of the disarmament campaign on the level of firearms in Uganda relative to Kenya. I do this using two measures of firearms that were recorded each week by the field monitors in Uganda and Kenya between 2004 to 2009.[22] Specifically, the field monitors are asked by CEWARN to respond to the following survey questions:[23]

1. Has a disarmament, weapons reduction or buyback program been initiated?
2. Are bullets in use as an exchangeable commodity?

The first question provides direct evidence on the implementation of the policy, while the second question provides more subtle evidence. If the disarmament campaign was implemented, then demand for bullets would decrease, due to the decline in use of firearms and the potential risk of holding bullets, making bullets a less popular tradable commodity. The response to these questions are scored on an index where 0 indicates "disagree", 0.25 indicates "somewhat disagree", 0.50 indicates "neither agree nor disagree", 0.75 indicates "somewhat agree" and 1 indicates "agree".

[22] There are 7 field monitors in Uganda and 5 in Kenya.

[23] The field monitors complete a 55 question survey each week to aid CEWARN in its ability to forecast outbreaks of violence and this survey includes the two question relating to disarmament and bullets.

Figures 8 and 9 plot the time series of these survey measures for Ugandan and Kenyan field monitors and a vertical red line is used to mark the week the disarmament campaign began. Figure 8 suggests that before May 2006 there was no indication of any type of disarmament in either Kenya or Uganda, but after May 2006 field monitors in Uganda recorded a high level of disarmament.[24] Similarly, Figure 9 shows that field monitors in Uganda observed a reduction in the use of bullets after the policy was implemented, but there was no decrease in Kenya. In addition, Figure 10 complements these figures by plotting the total number UPDF disarmament operations recorded each month in the CEWARN incident report data. This figure shows that there was no significant disarmament activity until May 2006 and that after April 2007 the operations had been scaled back considerably.

To test these results formally, Table 3 reports the regression results from the following specification:

$$weapons_{dct} = \alpha + \mu_{dc} + \gamma_t + \delta_1 ug_{dc} * disarm_t + \varepsilon_{dct} \tag{1}$$

where $weapons_{dct}$ is one of the two survey measures and $ug_{dc} * disarm_t$ is an indicator variable equal to one for all observations in Uganda after May 2006. The field monitor fixed effects, μ_{dc}, control for any permanent differences in the level of firearms in each monitored area, while the week fixed effects, γ_t, non-parametrically control for any region-wide shocks to weapons stocks that may affect both countries. As there are a small number of field monitors, rather than clustering the standard errors by field monitor, a wild cluster boostrap is used to compute p-values for the test $\delta_1 = 0$.

Column (1) of Table 3 shows that there was a significant decrease in firearms in Uganda relative to Kenya based on the survey measure of a weapons reduction. Once the disarmament campaign was launched, field monitors in Uganda on average either agreed or somewhat agreed that the a weapons reduction was occurring, while on average Kenyan field monitors continued to somewhat disagree that any such change to firearms was occurring. For the second measure, column (2) shows that the post disarmament response in Ugandan districts decreased by about 0.2 points, indicating that these field monitors on average disagreed that bullets were in use as an exchangeable commodity, while field monitors in Kenya continued to somewhat agree that the opposite was the case in their districts.[25]

[24]Immediately after the policy began, field monitors in Kenya also reported an increase in disarmament. However, these reports only stayed high for a few weeks before dropping considerably, suggesting there may have been some misunderstanding by the Kenyan field monitors. In addition, a test on the mean survey response in Kenya before and after May 2006 indicates there was no increase in this survey measure.

[25]Separate regressions are run to test for any differences in the mean survey response in Kenya before and after May 2006 and these results are in shown in Table 1 in the Appendix. These results show that Kenyan field monitors continued to disagree that any weapons

4.2 Targeting by the Military

The model assumes that the disarmament campaign led to a reduction in p, the proportion of tribes with a high level of arms. This can be checked by examining whether the military were more likely to carry out a disarmament operation on a tribe that had been aggressive in the past. I do this by estimating:

$$\Sigma_{t\in\{0,12\}} UPDF_{it} = \alpha + \mu_i + \delta_1 \Sigma_{t\in\{-12,-1\}} raids_{it} + \varepsilon_i \tag{2}$$

where $\Sigma_{t\in\{-12,-1\}} raids_{it}$ denotes the number of raids that tribe i initiated in the 12 months before the campaign began, while $\Sigma_{t\in\{0,12\}} UPDF_{it}$ denotes the number of disarmament operations the UPDF carried out in the 12 months after the campaign began on tribe i.[26] I also estimate equation (2) using an indicator variable for whether any military visits were experienced, $I[\Sigma_{t\in\{0,12\}} UPDF_{it} > 0]$, as the dependent variable.

Table 4 presents the results from estimating equation (2). A simple OLS regression, as shown in column (1) and (3), finds that tribes that initiated more raids in the 12 months before the campaign, were more likely to be visited by the military and experienced a larger number of visits. The magnitude of the coefficient estimated in column (1) suggests that about 2.5 raids in the pre-period led to an additional military visit during the campaign. Column (2) verifies the OLS results using a poisson model as an alternative specification, since the number of UPDF visits is a count measure, and corroborates the positive correlation between tribe aggression and military attention.

To summarize the results so far, the disarmament campaign was followed by a reduction in the availability of firearms and ammunition in Uganda but not in Kenya, the disarmament operations were focused in the 12 months after May 2006, and the military paid more attention to disarming the most aggressive tribes during these operations. This verifies the appropriateness of using difference-in-differences to identify the impact of the campaign and that the immediate impacts of the campaign should be observable in the 12 months following the disarmament announcement. In addition, the model assumption that the military targeted the H-types is consistent with the data.

4.3 Impact on Conflict

The second stage of the empirical approach estimates how the disarmament campaign affected Ugandan tribes' willingness to participate in violence by comparing the monthly raid rate in Ugandan sublocations to Kenyan

reduction was occurring and to agree that bullets were in use as an exchangeable commodity.

[26]This measure is based on the reports of the military operations recorded in CEWARN's incident reports.

sublocations in the 12 months before and after the policy was implemented. To visualize this outcome, Figure 11 plots the average monthly raid rate for each country and Figure 12 plots the difference in these average rates. These figures reveal converging conflict trends between the two countries prior to the disarmament campaign, with the raid rate decreasing in Uganda while increasing in Kenya, and they suggest that the impact of the policy may have evolved over time. Given this, three different forms of the difference-in-difference model are estimated and for each model the within country differences are also presented.[27]

First, the standard difference-in-difference model is estimated using the following equation:

$$conflict_{ict} = \alpha + \mu_{ic} + \beta_1 ug_{ic} * disarm_t + \beta_2 disarm_t \tag{3}$$

$$+\beta_3 ug_{ic} * predisarm_t + \beta_4 predisarm_t + \beta_5 ug_{ic} * postdisarm_t + \beta_6 postdisarm_t + \sum \delta_m D_m + \varepsilon_{ict}$$

where μ_{ic} controls for sublocation fixed effects, $ug_{ic} * disarm_t$ is an indicator for sublocations in Uganda in the 12 months after the disarmament campaign began (starting in May 2006), while $disarm_t$ is an indicator for all sublocations in this period. In addition, the conflict measure is deseasonalized to account for any predictable inter-annual variation in conflict. I do this using a set of month of year dummies (D_m) and the full time series of data (72 months), which is why the additional $predisarm_t$ and $postdisarm_t$ terms have been included.[28]

Second, a single time trend for each country is introduced:[29]

$$conflict_{ict} = \alpha + \mu_{ic} + \beta_1 ug_{ic} * disarm_t + \beta_2 disarm_t + \gamma_1 t + \gamma_2 ug_{ic} * t + \ldots + \sum \delta_m D_m + \varepsilon_{ict} \tag{4}$$

Third, a trend break for each country around the disarmament campaign is introduced:

$$conflict_{ict} = \alpha + \mu_{ic} + \beta_1 ug_{ic} * disarm_t + \beta_2 disarm_t + \gamma_1 t + \gamma_2 ug_{ic} * t + \gamma_3 t * disarm_t + \gamma_4 ug_{ic} * t * disarm_t + \ldots \tag{5}$$

$$\ldots + \sum \delta_m D_m + \varepsilon_{ict}$$

[27]While most applications of difference-in-difference models show comparable pretrends, allowing for differences in pre-trends in this setting would bias against identifying any effect of the disarmament campaign since in the pre-disarmament period the conflict rate in Kenya is increasing but decreasing in Uganda.

[28]$predisarm_t$ references the period from January 2004 to May 2005 and $postdisarm_t$ references the period from May 2007 to December 2009.

[29]The conflict measures are deseasonalized for all of the equations, as in (3), using corresponding interaction terms for $predisarm_t$ and $postdisarm_t$ with t and $ug_{ic} * t$, although for conciseness the full specifications have not been shown.

Standard errors for all of these equations are clustered to allow for correlation within sublocations.

Before showing the full difference-in-difference results, Table 5 first presents the results on changes to the monthly raid rates that occurred within each country. As well as showing the coefficient estimates, the estimated impact of the disarmament 6 months into the post period is included. Reading across columns (1)-(3), the estimates suggest that after the disarmament campaign was introduced the frequency of raids in Ugandan sublocations increased by at least 0.1 raids per month, from a mean raid frequency of 0.27 raids per month, while, under specifications shown in columns (1) and (2), the frequency of raids in Kenyan sublocations did not change from a mean raid frequency of 0.11 raids per month. Under the specification in column (3), the coefficient estimate on $t * disarm_t$ suggests that the number of raids may have slightly decreased in Kenya after the campaign announcement.

The combined difference-in-difference estimates are shown in Table 6. Columns (1)-(3) estimate large impacts of the disarmament on the raid frequency in Uganda. The standard difference-in-difference model suggests that the disarmament campaign led to about a 40% increase in the raid frequency in Uganda, while the most flexible model that takes into account the differences in pre-trends between the two countries and allows the impact of the disamament campaign to develop over time, provides a much larger and significantly different estimate.[30] This can be understood by noticing that the coefficient on $ug_{ic} * t * disarm_t$ is relatively large, indicating that during the disarmament campaign the monthly raid rate in Uganda increased each month (by about 0.01 raids once pre-trends are accounted for). In the absence of the campaign, the model predicts that the monthly raid rate in Uganda would have decreased each month based on the coefficient estimates on the pre-trend terms t and $ug_{ic} * t$ and the trend reversal that was estimated for Kenya with $t * disarm_t$. Taken together this implies that the impact of the campaign was much larger than the standard difference-in-difference estimate would first suggest. [31] Both estimates indicate that the campaign led to a significant increase in raiding in Uganda.

Table 7 examines the impact of the disarmament campaign on the number of deaths that occur as a result of raids in each sublocation, and the impact on resource capture using the number of livestock stolen per sublocation. The results from columns (1)-(3) show that the disarmament campaign did not lead to an increase in the monthly death rate in Uganda, even though the number of raids increased. This suggests that raids became less deadly, which is in line with the model prediction that an increase in raids can be explained by participation of weaker

[30] The row labelled "Difference between estimates" indicates whether the difference between the estimates from specifications (2) and (3) relative to specification (1) is significant.

[31] The difference-in-difference estimate for equation (5) is computed for the impact 6 months into the post period: $\hat{\beta}_1 + 6\hat{\gamma}_4$, as t=0 when $disarm_t$ first becomes 1.

tribes who are less costly to fight and will reduce the average cost of a raid. Columns (5)-(6) indicate that the disarmament campaign led to an increase in the total volume of livestock stolen, which is also predicted by the model when both types raid due to the scale effect of more raids occurring.

In addition, Table 8 directly estimates whether the number of deaths that occurred per raid decreased, given that the model predicted that this would result if the increase in raiding was due to participation of weaker tribes. Columns (1)-(3) corroborate the findings from Table 7 and directly show that raids became less deadly, while columns (4)-(6) show that the number of livestock taken per raid did not significantly change. This latter result could also be consistent with the model, as the model predicts only a small decrease in the number of livestock taken per raid when both types raid that scales with the relative arms levels of the different types.[32]

Together these results suggest that the disarmament had the the unintended effect of increasing the number of raids. While reducing the guns of heavily armed tribes may have eliminated their predatory advantage, this appears to have led to weaker tribes choosing to raid that had previously been deterred. This increase in raiding was accompanied by a decrease in the average cost of a raid, consistent with the hypothesis that weaker tribes had started to raid, and overall this led to no change to the monthly death rate in Uganda.

4.3.1 Heterogeneous Impacts on Conflict

A secondary consideration is whether the disarmament campaign impacted the propensity to raid among stronger tribes, and whether the campaign impacted the vulnerability of different sublocations to raids. To investigate such heterogenous impacts, I estimate:

$$\Delta raids_i = \alpha + \mu_i + \beta_1 \Sigma_{t\in\{-12,-1\}} raids_{it} + \varepsilon_i \tag{6}$$

where $\Sigma_{t\in\{-12,-1\}} raids_{it}$ denotes the number of raids that tribe i initiated in the 12 months before the campaign began, or that occurred in sublocation i in the pre-campaign period, while $\Delta raids_i$ denotes the corresponding change in the number of raids between the 12 months before and after the campaign.

The results in column (1) of Table 9 suggest a negative correlation between the pre-period level of aggression

[32] The relative decrease in number of livestock taken per raid is predicted to be

$$\frac{1}{2}p_0 + (1-p_0)\frac{\overline{G}}{\overline{G}+\underline{G}} - \frac{1}{2} \in \left[0, \frac{\overline{G}}{\overline{G}+\underline{G}}\right]$$

where p_0 is the initial proportion of H-types. See Appendix for details.

of tribes and the impact of the campaign. That is, tribes that were less aggressive before the campaign contributed more to the to the increase in raids, while tribes that were more aggressive contributed less. While this result is imprecisely estimated, it is consistent with the disarmament campaign being effective at weakening stronger tribes and changing the incentives of weaker tribes.

The results in column (2) suggest that sublocations that were less vulnerable before the campaign, experienced the largest increase in raids. Under the assumption that the strongest tribes tended to live in the least vulnerable sublocations, these results are also consistent with the disarmament campaign being effective at weakening stronger tribes and changing the incentives of weaker tribes.

Descriptive evidence is also provided in Figure 13 which shows the change in the number of raids by the total number of raids in the pre-campaign period for each sublocation and tribe, and visually demonstrates the negative correlation between post-campaign aggression and vulnerability with pre-campaign aggression and vulnerability.

4.4 Impact on Cross-border Raids

The primary sample for the difference-in-difference equations excluded Kenyan sublocations within 20 km from the Kenya-Uganda border in case the disarmament policy led to a decrease in the number of raids in these sublocations only because of a decrease in raids by Ugandans on Kenyans. The next stage to the empirical approach directly estimates whether any such spillovers occurred using sublocations within 20 km of the border in each country. For each country, I estimate:[33]

$$conflict_{ict} = \alpha + \mu_{ic} + \beta_1 disarm_t + \varepsilon_{ict} \tag{7}$$

In addition to estimating (7) for each country, separate equations are estimated for each type of initiator-target interactions: Ugandans attacking Ugandans, Ugandans attacking Kenyans, Kenyans attacking Kenyans and Kenyans attacking Ugandans. Thus, any change in conflict activity near the border is decomposed into the change contributed by each interaction to address whether the policy may have led to an increased vulnerability of Ugandans to Kenyans or even displacement effects within Kenya.[34]

Figure 14 plots the time series on raids for each country, showing separately this outcome for cross-border

[33]The conflict measures are again deseasonalized, as in (3), using a set of month of year dummies (D_m) and the full time series of data (72 months).

[34]Only (7) is estimated for each country and each initiator-target interaction and no equivalent difference-in-difference regression is estimated, since there is no obvious comparison group for these border categories.

interactions (for example, Kenyans attacking Ugandans or Ugandans attacking Kenyans) and within country interactions (for example, Ugandans attacking Ugandans or Kenyans attacking Kenyans). The figure suggests that in the Ugandan border sublocations there was only an increase in the raiding between Ugandans, while in the Kenyan border sublocations there was both a decrease in raids initiated by Ugandans as well as other Kenyans.

Table 10 provides the corresponding regression analysis for the Ugandan sublocations. In these regressions, only a difference in the level of raiding is evaluated as the time series plots do not suggest there were any pre-trends or trend changes after the policy was implemented. Column (1) of Table 10 shows that raiding significantly increased in the Ugandan border sublocations. Moreover, the results in columns (2) and (3) verify what was seen in Figure 14, showing that this increase was largely due to an increase in the raids between Ugandans, not by cross-border raids from Kenyans. Columns (4)-(6) show that there was no change to the monthly death rate, but columns (7)-(9) show an increase to the livestock theft rate in Uganda border sublocations that was driven by an increase in Ugandan-on-Ugandan conflict. The model implied that the Ugandans should have become a more attractive target for Kenyans, so given that there was no increase in this type of cross-border raid, this indicates there may have been other factors that limited the ability of Kenyan tribes to carry out cross-border raids.[35]

Table 11 presents the same analysis but for Kenyan sublocations near to the Kenya-Uganda border. This shows an overall decrease in raiding in these sublocations that is almost equally due to a decrease in Kenyan-on-Kenyan raids and Ugandan-on-Kenyan raids. This indicates that the campaign made Kenyans less vulnerable to Ugandan attacks, even though it did not make Ugandans more vulnerable to Kenyans. The disarmament may have also contributed to lowering violence between Kenyans, for example, if the decrease in attacks from Ugandans lowered the necessity for Kenyans to raid each other.[36] Columns (4)-(9) show that this change in the raid frequency did not, however, lead to a lower the monthly death rate or livestock theft rate in the Kenyan border sublocations.

4.5 Longer Term Impacts on Conflict

The last stage of the empirical approach investigates the longevity of the impact of the campaign. Figure 10 demonstrated that the disarmament operations were focused in the 12 months between May 2006 - April 2007 so

[35]For example, the increase in military presence due to the disarmament campaign may have had a stronger deterrent affect on Kenyan tribes than Ugandan tribes.

[36]Alternatively, if bullets or weapons became more widely available in the border region of Kenya due to the disarmament campaign, this may have had a negative impact on raids in Kenya as raiding may have been perceived to be more costly by Kenyans. Appendix table 2 investigates this relationship but finds no indication that an increase in the availability of bullets or weapons led to the lower raid rate.

the last series of regressions examine whether the impact of the campaign on the raid frequency extended into the following 12 months. Specifically, the frequency of livestock raids between May 2006 - April 2008 is compared to May 2005 - April 2006 using corresponding specifications to (3) - (5). For example, the corresponding regression to (3) is:

$$conflict_{ict} = \alpha + \mu_{ic} + \beta_1 ug_{ic} * LTdisarm_t + \beta_2 LTdisarm_t \tag{8}$$

$$+\beta_5 ug_{ic} * predisarm_t + \beta_5 predisarm_t + \beta_6 ug_{ic} * postpostdisarm_t + \beta_7 postpostdisarm_t + \sum \delta_m D_m + \varepsilon_{ict}$$

where $LTdisarm_t$ is an indicator variable for the 24 month period May 2006 - April 2008. The terms $predisarm_t$ and $postpostdisarm_t$ correspond to the periods January 2004 - April 2005 and May 2008 - December 2009, and are included to enable the deseasonalization of the conflict measure, as in (3) - (5), using month of year dummies (D_m) and the full time series of data.

By comparing the results in Table 12, where the longer term impact estimates are shown, to the results in Tables 5 and 6, where the initial impact estimates are shown, we can see that the impact of the disarmament continued into the 12 months immediately after the cordon and search operations had halted. To test whether there was any fade-out of the impact of the campaign on the raid frequency in this period, I include a separate indicator variable, denoted $postdisarm_t$, for the months May 2007 - April 2008. These results are in Table 13 and a comparison of the difference-in-difference estimates evaluated at 6 months and 18 months after the campaign announcement is shown in the third panel.[37] The least flexible difference-in-difference estimate, that is shown in column (1), indicates that there was fade out, while the more flexible specifications, that are shown in columns (2) and (3) find no such fade out. This difference can be explained by noticing that the coefficients on the post trend terms ($LTdisarm_t * t$) for both Uganda and Kenya are large in magnitude and of opposite signs, and prevail throughout the 24 months after the announcement. Therefore, increasing the flexibility of the specification to allow for trend changes leads to estimates that suggest that the impact of the campaign was sustained throughout the 24 months after the campaign announcement.

To check whether the disarmament campaign impacted the propensity to raid among stronger tribes or the vulnerability of different sublocations to raids over this extended time period, Figure 15 plots the number of raids 12-24 months after the campaign against the number of raids 0-12 months before the campaign by sublocation and

[37] The initial difference-in-difference estimates in Tables 5 and 6 evaluated the impact of the campaign 6 months after its announcement.

tribe. This figure indicates that while a couple of sublocations became much less vulnerable to raids and a few tribes became less aggressive, by this point in time there was not a substantial change to vulnerability of sublocations or the strength of tribes, relative to their pre-disarmament ranking, suggesting that the campaign did not affect the distribution of power in the long run. Therefore, while the impact of the campaign on the raid frequency continued after the campaign was halted, these figures suggest that overall the distribution of power was not permanently affected by the campaign.

4.6 Robustness Checks

The regression results from Table 6 undergo robustness checks that involve extending the analysis to include the 20 months before and after the campaign announcement, removing observations for months in which a forceful UPDF disarmament operation was reported in the sublocation and removing sublocations in Uganda that were within 20 km of the Uganda-Kenya border. The first check extends the period of analysis to include months in which an additional 9 operations occurred so that in total the period of analysis covers 89 out of 93 recorded operations. The second check is to verify that the mechanism through which the campaign led to an increase in raids was not due to the military incapacitating tribes and preventing them from responding to attacks. The third check is to verify that the increase in raids in Uganda was not due to an increase in attacks from Kenyans. These checks are shown in Table 3 in the appendix and the results are robust to all three checks, although the precision of the estimates decrease once the sample size is reduced by the third check.

Another potential concern regarding this analysis is whether the effort of field monitors varied systematically with the timing of the disarmament campaign and across the two countries. For example, if field monitors felt greater motivation to record raid incidents while the disarmament campaign was implemented, this could lead to an overestimate of its impact, particularly if this increased effort was only exerted by field monitors in Uganda. To address this concern I examine the recording of two other types of crime between May 2005 - April 2007: banditry and assault. Most incidents of banditry involve a hold-up of travellers (traders or aid workers) by tribesmen, while assaults mainly involve drunken brawls and violent quarrels. As banditry involves aggression by tribes to people from outside the region, the incentive to carry out such hold-ups should decrease if the disarmament is effective at removing weapons from the tribes and the tribes used guns to carry out hold-ups. In contrast, as assaults tend to occur between tribesmen and not to outsiders, the willingness to assault each other should increase when gun carrying decreases if the tribesmen care about the risks of violent altercations. The results shown in Table 4 in the appendix are in line with these predictions and are consistent with the assumption that the field monitors were not more likely to record incidents during the disarmament campaign.

5 Conclusion

The motivation for this study was to understand how guns influence violent conflict and to understand the effectiveness of the UPDF's disarmament campaign in the highly volatile region of the Ugandan Karamoja. Some of the questions that I hoped to address were: do guns facilitate violence by enabling some tribes to become significantly stronger than other tribes, and therefore, would the campaign be able to reduce livestock raiding by levelling the playing field? Or, would it worsen the situation by lowering the costs of conflict for all tribes, and encourage greater participation in livestock raiding?

My most substantial finding was that after the disarmament campaign the frequency of livestock raids (my measure of violent conflict) increased in Uganda by at least 40%, while there was no increase to the frequency of livestock raids in Kenyan. Moreover, even at the Kenya-Uganda border, the increase in livestock raids in Uganda was driven by an increase in Ugandan initiated raids on other Ugandans, rather than an increase in Kenyan initiated raids on Ugandans. This suggests that guns were important for deterrence among Ugandan tribes, and the disarmament had the unfortunate impact of increasing the number of livestock raids carried out each month in Ugandan sublocations from 0.27 to over 0.38. There was no impact on the monthly death rate which remained at approximately 0.4 deaths per sublocation per month, suggesting that the campaign had no effect on reducing the overall costs to human life. However, the number of deaths per raid decreased by about 80-120% showing us that the campaign did lead to raids becoming less deadly. There is also no evidence that aggregate amount of resource capture was reduced after the campaign, because even though the number of livestock stolen per raid may have fallen, the total livestock stolen per month from Ugandan sublocations increased due to the increased number of raids.

The disarmament campaign in the Ugandan Karamoja provides strong evidence towards the role of guns as a deterrent in insecure areas. Clearly firearms in the region have contributed to its insecurity, but the forceful removal of weapons led to greater instability, rather than lowering the frequency of violent conflicts, or the homocide rates. Despite the strong military involvement in this campaign, the military ultimately had limited ability to provide protection from these violent conflicts, suggesting that containing violence in these environments is very difficult. Perhaps the greatest obstacle of this particular intervention was the inability of state actors to control the flow of illegal arms into the region or provide appropriate protection to disarmed tribes. This example demonstrates that a one-dimensional approach of reducing firearms can be more detrimental than effective at addressing violent conflict.

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6 Tables

Table 1: Selected Human Development Indicators

	Uganda National	Uganda Karamoja	Kenya National	Kenya Karamoja
Life Expectancy [UNDP 2007]	50.4 yrs	47.7 yrs	52.0 yrs	46.9 yrs
Population living below poverty line [World Bank 2006]	31%	82%	58%	74%
Maternal mortality rate (per 100,000 live births) [UDHS 2006]	435	750	414	.
Infant mortality rate (per 1,000 live births) [UNICEF/WHO 2008]	76	105	55	.
Under 5 mortality rate (per 1,000 live births) [UNICEF/WHO 2008]	134	174	84	.
Global Acute Malnutrition (GAM) rate [MoH/WFP April 2009]	6%	11%	~5%	>15%
Access to sanitation units [UNICEF 2008]	62%	9%	31%	<32%
Access to safe water [UNICEF 2008]	63%	40%	59%	<52%
Literacy rate [UDHS 2006]	67%	11%	73%	.
Population Projection [UBOS 2009, GoK 2008]		1,062,300		502,000

Table 2: Selected Conflict and Pastoral Indicators

	Uganda Karamoja	Kenya Karamoja	Both
Population (1)	1,062,300	502,000	1,564,300
Total Cattle (1)	1,472,925	234,420	1,707,345
Total livestock (1)	2,846,601	3,631,530	6,478,131
Average Household Size (1)	6.2	6.3	6.2
Livestock Raids (per month per subloc) (2)	0.31	0.09	0.20
% Livestock Raids that are Ug-Ug or Ke-Ke (2)	*89%*	*82%*	
% Livestock Raids that are Ke-Ug or Ug-Ke (2)	*11%*	*18%*	
Deaths (per month per subloc) (2)	0.57	0.12	0.48
Livestock stolen (per month per subloc) (2)	24.9	11.3	22.2
Pastoral conflict death rate (per 100,000) (2)	55	17	42
Firearms deaths Colombia (per 100,000) (3)			*60*
Firearms deaths US (per 100,000) (3)			*4*
Livestock theft rate (per 100,000) (2)	1000	500	700

Sources: 1. [UBOS 2009, GoK 2008], 2. [CEWARN Jan 2004-May 2006], 3. [Small Arms Survey 2006]

Table 3: Weekly Survey Reports on Disarmament Measures

	Weapons Reduce	Bullet Commodity
$uganda_{ic} * disarm_t$	0.54	-0.26
p-value for test: $\delta_1 = 0$	(0.04)**	(0.06)*
N	1,040	1,040
Pre-disarmament mean in Uganda	0.12	0.28
Pre-disarmament mean in Kenya	0.22	0.70

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

Notes: $uganda_{ic} * disarm_t$ is an indicator variable for observations in Uganda after May 2006. These regressions include controls for field monitor fixed effects and week fixed effects. The pre-disarmament means give the mean level of each survey measure in Uganda and Kenya before the disarmament campaign. The survey measures record each field monitors response to the questions: (1) Has a disarmament, weapons reduction or buyback program been initiated? (2) Are bullets in use as an exchangeable commodity? 0 indicates disagreement and 1 indicates agreement. A wild cluster bootstrap is used to compute p-values for the test that coefficient of interest ($uganda_{ic} * disarm_t$) is zero. These p-values are reported in parenthesis and the bootstrap is clustered at the level the survey measures are collected.

Table 4: Evidence of Disarmament attention to Stronger Tribes

	Total # of UPDF visits		Any UPDF visits (0/1)
	OLS	Poisson	OLS
	(1)	(2)	(3)
$\Sigma raids_{i,t-1}$	0.382	0.048	0.013
	[0.170]*	[0.007]***	[0.007]
R^2	0.46		0.37
N	8	8	8

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

Notes: The outcome variable "UPDF visits" is obtained by using records on the disarmament operations that are recorded in the incident reports. $\Sigma raids_{i,t-1}$ denotes the number of raids that a tribe initiated in the 12 months before the disarmament campaign. Being visited by the UPDF during the disarmament is perfectly predicted when a tribe initiates a raid at least 6 times in the pre-disarmament period.

Table 5: First Difference Estimates - Raids (Sublocation by Month)

	(1)	(2)	(3)
	Ugandan sublocations		
$disarm_t$	0.11	0.12	0.16
	[0.04]**	[0.08]	[0.09]*
t		-0.00	-0.02
		[0.01]	[0.01]
$disarm_t * t$			0.03
			[0.01]**
Estimated effect at t=6 months	0.11	0.12	0.34
	[0.04]**	[0.08]	[0.14]**
Pre-disarmament mean in Uganda	0.27	0.27	0.27
R^2	0.02	0.02	0.03
N	4,108	4,108	4,108
	Kenyan sublocations		
$disarm_t$	-0.01	-0.03	-0.05
	[0.02]	[0.04]	[0.04]
t		0.00	0.01
		[0.00]	[0.00]**
$disarm_t * t$			-0.01
			[0.01]**
Estimated effect at t=6 months	-0.01	-0.03	-0.13
	[0.02]	[0.04]	[0.05]*
Pre-disarmament mean in Kenya	0.11	0.11	0.11
R^2	0.01	0.01	0.02
N	3,713	3,713	3,713

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which raids are reported, and errors are clustered at this level too. The sample for Kenya excludes sublocations that have centres within 20km of the Uganda-Kenya border. The fourth row of each panel shows the estimated impact of the disarmament 6 months into the post period. Month fixed effects and the full time series are used to deseasonalize the data.

Table 6: Difference-in-Difference Estimates - Monthly Raid Rate

	(1)	(2)	(3)
$disarm_t$	-0.01	-0.01	-0.02
	[0.02]	[0.04]	[0.04]
$uganda_{ic} * disarm_t$	0.12	0.11	0.15
	[0.05]**	[0.08]	[0.08]*
t		0.00	0.01
		[0.00]	[0.00]
$uganda_{ic} * t$		0.00	-0.02
		[0.01]	[0.01]**
$disarm_t * t$			-0.01
			[0.01]**
$uganda_{ic} * disarm_t * t$			0.04
			[0.01]***
Estimated effect at t=6 months	0.12	0.11	0.41
	[0.05]**	[0.08]	[0.13]**
Difference between estimates	.	.	**
Pre-disarmament mean in Uganda	0.27	0.27	0.27
R^2	0.01	0.02	0.02
N	7,821	7,821	7,821

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement, $uganda_{ic}$ is an indicator variable for observations in Uganda, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample for Kenya excludes sublocations that have centres within 20km of the Uganda-Kenya border. The row labelled "Estimated effect at t=6 months" shows the estimated impact of the disarmament 6 months into the post period in Uganda relative to Kenya. The row labelled "Difference between estimates" indicates whether the difference between the estimates from specifications (2) and (3) relative to specification (1) is significant. The reported "pre-disarmament mean in Uganda" is mean raid rate in Uganda in the 12 months before the campaign was announced. Month fixed effects and the full time series are used to deseasonalize the data.

Table 7: Difference-in-Difference Estimates - All Conflict Outcomes

	(1)	(2)	(3)		(4)	(5)	(6)
	Monthly Death Rate				Monthly Livestock Thefts		
$disarm_t$	0.02	0.17	0.20	|	8.9	-29.1	-33.8
	[0.06]	[0.24]	[0.25]	|	[8.6]	[28.9]	[30.9]
$uganda_{ic} * disarm_t$	0.03	-0.08	-0.12	|	-0.3	65.8	71.4
	[0.12]	[0.27]	[0.27]	|	[10.4]	[31.7]**	[33.2]**
t		-0.01	-0.03	|		3.1	5.4
		[0.02]	[0.02]	|		[2.3]	[3.5]
$uganda_{ic} * t$		0.01	0.03	|		-5.3	-8.4
		[0.02]	[0.03]	|		[2.6]**	[3.7]**
$disarm_t * t$			0.03	|			-4.1
			[0.01]**	|			[2.6]
$uganda_{ic} * disarm_t * t$			-0.04	|			5.6
			[0.03]	|			[2.9]*
Estimated effect at t=6 months	0.03	-0.08	-0.36	|	-0.3	65.8	105.0
	[0.12]	[0.27]	[0.37]	|	[10.4]	[31.7]**	[45.3]**
Pre-disarmament mean in Uganda	0.38	0.38	0.38	|	17.7	17.7	17.7
Difference between estimates	.	.	.	|	.	**	**
R^2	0.00	0.00	0.00	|	0.01	0.01	0.01
N	7,821	7,821	7,821	|	7,821	7,821	7,821

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement, $uganda_{ic}$ is an indicator variable for observations in Uganda, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample for Kenya excludes sublocations that have centres within 20km of the Uganda-Kenya border. The row labelled "Estimated effect at t=6 months" shows the estimated impact of the disarmament 6 months into the post period in Uganda relative to Kenya. The row labelled "Difference between estimates" indicates whether the difference between the estimates from specifications (2) and (3) relative to specification (1) is significant. The reported "pre-disarmament mean in Uganda" is mean death or livestock theft rate in Uganda in the 12 months before the campaign was announced. Month fixed effects and the full time series are used to deseasonalize the data.

Table 8: Difference-in-Difference Estimates - Outcomes per Raid

	(1)	(2)	(3)		(4)	(5)	(6)
	Deaths per Raid				Livestock per Raid		
$disarm_t$	0.87	2.19	1.83	|	127.1	69.7	37.3
	[0.92]	[2.26]	[2.19]	|	[127.9]	[87.6]	[74.1]
$uganda_{ic} * disarm_t$	-1.55	-1.08	-1.02	|	-115.3	16.2	45.3
	[1.12]	[1.29]	[1.22]	|	[129.6]	[94.7]	[80.9]
t		-0.11	-0.33	|		5.2	-16.9
		[0.17]	[0.20]	|		[12.5]	[14.4]
$uganda_{ic} * t$		-0.03	0.29	|		-10.9	12.6
		[0.10]	[0.11]***	|		[12.9]	[14.7]
$disarm_t * t$			0.49	|			49.5
			[0.21]**	|			[28.2]*
$uganda_{ic} * disarm_t * t$			-0.66	|			-52.2
			[0.23]***	|			[28.3]*
Estimated effect at t=6 months	-1.55	-1.08	-4.98	|	-115.3	16.2	-267.6
	[1.12]	[1.29]	[1.85]***	|	[129.6]	[94.7]	[195.8]
Pre-disarmament mean in Uganda	1.56	1.56	1.56	|	54.0	54.0	54.0
Difference between estimates	.	.	***	|	.	.	.
R^2	0.01	0.02	0.02	|	0.01	0.03	0.04
N	1,208	1,208	1,208	|	1,208	1,208	1,208

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement, $uganda_{ic}$ is an indicator variable for observations in Uganda, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample for each country includes all sublocations (to increase the sample size). The row labelled "Estimated effect at t=6 months" shows the estimated impact of the disarmament 6 months into the post period in Uganda relative to Kenya. The row labelled "Difference between estimates" indicates whether the difference between the estimates from specifications (2) and (3) relative to specification (1) is significant. The reported "pre-disarmament mean in Uganda" is mean deaths or livestock taken per raid in Uganda in the 12 months before the campaign was announced. Month fixed effects and the full time series are used to deseasonalize the data.

Table 9: Disarmament Impact by Pre-Raid Vulnerability and Strength

	$\Delta raids_i$	
	by tribe	by sublocation
$\Sigma raids_{i,t-1}$	-0.33	-0.33
	[0.35]	[0.12]***
R^2	0.13	0.13
N	8	56

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

Notes: $\Delta raids_i$ denotes the change in number of raids between the 12 months before and after the campaign began and $\Sigma raids_{i,t-1}$ denotes the number of raids that a tribe initiated in the 12 months before the disarmament campaign, or the number of raids that occurred in a sublocation in the 12 months before the disarmament campaign.

Table 10: First Difference Estimates for Border Sublocations in Uganda - All Conflict Outcomes

	Raids			Deaths			Livestock		
	All	Ug-Ug	Ke-Ug	All	Ug-Ug	Ke-Ug	All	Ug-Ug	Ke-Ug
$disarm_t$	0.14	0.13	0.01	-0.08	-0.04	-0.04	17.8	17.4	0.3
	[0.06]**	[0.06]**	[0.02]	[0.15]	[0.15]	[0.06]	[8.3]**	[8.3]**	[0.9]
Pre-disarmament mean	0.20	0.15	0.05	0.20	0.13	0.07	4.6	2.4	2.2
R^2	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.01
N	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement. The regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample includeds only sublocations that have centres within 20km of the Uganda-Kenya border. The results are broken down into the change in conflict frequency caused by both within country raids (Ug-Ug) and cross border raids from Kenyans attacking Ugandans (Ke-Ug). Month fixed effects and the full time series are used to deseasonalize the data. The reported "pre-disarmament mean" is used to denote the mean conflict measure in the 12 months before the campaign was announced.

Table 11: First Difference Estimates for Border Sublocations in Kenya - All Conflict Outcomes

	Raids			Deaths			Livestock		
	All	Ke-Ke	Ug-Ke	All	Ke-Ke	Ug-Ke	All	Ke-Ke	Ug-Ke
$disarm_t$	-0.10	-0.06	-0.04	-0.01	0.01	-0.02	6.8	11.3	-4.4
	[0.03]***	[0.02]**	[0.02]**	[0.05]	[0.05]	[0.02]	[10.7]	[10.1]	[2.8]
Pre-disarmament mean	0.18	0.11	0.07	0.04	-0.00	0.04	4.8	-3.9	8.7
R^2	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
N	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement. The regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample includeds only sublocations that have centres within 20km of the Uganda-Kenya border. The results are broken down into the change in conflict frequency caused by both within country raids (Ke-Ke) and cross border raids from Ugandans attacking Kenyans (Ug-Ke). Month fixed effects and the full time series are used to deseasonalize the data. The reported "pre-disarmament mean" is used to denote the mean conflict measure in the 12 months before the campaign was announced.

Table 12: Cumulative Long Term Impacts - Raids (Sublocation by Month)

	(1)	(2)	(3)
		Ugandan sublocations	
$LT\,disarm_t$	0.07	0.18	0.27
	[0.04]*	[0.06]***	[0.08]***
t		-0.01	-0.02
		[0.00]**	[0.01]*
$LT\,disarm_t * t$			0.02
			[0.01]
Estimated effect at t=18 months	0.07	0.18	0.59
	[0.04]*	[0.06]**	[0.27]**
R^2	0.02	0.03	0.03
N	4,108	4,108	4,108
		Kenyan sublocations	
$LT\,disarm_t$	-0.01	0.00	-0.06
	[0.02]	[0.03]	[0.03]*
t		-0.00	0.01
		[0.00]	[0.00]**
$LT\,disarm_t * t$			-0.01
			[0.00]**
Estimated effect at t=18 months	-0.01	0.00	-0.27
	[0.02]	[0.03]	[0.11]**
R^2	0.01	0.02	0.02
N	3,713	3,713	3,713
		All sublocations	
Estimated effect at t=18 months	0.08	0.15	0.64
	[0.04]*	[0.05]***	[0.27]**
Difference between estimates	.	.	**
Pre-disarmament mean in Uganda	0.27	0.27	0.27
R^2	0.02	0.02	0.02
N	7,821	7,821	7,821

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

Notes: $LT\,disarm_t$ is an indicator variable for observations between May 2006 - April 2008, the 24 months following the campaign announcement, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample for Kenya excludes sublocations that have centres within 20km of the Uganda-Kenya border. The estimated impact of the disarmament 18 months into the post period in Uganda relative to Kenya is shown in the third panel. The row labelled "Difference between estimates" indicates whether the difference between these estimates from specifications (2) and (3) relative to specification (1) is significant. The reported "pre-disarmament mean in Uganda" is mean deaths or livestock taken per raid in Uganda in the 12 months before the campaign was announced. Month fixed effects and the full time series are used to deseasonalize the data.

Table 13: Decomposition of Cumulative Long Term Impacts- Raids (Sublocation by Month)

	(1)	(2)	(3)
		Ugandan sublocations	
$LTdisarm_t$	0.11	0.16	0.18
	[0.04]**	[0.07]**	[0.09]**
$postdisarm_t$	-0.08	-0.03	-0.10
	[0.04]**	[0.08]	[0.08]
t		-0.00	-0.02
		[0.00]	[0.01]
$LTdisarm_t * t$			0.03
			[0.01]**
$postdisarm_t * t$			-0.02
			[0.01]
R^2	0.02	0.03	0.03
N	4,108	4,108	4,108
		Kenyan sublocations	
$LTdisarm_t$	-0.01	0.00	-0.04
	[0.02]	[0.04]	[0.04]
$postdisarm_t$	-0.01	-0.00	0.05
	[0.02]	[0.04]	[0.05]
t		0.00	0.01
		[0.00]	[0.00]**
$LTdisarm_t * t$			-0.01
			[0.01]**
$postdisarm_t * t$			0.00
			[0.00]
R^2	0.01	0.02	0.02
N	3,713	3,713	3,713
		All sublocations	
Estimated effect at t=6 months	0.12	0.11	0.41
	[0.05]**	[0.06]*	[0.13]**
Estimated effect at t=18 months	0.05	0.03	0.61
	[0.04]	[0.13]	[0.27]*
Difference b/w estimates?	x		
Pre-disarmament mean in Uganda	0.27	0.27	0.27
R^2	0.02	0.02	0.02
N	7,821	7,821	7,821

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

Notes: $LTdisarm_t$ is an indicator variable for observations between May 2006 - April 2008, the 24 months following the campaign announcement, $postdisarm_t$ denotes the second half of this period, May 2007 - April 2008, and t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The sample for Kenya excludes sublocations that have centres within 20km of the Uganda-Kenya border. The estimated impact of the disarmament at both 6 and 18 months into the post period in Uganda relative to Kenya is shown in the third panel. The row labelled "Difference b/w estimates?" indicates whether the difference between these two estimates from each specification is significant. The reported "pre-disarmament mean in Uganda" is mean raie rate in Uganda in the 12 months before the campaign was announced. Month fixed effects and the full time series are used to deseasonalize the data.

7 Figures

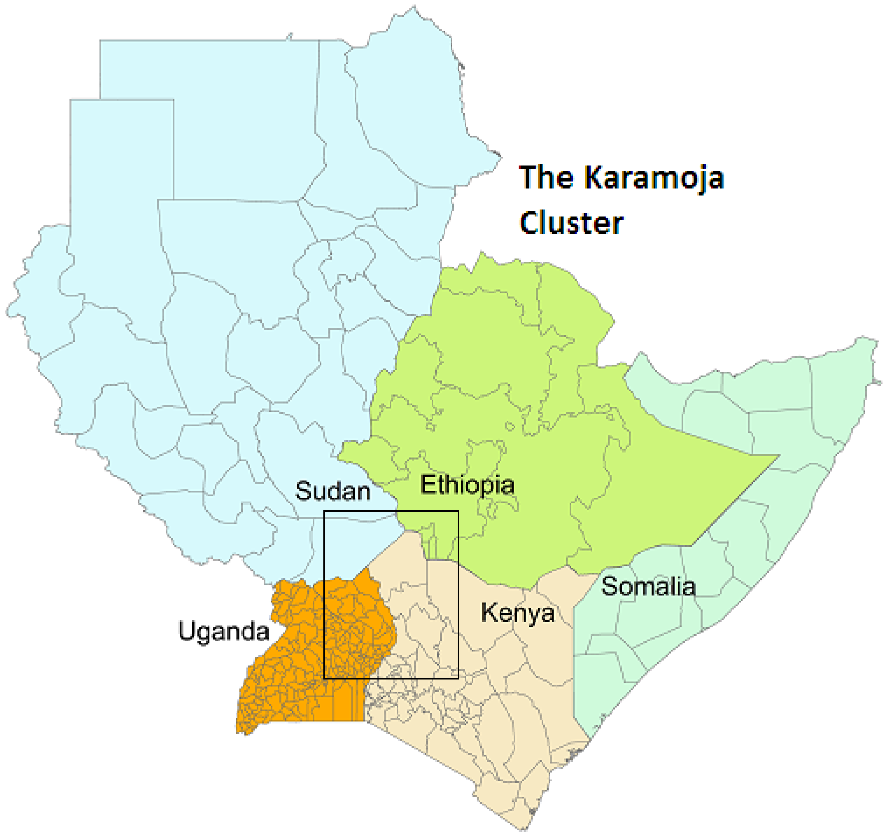


Figure 1: The Karamoja Region

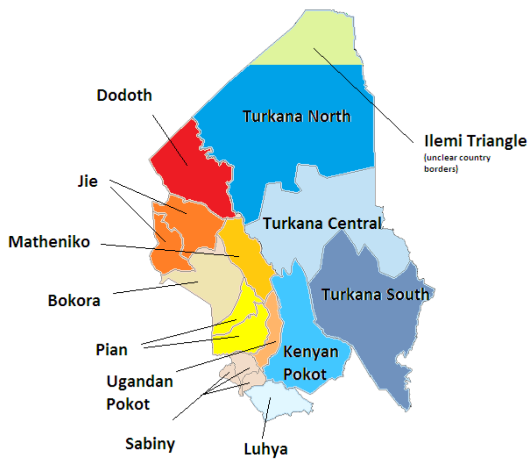


Figure 2: The Karamoja Tribes. (Sources include Mkutu (2006) and various NGO reports.)

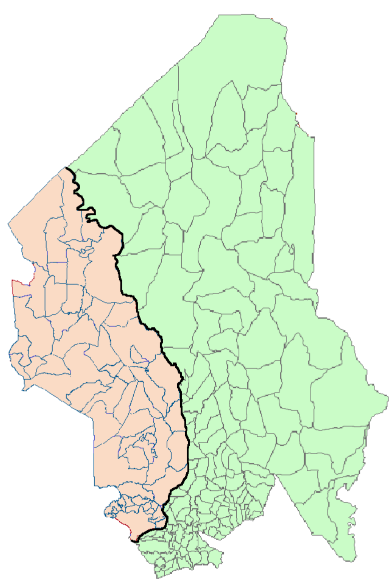


Figure 3: The 51 Ugandan and 61 Kenyan sublocations

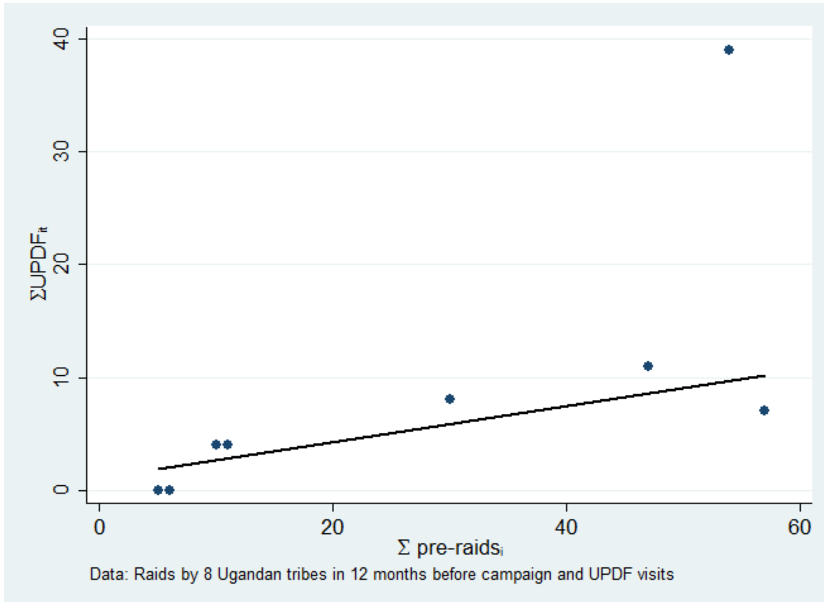
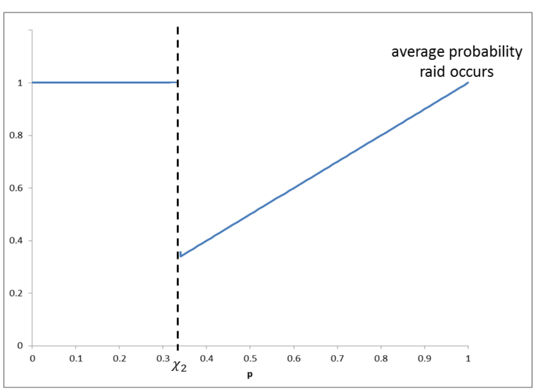
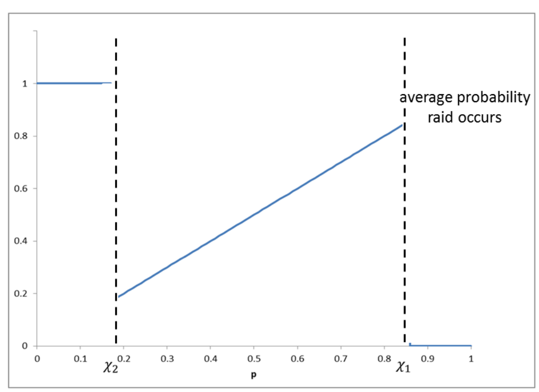


Figure 4: UPDF visits and pre-campaign raids by tribe

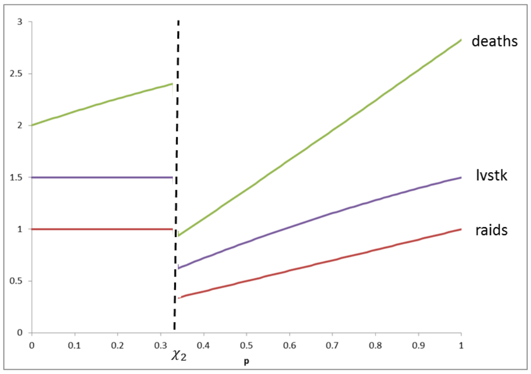


(a) $0 < \chi_2 < 1 < \chi_1$

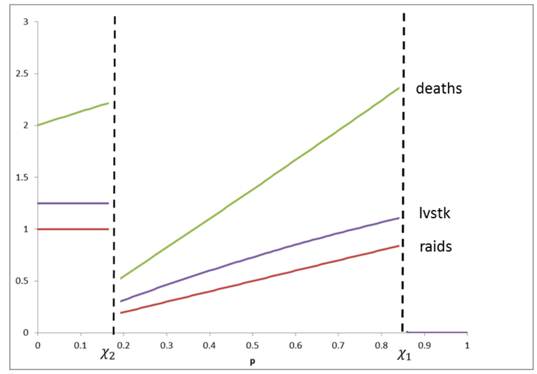


(b) $0 < \chi_2 < \chi_1 < 1$

Figure 5: Number of raids initiated

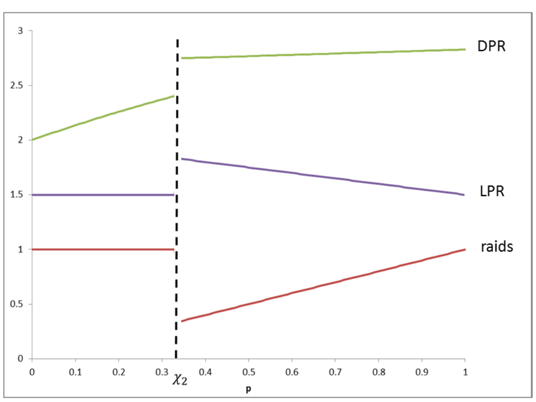


(a) $0 < \chi_2 < 1 < \chi_1$

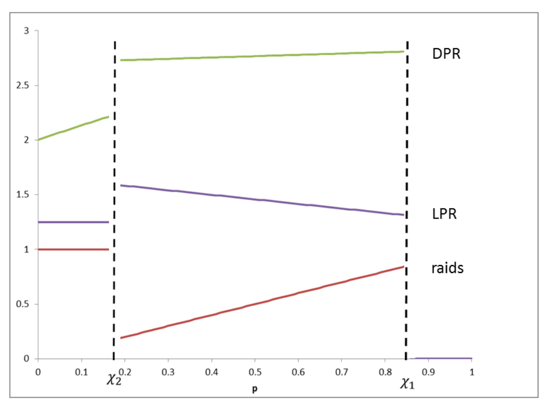


(b) $0 < \chi_2 < \chi_1 < 1$

Figure 6: Total conflict cost and livestock losses



(a) $0 < \chi_2 < 1 < \chi_1$



(b) $0 < \chi_2 < \chi_1 < 1$

Figure 7: Average conflict cost and livestock stolen per raid

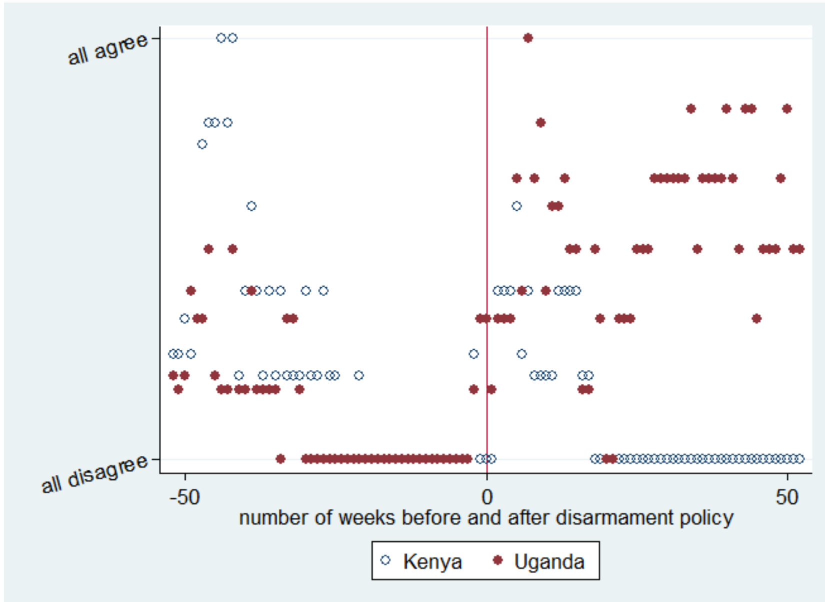


Figure 8: Survey Reports on a Weapons Reduction or Disarmament

Note: Time series plot of the average weekly field monitor scores in Uganda (solid points) and Kenya (circles) to the survey question: Has a disarmament, weapons reduction or buyback been initiated? There are 5 field monitors in Kenya and 4 in Uganda.

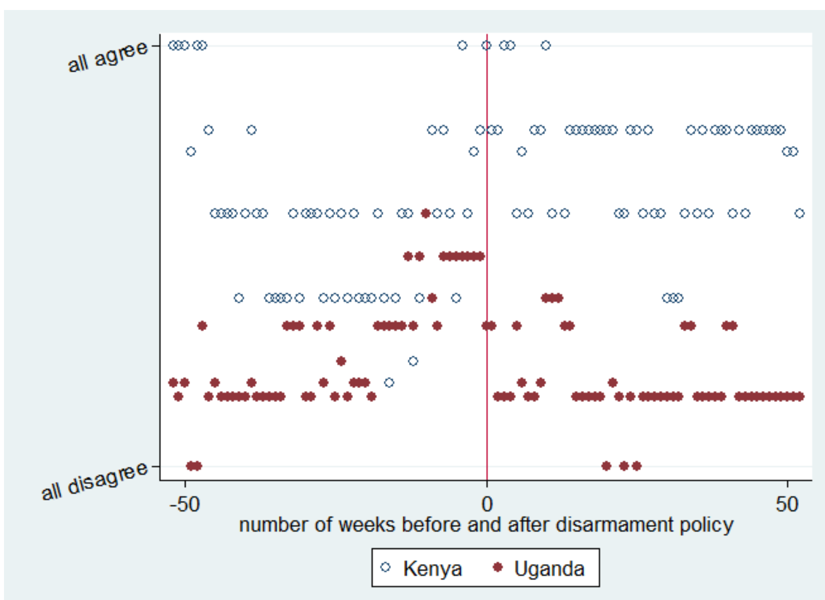


Figure 9: Survey Reports on the use of Bullets as an Exchangeable Commodity

Note: Time series plot of the average weekly field monitor scores in Uganda (solid points) and Kenya (circles) to the survey question: Are bullets in use as an exchangeable commodity? There are 5 field monitors in Kenya and 4 in Uganda.

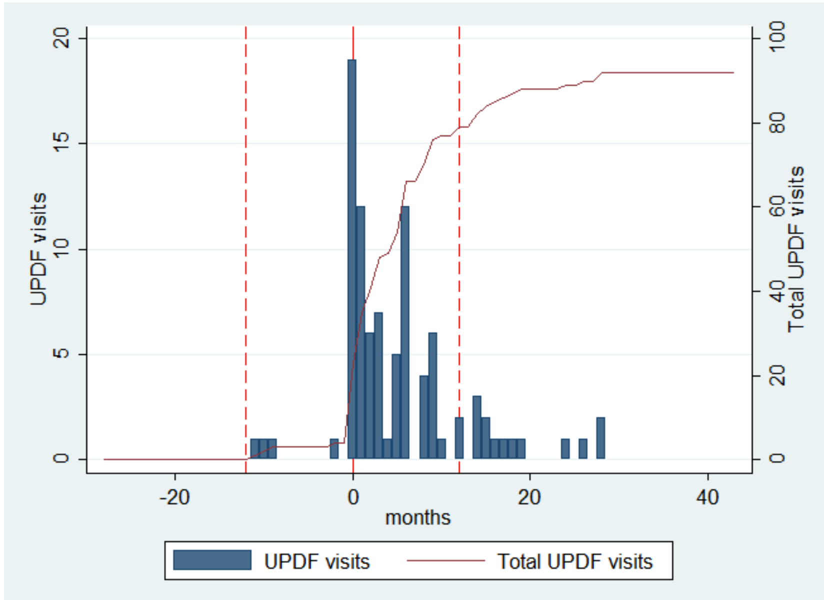


Figure 10: Raids and UPDF Operations in Uganda

Note: Time series plot of the total number of raids in Uganda and the number of reported forceful UPDF disarmament operations. The solid red line at month 0 denotes May 2006, while the dashed red lines show the 12 month cut-offs before and after this date.

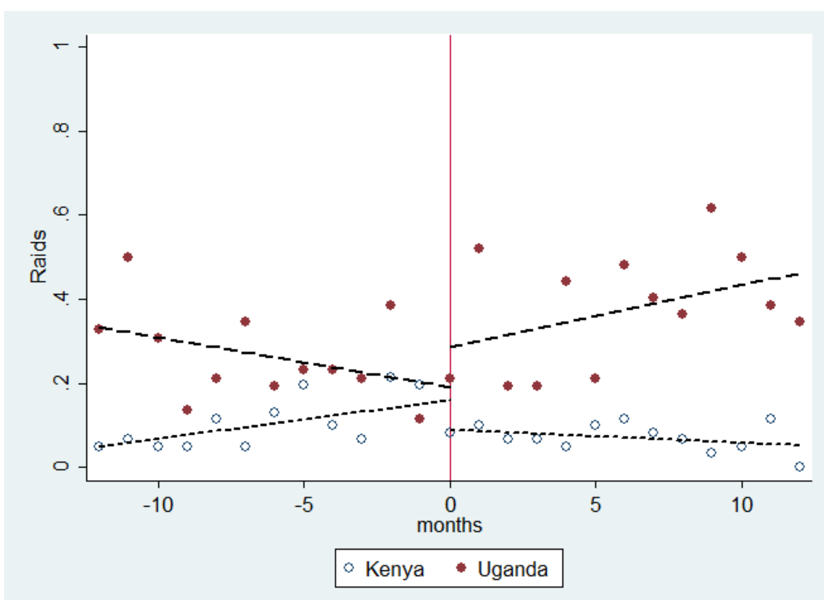


Figure 11: Raid Frequency by Country (12 months pre- and post- disarmament)

Note: Time series plot of the average monthly raid frequency in Ugandan and Kenyan sublocations.

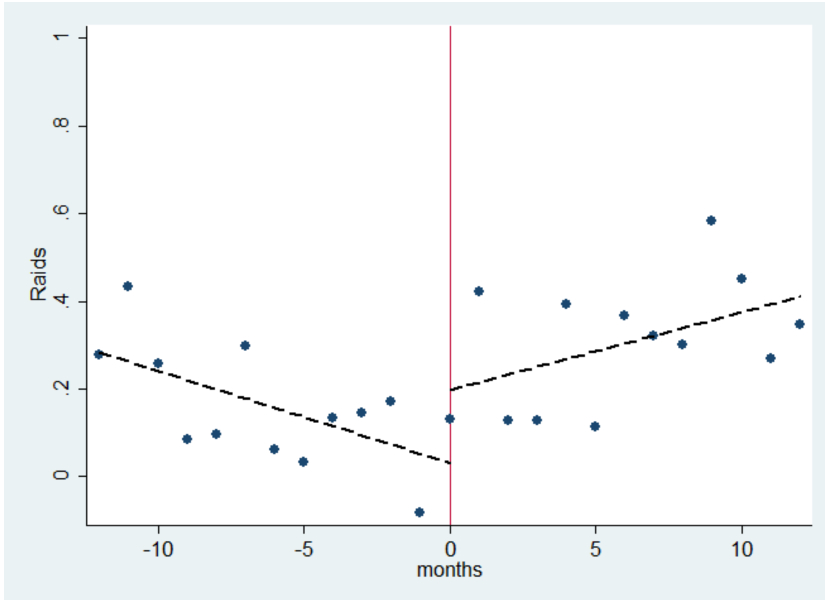


Figure 12: Difference in Raid Frequency between Uganda and Kenya (12 months pre- and post- disarmament)

Note: Time series plot of the difference in the average monthly raid frequency between Ugandan and Kenyan sublocations.

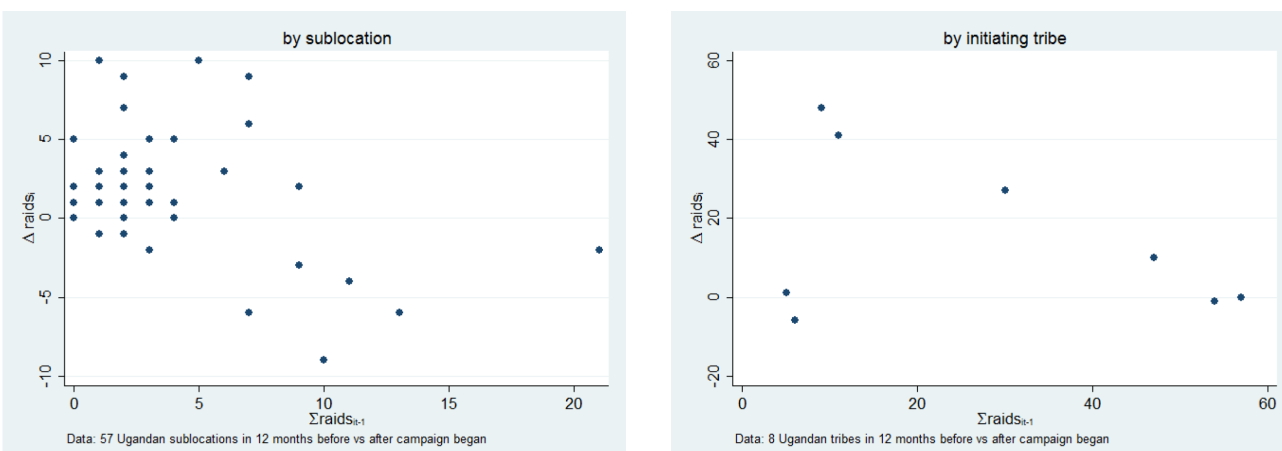
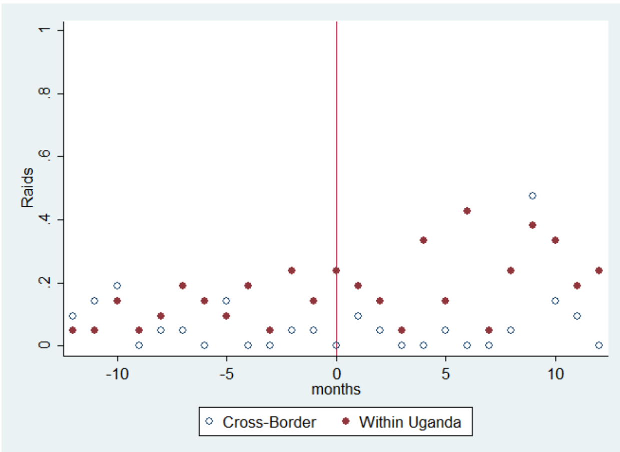
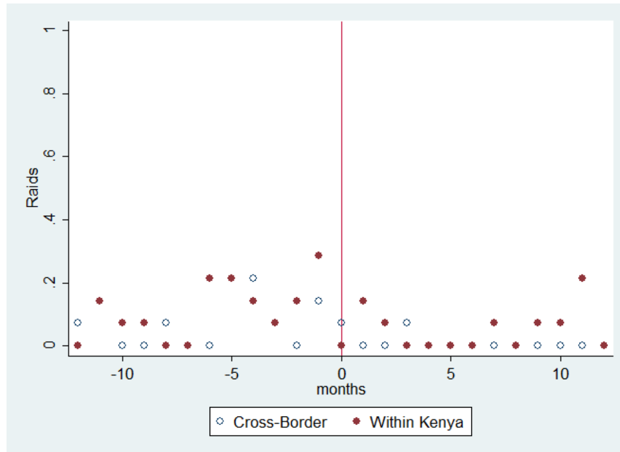


Figure 13: Evidence of Disarmament Impact by Pre-Raid Vulnerability and Strength

Note: $\Delta raids_i$ denotes the change in number of raids between the 12 months before and after the campaign began, and $\Sigma raids_{i,t-1}$ denotes the number of raids that a tribe initiated in the 12 months before the disarmament campaign, or the number of raids that occured in a sublocation in the 12 months before the disarmament campaign.



(a) Uganda



(b) Kenya

Figure 14: Times series trends : Raids near to the Uganda-Kenya Border (12 months pre- and post- disarmament)

Note: Time series plot of the average monthly raid rate in sublocations that are geographically centred within 20 km of the Uganda-Kenya border.

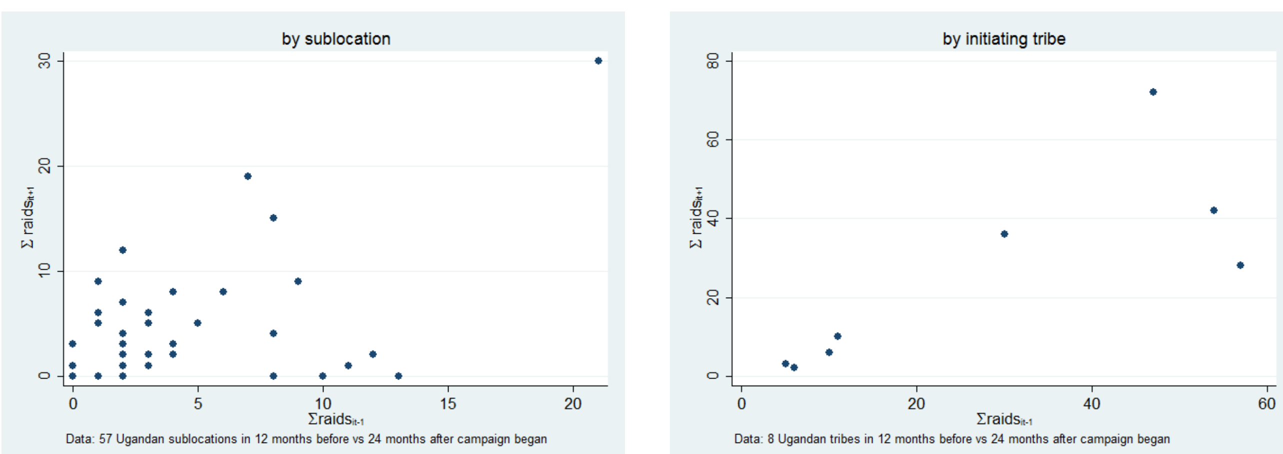


Figure 15: Evidence of Long Term Impacts by Pre-Raid Vulnerability and Strength

Note: $\Sigma raids_{i,t+1}$ denotes the number of raids 12-24 months after the campaign began, and $\Sigma raids_{i,t-1}$ denotes the number of raids 12-0 months before the disarmament campaign.

1 Appendix Theory

Proposition 3

Given $\frac{1}{2}B - C(\overline{G},\overline{G}) < 0$ and $\frac{1}{2}B - C(\underline{G},\underline{G}) > 0$, then $\chi_1 > \chi_2$.

Proof

$\chi_1 > \chi_2 \iff$

$$\frac{\frac{\overline{G}}{\overline{G}+\underline{G}}B - C(\overline{G},\underline{G})}{\left(\frac{\overline{G}}{\overline{G}+\underline{G}}B - C(\overline{G},\underline{G})\right) - \left(\frac{1}{2}B - C(\overline{G},\overline{G})\right)} > \frac{\frac{1}{2}B - C(\underline{G},\underline{G})}{\left(\frac{1}{2}B - C(\underline{G},\underline{G})\right) - \left(\frac{\underline{G}}{\underline{G}+\overline{G}}B - C(\underline{G},\overline{G})\right)}$$

$\iff$

$$\frac{W}{W-X} > \frac{Y}{Y-Z} \iff -WZ > -XY$$

where

$$W \equiv \frac{\overline{G}}{\overline{G}+\underline{G}}B - C(\overline{G},\underline{G})$$

$$X \equiv \frac{1}{2}B - C(\overline{G},\overline{G})$$

$$Y \equiv \frac{1}{2}B - C(\underline{G},\underline{G})$$

$$Z \equiv \frac{\underline{G}}{\underline{G}+\overline{G}}B - C(\underline{G},\overline{G})$$

and $W > Y$ as:

$$\frac{\overline{G}}{\overline{G}+\underline{G}} > \frac{1}{2} \text{ and } C(\overline{G},\underline{G}) < C(\underline{G},\underline{G})$$

and $-Z > -X$ as:

$$C(\underline{G},\overline{G}) > C(\overline{G},\overline{G}) \text{ and } \frac{\underline{G}}{\overline{G}+\underline{G}} < \frac{1}{2}$$

Therefore,

$$-WZ > -XY \iff \chi_1 > \chi_2$$

Proposition 4

If $2C(\overline{G},\overline{G}) > C(\overline{G},\underline{G}) + C(\underline{G},\overline{G}) > 2C(\underline{G},\underline{G})$, implying that cross-type interactions are less costly than H-type only interactions but more costly than L-type only interactions, the average conflict cost of a raid strictly decreases when L-types also raid.

Proof

For a given p, if the average cost when an L-type raids is lower than average cost when an H-type raids, then when L-types raid as well as H-types, the average cost of any raid must decrease.

The average conflict cost when an L-type raids is:

$$p(C(\overline{G},\underline{G})+C(\underline{G},\overline{G}))+(1-p)2C(\underline{G},\underline{G})$$

while the average cost when an H-type raids is:

$$p2C(\overline{G},\overline{G})+(1-p)(C(\overline{G},\underline{G})+C(\underline{G},\overline{G}))$$

For the average conflict cost of an L-type to be less than the average conflict cost of an H-type, the following condition must be satisfied:

$$p\left(2C(\overline{G},\overline{G})-[C(\overline{G},\underline{G})+C(\underline{G},\overline{G})]\right)+(1-p)\left([C(\underline{G},\overline{G})+C(\overline{G},\underline{G})]-2C(\underline{G},\underline{G})\right)>0$$

This will be satisfied if $2C(\overline{G},\overline{G})>C(\overline{G},\underline{G})+C(\underline{G},\overline{G})>2C(\underline{G},\underline{G})$, and then once L-types raid as well as H-types, the average conflict cost of a raid will fall.

Predicted Changes to Livestock Taken per Raid

The model predicts a decrease in the number of livestock taken per raid when both types raid rather than just H-types and this decrease scales with the relative arms levels of the different types. The number of livestock taken per raid when just H-types raid is:

$$p_0\frac{1}{2}B+(1-p_0)\frac{\overline{G}}{\overline{G}+\underline{G}}B$$

where p_0 denotes the initial proportion of H-types. The number of livestock taken per raid when both types raid is:

$$\frac{1}{2}B$$

Thus, the relative decrease in number of livestock taken per raid is predicted to be

$$\frac{1}{2}p_0+(1-p_0)\frac{\overline{G}}{\overline{G}+\underline{G}}-\frac{1}{2}\in\left[0,\frac{\overline{G}}{\overline{G}+\underline{G}}\right]$$

2 Appendix Tables

Table 1: Weekly Survey Reports on Disarmament Measures in Kenya

	Weapons Reduce	Bullet Commodity
$disarm_t$	-0.12	0.15
p-value for test: $\delta_1 = 0$	(0.06)*	(0.26)
N	510	510
Pre-disarmament mean in Kenya	0.22	0.70

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

Note: $disarm_t$ is an indicator variable for observations in Kenya after May 2006. These regressions include controls for field monitor fixed effects. The pre-disarmament means give the mean level of each survey measure before the disarmament campaign. The survey measures record each field monitors response to the questions: (1) Has a disarmament, weapons reduction or buyback program been initiated? (2) Are bullets in use as an exchangeable commodity? 0 indicates strong disagreement and 1 indicates strong agreement. A wild cluster bootstrap is used to compute p-values for a decrease in weapons reduction and an increase in the bullets measure. These p-values are reported in parenthesis and the bootstrap is clustered at the level the survey measures are collected.

Table 2: Raids in Kenya

	Weekly Raid Rate	
$bullets_{it}$	0.025	
	[0.054]	
$weapons_{it}$		-0.052
		[0.069]
R^2	0.01	0.01
N	510	510
mean	0.244	0.269

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

Notes: The unit of analysis is the weekly number of raids reported by each field monitor in Kenya, $bullets_{it}$ denotes their survey response to the question: are bullets in use as an exchangeable commodity? and $weapons_{it}$ denotes their survey response to the question: has a disarmament, weapons reduction or buyback program been initiated? Their response is coded 0 for disagree and 1 for agree. Standard errors clustered by field monitor.

Table 3: Raids - Robustness Checks

	(1a)	(1b)	(1c)	(1d)	(3a)	(3b)	(3c)	(3d)
$disarm_t$	-0.01	-0.01	-0.01	-0.01	-0.02	-0.00	-0.02	-0.00
	[0.02]	[0.02]	[0.02]	[0.02]	[0.04]	[0.03]	[0.04]	[0.04]
$uganda_{ic} * disarm_t$	0.12	0.08	0.10	0.09	0.15	0.14	0.14	0.17
	[0.05]**	[0.05]*	[0.05]**	[0.07]	[0.08]*	[0.05]***	[0.08]*	[0.12]
$disarm_t * t$					-0.01	-0.00	-0.01	-0.01
					[0.01]**	[0.00]	[0.01]**	[0.01]**
$uganda_{ic} * disarm_t * t$					0.04	0.00	0.04	0.05
					[0.01]***	[0.01]	[0.01]***	[0.02]***
R^2	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
N	7,821	7,821	7,759	6,109	7,821	7,821	7,759	6,109
Pre-disarmament mean in Uganda	0.24	0.27	0.24	0.28	0.24	0.27	0.24	0.28
Sample	24mth	40mth	UPDF	farbr	24mth	40mth	UPDF	farbr

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement, $uganda_{ic}$ is an indicator variable for observations in Uganda, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). The (b) regressions use 20 months before and after the announcement to evaluate the impact of the campign, the (c) regressions omit observations for months in which a sublocation reported a forceful UPDF visit, while the (d) regressions also exclude sublocations that have centres within 20km of the Uganda-Kenya border. All the regressions control for fixed effects at the sublocation level - the geographic unit at which raids are reported, and errors are clustered at this level too. The sample for Kenya excludes sublocations that have centres within 20km of the Uganda-Kenya border. Month fixed effects and the full time series are used to deseasonalize the data. Top-coding the results to record a maximum of 4 raids per month per sublocation does not change the results and affects only 22 observations.

Table 4: Monitoring - Robustness Checks

	(1)	(2)	(3)		(4)	(5)	(6)
			Ugandan sublocations				
	Monthly Banditry Rate				Monthly Assault Rate		
$disarm_t$	-0.00	-0.04	-0.05		0.04	0.13	0.12
	[0.01]	[0.03]*	[0.03]		[0.03]	[0.05]**	[0.05]**
t		0.00	0.00			-0.01	-0.00
		[0.00]	[0.00]			[0.00]**	[0.00]
$disarm_t * t$			-0.00				-0.01
			[0.00]				[0.01]
Difference at 6 months	-0.00	-0.04	-0.05		0.04	0.13	0.09
	[0.01]	[0.03]*	[0.04]		[0.03]	[0.05]**	[0.04]*
R^2	0.00	0.00	0.00		0.01	0.02	0.02
N	4,108	4,108	4,108		4,108	4,108	4,108
			Kenyan sublocations				
$disarm_t$	-0.01	-0.00	-0.00		-0.00	-0.02	-0.02
	[0.01]	[0.01]	[0.01]		[0.01]	[0.03]	[0.03]
t		-0.00	-0.00			0.00	0.00
		[0.00]	[0.00]			[0.00]	[0.00]*
$disarm_t * t$			0.00				-0.00
			[0.00]				[0.00]
Difference at 6 months	-0.01	-0.00	0.00		-0.00	-0.02	-0.05
	[0.01]	[0.01]	[0.02]		[0.01]	[0.03]	[0.03]*
R^2	0.00	0.01	0.01		0.00	0.01	0.01
N	4,819	4,819	4,819		4,819	4,819	4,819
			All sublocations				
Difference-in-difference at 6 months	0.01	-0.03	-0.05		0.04	0.18	0.18
	[0.01]	[0.03]	[0.04]		[0.03]	[0.06]**	[0.05]**
Pre-disarmament mean in Uganda	0.034	0.034	0.034		0.109	0.109	0.109
R^2	0.00	0.00	0.00		0.01	0.01	0.01
N	8,927	8,927	8,927		8,927	8,927	8,927

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

Notes: $disarm_t$ is an indicator variable for observations between May 2006 - April 2007, the 12 months following the campaign announcement, while t is a linear time trend with t set to zero at May 2006 (e.g., April 2006 has $t = -1$). All the regressions control for fixed effects at the sublocation level - the geographic unit at which conflict data is reported, and errors are clustered at this level too. The reported "difference-in-difference" is the estimated impact of the disarmament 6 months into the post period in Uganda relative to Kenya. The reported "pre-disarmament mean in Uganda" is mean banditry and assault rate in Uganda in the 12 months before the campaign was announced. Month fixed effects and the full time series are used to deseasonalize the data.