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From Rebellion to Electoral Violence Evidence from Burundi*

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Abstract

We aim at understanding the triggers of electoral violence, which spoiled 80% of elections in Africa during the last decades. We focus on Burundi, a country where polls were organized in 2010, only few months after the end of a long-lasting civil war. We find that an acute polarization between ex-rebels' groups is highly conducive to electoral violence. In particular, we predict a five-fold increase in electoral violence between the lowest- and highest-polarized municipality. However, neither ethnic nor political cleavages significantly determine such electoral malpractices. These results are robust to numerous specifications. We therefore argue that policies supporting the transition of ex-rebel groups from warfare to the political arena should be reinforced.

Keywords: Civil war, Electoral violence, Polarization, Demobilization, Burundi

JEL Classification: D74, O11, O17, O55

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1 Introduction

Promoting democratization and elections has been at the core of peace-building missions in post-conflict societies since the end of the Cold War (Huntington 1991). Early elections can increase the legitimacy of the newly emergent governments and foster social trust in war-torn societies, thus contributing to long-lasting peace (Soudriette and Pilon 2007; Reilly 2002). Nonetheless, elections fail to be implemented properly in a vast majority of post-conflict countries in Africa. A recent study reveals that during the 1975-2011 period, 80% of African polls were spoiled by violence, bribery, intimidation or inequitable government interference, compared to 40% in non-African countries (Bishop and Hoeffler 2014). This type of violence can further plunge the country back into war (Brancati and Snyder 2012; Hegre *et al.* 2001; Henderson and Singer 2000). We argue that developing a better understanding of the causes of failed elections, and more generally democratic transitions, is all the more important in view of their devastating effects on the living conditions of civilians (Dupas and Robinson 2012, 2010; Omotola 2010). By undermining the legitimacy of the states (Berman *et al.* 2014) and destroying social capital within societies (Dercon and Gutiérrez-Romero 2012), failed transitions ultimately translate into poor economic and political performance (Collier and Hoeffler 2013; Kudamatsu 2012; Chauvet and Collier 2009).

The existing literature points out several determinants of electoral violence. First, ethnic allegiances are likely to be exploited by elites wanting to seize political power (Wilkinson 2004). Ethnic identification may be further strengthened during electoral campaigns conducted in highly competitive political settings (Eifert *et al.* 2010). In addition, political competition may lead to electoral violence conditional on the distribution of power and support among the parties (Collier and Vicente 2012; Robinson and Torvik 2009; Chaturvedi 2005; Ellman and Wantchekon 2000). Then, as illustrated by the greed theory of civil conflict of Collier and Hoeffler (2004)[1], electoral violence tends to increase with the amount of lootable resources controlled by the State (Collier *et al.* 2008). Noteworthy, it is not only the rich areas that are targeted by armed groups. Poor settings may be equally or more prone to electoral violence, as voters are easier to bribe and have fewer means of resisting manipulation (Omotola 2010; Collier *et al.* 2008). Finally, post-conflict elections may induce violence relapse, bribery and fraud in the presence of ineffective electoral regulation (Collier and Vicente 2012) and poorly organized disarmament, demobilization and reintegration programs (DDR) (Brancati and Snyder 2012).

This paper aims to test all of these hypotheses in one single empirical study, focusing

[1]For an exhaustive review of the causes and consequences of civil war, see Blattman and Miguel (2010).

on Burundi - a country of recent political unrest. By using micro-level data, we analyze how old ethnic divides, competition between the political parties and antagonisms between Hutu ex-combatants have affected the election performance in 2010. We consider Burundi a particularly interesting case study for a number of reasons. First, all of the attempts to organize elections in the last 50 years had a highly destabilizing effect on the country. Over the years, the type of violence changed from large-scale ethnic massacres to targeted intimidation practices and political assassinations. Second, a year before the 2010 elections, a peace agreement put an end to a 16 years civil war. Preventing the resurgence of violence in Burundi is also crucial since history has shown that instability in one country of the Great Lake region may destabilize the whole area, with dramatic effect on civilian population (Prunier 2009). Finally, Burundi's 2015 elections are fast approaching and the incumbent president does not seem to be willing to conform to the constitutional requirement of ceding the term of office (BBC 2014). Burundi's internal stability will thus be challenged, once again.

Micro-quantitative studies on electoral violence have so far been undertaken in two African countries: Kenya and Nigeria. Dercon and Gutiérrez-Romero (2012) use micro-level data from Kenya to study electoral violence that erupted in 2007. They find that violence emerged in areas prone to land disputes and with politically connected gangs. In the same context, Gutiérrez-Romero (2012) finds that political parties engaged in vote-buying in areas where they were less likely to win, in order "to weaken the support of their political rivals and to mobilize their own". Complementing these results, Collier and Vicente (2013) recently evaluated a randomized anti-violence community campaign in Nigeria. They find that the intervention decreased the intensity and the violence-related perceptions and increased turnout. Fafchamps and Vicente (2013) further show that the effects of the campaign were also transmitted indirectly through kinship and geographical proximity.

Our empirical investigation complements this scarce literature by focusing on a post-conflict context and by directly studying the long-term impact of Burundi's civil war on post-conflict elections. This focus is particularly relevant since conflict-affected countries have been shown to be more likely to return to war (Collier 2008). Importantly, our study also contributes to the body of research that assesses the effectiveness of demobilization programs in post-conflict societies (D'Aoust *et al.* 2013; Gilligan *et al.* 2012; Verwimp and Bundervoet 2009; Humphreys and Weinstein 2007, 2005). To our knowledge, our paper is the first empirical study that evaluates the impact of ex-combatants demobilization on violence outbursts' recurrence. More generally, we claim that understanding the causes of electoral violence is an important preliminary step before implementing and assessing policies aiming to reduce these misconducts.

We show that the episodes of violence which frequented the 2010 electoral cycle in Burundi have been mainly driven by the standing enmities from the past that were made to re-emerge through the electoral competition. We identify two channels. First, our study highlights the involvement of ex-combatants in the spreading of violence. In particular, we show that a one standard deviation increase in polarization among rebel groups lead to an increase of 38% of violent events. Namely, going from the lowest polarized municipality in Burundi to the highest one, we predict a five-fold increase in the incidence of violent events. This effect is even stronger in pro-Hutu municipalities. Second, we find that the episodes of electoral violence were more likely to occur in municipalities that were heavily affected during the 1993-2009 civil war.

In contrast, we find that the acclaimed Hutu-Tutsi antagonism does not seem to have had an impact on violence incidence. Interestingly, political competition between parties does not matter either in explaining electoral violence when tensions between ex-rebel groups are accounted for. Our results suggest that the triggers of violence in Burundi have disengaged from their original inter-ethnic roots. They became anchored in the intra-Hutu rivalry, manifested by the Hutu ex-rebels groups competing to seize power. Our study concludes that demobilization programs alone may not be enough to prevent the resurgence of violence. Policies to facilitate the transition from rebellion to political competition are much needed.

The article is organized as follows. The next section reviews the major events which have determined the political evolution of Burundi in the last sixty years of its history. Section 3 describes the dataset and the econometric methods used in the empirical analysis. Results are presented in section 4 and are refined in section 5. In section 6, we show that estimates are robust to a set of alternative specifications. Section 7 concludes.

2 Historical background

Burundi is a small landlocked country situated in the Great Lakes region in sub-Saharan Africa. This densely populated country has 10 million inhabitants, among whom 90% lives in rural areas. According to the World Bank Indicators, the country's GDP per capita was USD 251 in 2012. Burundi is ranked 178 out of 187 countries according to the Human Development Index. Traditionally, the Burundian population is divided into three ethnic groups: the Hutu (85% of the population), the Tutsi (14%) and the Twa (1%).

The recent history of Burundi is ineluctably related to the cleavages between these ethnic groups. There is no consensus among scholars on the origins of these divisions.

While some argue that even in pre-colonial times, the Tutsi already dominated the Hutu "in a manner similar to feudalism", others claim that before colonization, Hutu, Tutsi and Twa "were no more than flexible and harmonious social categories within one nation" (Vandeginste 2014). It is nevertheless clear that in the 1920s, the Belgian colonial administration identified the Tutsi as natural rulers over the Hutu, since the former were considered to allegedly belong to the superior Hamitic race[2]. The Tutsi were therefore considered as the most qualified group to rule and control the bureaucracy of the colonial system of the indirect rule (Mamdani 1996). Education and jobs in the administration were reserved almost exclusively for them (Uvin 1999).

The transition towards independence was not immediately characterized by a Hutu-Tutsi strife (Uvin 1999). Burundi's first elections were held in 1961, and handed a large majority to the recently-founded *Union pour le Progrès National* (UPRONA), a royalist and nationalist party led by Prince Louis Rwagasore. As the Kings' eldest son, Prince Rwagasore was popular among every social group (Chrétien 2000). Rwagasore's government, however, did not last long, since its leader was assassinated in October 1961, few months before the country's independence. A period of acute political instability followed, with four governments succeeding one another between 1962 and 1965. New elections were organized in 1965. Following these elections, the King refused to recognize the Hutu victory and replaced the newly-elected Hutu prime minister by a Tutsi. This strategy triggered an uprising among Hutu who attempted to overthrow the illegitimate government. The failed coup led to violent reprisals from the Tutsi government. Most of the Hutu elite as well as thousands of Hutu peasants suspected to have supported the rebellion were killed (Falch 2009).

The fragile democracy definitely broke down in 1966 following a successful coup d'Etat fomented by Tutsi officers. Following the coup, a single party authoritarian regime was set up under the rule of UPRONA, and all important positions in the administration, the army and the police were attributed to the Tutsi minority. Three Tutsi presidents from the same village in Bururi governed the country between 1966 and 1993, each of them taking control of the State via a new coup d'Etat. These military regimes violently repressed Hutu rebellions in 1972 and 1988 (Lemarchand 1998).

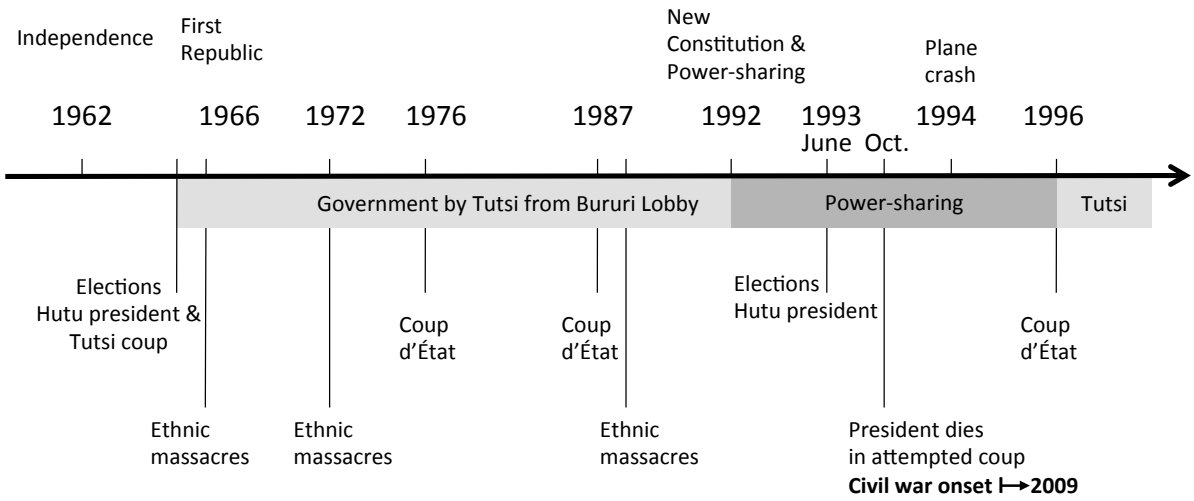
The international community started putting pressure on the Tutsi president Pierre Buyoya after the 1988 reprisals. Buyoya gave in to international pressure and formed a government with a Hutu prime minister and an equal numbers of members from both

[2]In the XIX century, Europeans classified the "Hamitic race" as a subgroup of the Caucasian race. All significant achievements in African history in terms of technologies and civilizing skills were attributed to the Hamitic people by the Western colonizers, justifying their superiority (Mamdani 2001).

ethnic groups. In 1992, a new constitution including provisions for multiparty competition was approved.

Elections were finally held in July 1993. Melchior Ndadaye, from the Hutu-based party FRODEBU[3], became head of State and formed a government that was composed by a third of Tutsi close to UPRONA. However, the new president was assassinated during a failed coup organized by Tutsi officers. This led to widespread massacres of Tutsi, followed by large-scale reprisals against Hutu. Eventually, the death of the *ad interim* President Cyprien Ntaryamina together with his Rwandan counterpart in the 1994 plane crash triggered a civil war opposing the Tutsi-controlled army and radical Hutu groups (Prunier 2009). The democratic transition was over and definitely buried in July 1996 when the former Tutsi president Buyoya and the Tutsi-controlled army overthrew the power-sharing government. Figure 1 shows the key events that happened between independence and 1996.

Figure 1: Major events: 1962 - 1996



Peace talks started in 1996 under the initiative of Tanzania. The Arusha Peace and Reconciliation Agreement was signed on August 28, 2000 by most parties and rebel groups. In spite of the agreement, peace remained fragile as the two largest Hutu rebel groups, the CNDD-FDD[4] and the FNL-Palipehutu[5] rejected the peace accords and kept on fighting the government of transition. The CNDD-FDD signed a Comprehensive Ceasefire Agreement in 2003 and joined the government of power-sharing. Combatants from the national army (FAB) and from the CNDD-FDD were selected to form the new

[3]Front pour la Démocratie du Burundi (FRODEBU).
[4]Conseil National de Défense de la Démocratie - Forces de Défense de la Démocratie (CNDD-FDD).
[5]Forces Nationales de Libération (FNL-Palipehutu).

Forces de Défense de la Nation (FDN). Those who did not fulfil selection criteria based on age, health status and experience were demobilized according to a "Disarmament, Demobilization and Reinsertion" (DDR) program: approximately 23,000 units from both sides spent a week attending training on economic opportunities, HIV/AIDS, civil responsibility, as well as peace and reconciliation (D'Aoust *et al.* 2013; Gilligan *et al.* 2012). Then, they benefited from a sequence of reinsertion and reintegration grants in order to be able "to return to their community and to sustain themselves and their families for a limited period following demobilization" (World Bank 2004).

The CNDD-FDD won the elections held in 2005 and its leader, Pierre Nkurunziza, became President. Despite the appointment of a Hutu exponent as head of the country, the FNL-Palipehutu kept on fighting the government, transforming what had been an inter-ethnic war into a Hutu-against-Hutu conflict. After a first attempt of ceasefire agreement in 2006, the FNL-Palipehutu finally accepted to gave up its weapons and turned into a political party in 2009. Minor administrative posts were attributed to the FNL leadership. As for the CNDD-FDD four year earlier, its combatants either joined the national army or benefited from the DDR program.

Elections were scheduled in 2010, only few months after the official epilogue of the civil war. Five consecutive ballots were organized, starting with the election of municipal representatives on May 24, 2010, followed by the presidential election on June 28, the parliamentary and senatorial elections at the end of July, and ending with the election of the hills' representatives early September. Even if several opposition parties seemed confident in their success (ICG 2011), the FNL party was seen as the most serious opposition to the CNDD-FDD of the incumbent president Pierre Nkurunziza.

The pre-electoral climate was spoiled by numerous violent episodes, claims of intimidation and suspicions of fraud. In such a context, the CNDD-FDD party won the first municipal ballot outright, catching 64% of votes and 62% of seats in municipal assemblies. The FNL ended up as the second largest force, with only 14% of the votes. FRODEBU and UPRONA obtained 5 and 6% of the votes respectively. Despite the electoral integrity acknowledged by the international community, the resounding defeat pushed the opposition parties to boycott the four following ballots, accusing Nkurunziza of massive frauds and irregularities (Vandeginste 2012; ICG 2011). Their strategy was to form the ADC-Ikibiri coalition and withdraw their candidacy, leaving Nkurunziza as the only candidate running for presidency (Helbig de Balzac *et al.* 2011). The incumbent president was re-elected with 95% of the preferences. Violence continued to be pervasive until the end of the electoral process.

The 2010 elections have legitimized a quasi-return to single-party rule, the CNDD-FDD having obtained a three-quarters majority in the National Assembly. Political tensions have therefore mounted, leading to the resurgence of rebel groups - among which the FNL - aiming to fight the government (ICG 2012). Many opposition leaders have left the country after complaining about constant harassment and threats to their lives. Several of those who remained politically active have been arrested or assassinated. Media and civil society have been threatened, increasing the risk of instability and insecurity (Vandeginste 2012). In such volatile context, the country will be going through a new electoral round in 2015.

3 Identification strategy

3.1 Econometric model

Our identification strategy aims at understanding the roots of violence that perturbed the electoral process in Burundi in 2010. First, in line with the grievance theory of civil war, we will assess the role played by ethnic cleavages (Collier and Hoeffler 2004). To do so, we will examine how the proportion of Hutu and the ethnic fractionalization at the municipality level impacted the likelihood of electoral violence. Second, we will study the role played by political competition in triggering electoral violence by examining the impact of political fractionalization and polarization indexes. Third, given the proximity between the 2010 electoral cycle and the end of the civil conflict in 2009, we will examine whether ex-rebels have been involved in the episodes of electoral violence. In particular, we will assess the impact of the number, the fractionalization and the polarization of demobilized ex-rebels in each municipality. Finally, we will also study if poverty, past violence and population size partly explain the emergence electoral violence.

We therefore propose to estimate the following equation:

$$\begin{aligned}\text{violent events}_m = {} & \beta_0 + \beta_1 \text{Prop. Hutu}_{m,1993} + \beta_2 \text{Ethnic frac.}_{m,1993} \\ & + \beta_3 \text{Political frac.}_{m,2010} + \beta_4 \text{Political polarization}_{m,2010} \\ & + \beta_5 \text{Nr. demob per 1000 inhab.}_m + \beta_6 \text{Demob. frac.}_m \\ & + \beta_7 \text{Demob. polarization}_m + \beta_8 \text{Wealth Index}_m \\ & + \beta_9 \log \text{past violence}_{m,1997-2009} + \beta_{10} \log \text{population}_{m,2008} + Z_k + \epsilon_m,\end{aligned} \tag{1}$$

where *violent events*$_m$ is the number of episodes of electoral violence which occurred in each municipality, with $m \in [1, 129]$, *Prop. Hutu* $_{m,1993}$ and *Ethnic frac.*$_{m,1993}$ are proxies for the municipal ethnic composition, *Political frac.*$_{m,2010}$ and *Political polarization*$_{m,2010}$ measure the political heterogeneity with respect to 2010 municipal elections' results,

Nr. demob per 1000 inhab.$_m$ is the the number of demobilized soldiers per 1000 inhabitants per municipality, *Demob frac.*$_m$ and *Demob. polarization*$_m$ are respectively the demobilized soldiers' indexes of fractionalization and polarization at the municipal level, *Wealth Index*$_m$ measures median wealth at the municipal level, *violence*$_{m,1997-2009}$ and *population*$_{m,2008}$ account for past violence from 1997 to 2009 and population size as of 2008 respectively. Z_k stands for province fixed effects[6].

3.2 Data

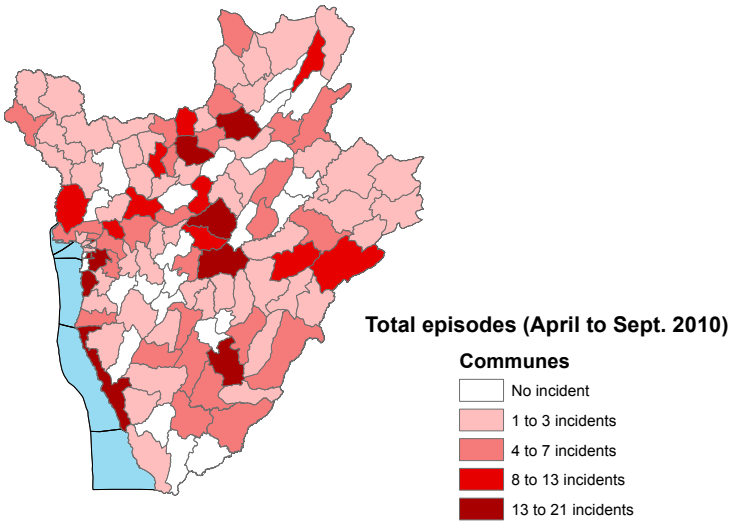
Electoral violence The dependent variable *violent events*$_m$ is constructed using the Burundi *Ushahidi* electoral violence dataset. More than 400 observers signaled incidents witnessed in the 129 municipalities of Burundi during the electoral period lasting from April, 26 to September 12, 2010. Observers had to meticulously describe and identify both the triggers and the subjects involved in the episodes of electoral violence. Information about, for instance, physical violence, attempted murders, general fights and injuries against a particular group of people are were recorded. Table 1 summarizes the main components of the dependent variable. The total number of episodes by municipality is mapped in figure 2. This count variable has a distribution skewed to the right.

Table 1: Descriptive statistics of violent events

Variable	Mean	Std. Dev.	Min.	Max.	N
Intergroup fights and clashes	0.589	1.254	0	9	76
Property damage	0.481	0.821	0	4	62
Arbitrary arrest and detention	0.333	0.743	0	5	43
Verbal abuse	0.287	0.575	0	3	37
Intimidation	1.202	1.738	0	7	155
Threat to the physical integrity	0.279	0.637	0	4	36
Murder	0.155	0.605	0	5	20
Disruption of elections	0.333	0.764	0	4	43
Attempted murder	0.364	0.77	0	5	47
Violent events	4.023	4.518	0	21	519

[6]Past violence and population are expressed in log given their high dispersion. The indexes of ethnic, political and ex-soldiers' fractionalization, the indexes of political and ex-soldiers' polarization and the wealth index are standardized.

Figure 2: Distribution of electoral violent events



Ethnic fractionalization. This paper first tests ethnic cleavages as a potential driver of electoral violence. According to the Belgian census of 1959, three ethnic groups coexist in Burundi: the Hutu (85%), the Tutsi (14%) and the Twa (1%). This is the latest direct measurement of ethnic affiliation available for Burundi. Census data is only available at the national level. We thus proxy ethnic composition by looking at the results of 1993 Presidential elections[7].

Three candidates competed for the Presidency in 1993 elections. Electoral competition was clearly rooted in ethnicity. As a consequence, we are able to infer the electorate's ethnic composition by looking at the share of votes for Hutu candidates (the FRODEBU's leader Melchior Ndadaye, who won the election, and Pierre-Claver Sendegeya, from the monarchist People's Reconciliation Party) and the Tutsi candidate (Pierre Buyoya, the incumbent president who had seized power in a 1987 military coup). On average, 64% of the electorate voted for a Hutu candidate[8], while 36% voted for the Tutsi candidate.

We compute two indicators in order to capture ethnic tensions. First, we proxy the proportion of Hutus living in the municipality by the percentage of votes obtained by both Hutu candidates. Second, we compute an ethnic fractionalization index (Alesina *et al.* 2003).

$$\text{Ethnic Fractionalization}_{m,1993} = \sum_{i=1}^{N} (1 - \pi_i)\, \pi_i \tag{2}$$

where π_i is the proportion of individuals who voted for a Hutu or a Tutsi candidate.

[7]Note that in 1993 only 124 municipalities existed, instead of the current 129.
[8]Ndadaye garnered 63% of the votes while Sendegeya obtained only 1% of the suffrages.

The index of ethnic fractionalization can simply be interpreted as the probability that two randomly selected individuals from a given municipality belong to a different ethnic group[9].

Political fractionalization and polarization. Results from 2010 municipal elections are used to construct indexes of political fractionalization and polarization[10]. The former is constructed according to equation (2) and can be interpreted as the probability that two randomly selected individuals from a given municipality voted for a different party in the 2010 municipal elections.

For the index of political polarization, we slightly modify the Garcia-Montalvo and Reynal-Querol (2005)'s index of polarization by considering the absolute rather than the quadratic value of the term in the sum. By doing so, we avoid to put excessive weights on outlier municipalities[11]:

$$\text{Political polarization}_{m,2010} = 1 - \sum_{i=1}^{N} \left| \frac{0.5 - \pi_i}{0.5} \right| \pi_i \tag{3}$$

where *Political polarization*$_m \in [0, 1]$, $N = 29$ is the number of political parties who ran for the 2010 municipal elections and π_i is the proportion of votes obtained by each party. The index captures how far the political distribution is from being bipolar, with *Political polarization*$_m = 1$ indicating a bipolar political scenario.

Ex-rebels' fractionalization, polarization and density. Previous literature suggests that demobilized soldiers are active in the post-war political life of the country and that most of the rebel groups turned into parties after their demobilization (Gilligan *et al.* 2012; Annan *et al.* 2011; Goose and Smyth 1994). We construct three different measures of ex-soldiers involvement in Burundian electoral violence: the number of demobilized combatants per municipality per 1000 inhabitants, a polarization index and a fractionalization index both based on their affiliation to rebel groups engaged during the civil war. We use data from official registers containing information on the return of approximately 30,000 combatants from 10 armed groups demobilized between 2004 and 2009[12].

Most of the rebels were demobilized from the traditionally Hutu CNDD-FDD, led

[9] In our sample, N=2. The formula thus becomes: Ethnic Frac. $= 2\pi_i(1 - \pi_i)$. In this case, fractionalization and polarization indexes are proportional.

[10] We were not able to exploit data on the other four rounds of 2010 elections since all parties boycotted them, accusing the winner of the municipal elections, the CNDD-FDD, of electoral frauds.

[11] As shown in appendix, similar results are obtained with the Garcia-Montalvo and Reynal-Querol (2005)'s original index.

[12] Data was kindly provided by the Center of Operations of the DDR program in Burundi.

by the incumbent President, Pierre Nkurunziza (12,000 demobilized soldiers)[13]. The second largest group of rebels was the FNL-Palipehutu, headed by Agathon Rwasa, the major opponent of Nkurunziza. The remaining 4,500 demobilized ex-combatants are shared among the remaining six Hutu rebel groups. Demobilized soldiers' polarization and fractionalization indexes are constructed by using the same procedure as for political fractionalization and polarization indexes (equations (2) and (3)).

Median wealth. We compute a wealth index at the municipal level based on the 2010 Demographic and Health Survey (DHS). The DHS wealth index uses information on household's ownership of assets (e.g. bicycle and radios), environmental conditions and housing characteristics (e.g. type of water source, sanitation facilities, materials used for housing construction) and uses a principal components analysis to assign weights to the different components of the index (Rutstein and Johnson 2004). We then compute a median wealth index for each municipality from the household data. The survey was conducted in 128 out of the 129 municipalities.

History of violence. We control for the history of violence experienced by the municipalities from 1997 to 2009 by relying on the Armed Conflict Location & Event Data (ACLED) dataset. ACLED contain information on 1,266 violent episodes which occurred throughout Burundi from 1997 to 2009 (Raleigh *et al.* 2010).

Population size. Data on population size are based on the last available census, conducted in 2008 by the *Institut de Statistiques et d'Etudes Economiques du Burundi* (ISTEEBU).

3.3 Methods of estimation

Given the count and non-normal nature of the dependent variable, Hilbe (2011) recommends to use Poisson and Negative Binomial regressions. We will nonetheless show that our results are robust to the OLS estimation method.

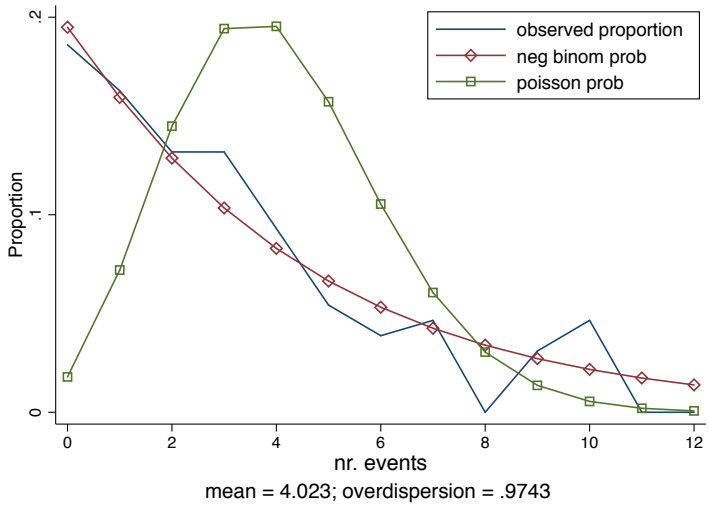
The assumption that the dependent variable is drawn from a Poisson distribution imposes the equality between the mean and the conditional variance. This assumption does not hold for the distribution of *violent events*$_m$. The conditional variance of *violent events*$_m$ (20.414) is five times higher than its conditional mean (4.023), indicating overdispersion in the data. This diagnosis is confirmed by chi-square goodness-of-fit tests which

[13]It should be noted that most of the demobilized soldiers come from the former national army (FAB) and the current national forces of defense (FDN) (13,000 demobilized soldiers). Nevertheless, since FAB did not turn into a political and its soldiers may be affiliated to different political group, we exclude these demobilized units from the analysis.

reject the null hypothesis that the data follow a Poisson distribution[14]. The outcomes of the Poisson regression are presented since they gives consistent asymptotically normal estimators (Wooldridge 2010). Yet, over-estimated standard errors bias the significance of the coefficients from this kind of regression.

A remedy to the overdispersed nature of the dependent variable is the use of a negative binomial regression model (Hilbe 2011). This claim is confirmed by an *ad-hoc* likelihood-ratio chi-squared test of overdispersion (H_0: no overdispersion). The chi-square test statistics are equal to 134.11 ($p < 0.00$) and 76.22 ($p < 0.00$) without and with province fixed effects respectively, implying that a negative binomial regression model should be considered. Figure 3 plots the distribution of *violent events*$_j$ against a Poisson distribution and a negative binomial distribution with the same mean and variance. It further confirms how the latter performs better than the former in explaining the data on electoral violence[15].

Figure 3: Goodness of fit of negative binomial and Poisson models



We choose not to cluster standard errors and only use province fixed effects. Indeed, since no ballot was organized at the provincial level, we do not expect much dependence between observations at that level. Furthermore, provinces fixed effects and control variables should absorb most of the systematic within-cluster correlation (Cameron and Miller 2013). Clustering at the province level does not change much the standard errors of the estimates, as shown in table 11 in appendix[16]. The model specification is validated by

[14] $\chi^2 = 400.25$ ($p < 0.00$) and $\chi^2 = 314.37$ ($p < 0.00$) without and with fixed effects respectively.

[15] The same figure shows that a zero-inflated negative binomial model is not needed.

[16] Since clustering can be misleading in the case of few clusters (Cameron and Miller 2013; Cameron *et al.* 2008), table 11 compares robust standard errors (column (1) and (4)), cluster-robust standard errors with residuals and degrees of freedom corrections (columns (2) and (5)) and pairs cluster boot-

the Pearson's dispersion tests and the link tests[17] (Hilbe 2011).

4 Results

Table 2 presents the results obtained through OLS, Poisson and negative binomial estimations of equation (1). Columns (1) and (2) show the OLS estimators, without and with province fixed effects respectively. Poisson results are displayed in columns (3), (4) and (5). Finally, the last three columns present negative binomial regression's results. In the columns (5) and (8), we consider population size as an offset variable[18]. Most of the analyzes will be based on the results from column (7), obtained with negative binomial specification with province fixed effects and no offset, as it is the less restrictive one.

The first result emerging from the column (6) of table 2 is that the ethnic composition of the population matters in explaining electoral violence. In particular, electoral violence seems to be increasing in the proportion of Hutu living in a municipality. The fact that the coefficient associated with ethnic fractionalization is positive and significant shows that this relationship is non linear. However, when provinces fixed effects are introduced, coefficients decrease and this relationship becomes insignificant at conventional levels. We refine and interpret these estimates in section 5.5 using an instrumental variable strategy.

Rather, it is the polarization of ex-combatants that best predicts violence incidence. Given the short timing between the end of the civil war and the 2010 elections, one of our hypotheses is that the presence of Hutu demobilized soldiers could have spoiled the regularity of the polls. While the number of ex-combatants alone does not significantly predict electoral violence, their distribution matters. Demobilized soldiers' polarization is positive and significant across all specifications. From column (7), a one standard deviation increase in the former combatants' polarization index implies on average 38% more violent events per municipality, *ceteris paribus*[19]. This represents a five-fold increase in the incidence of events between the lowest- and the highest-polarized municipalities.

strap standard errors (columns (3) and (6)). Given the count nature of the dependent variable, Wild bootstrapping is not feasible.

[17]The Pearson-dispersion statistic is reported in the last line of table 2. As the values of the Pearson-dispersion statistic are smaller than 1.25 for negative binomial regressions, we conclude that the model is well specified and fits the data. As for the link test, its p-values are 0.270 and 0.724 with and without province fixed effects respectively. This shows that our model is properly specified (Hilbe 2011).

[18]In this case, its coefficient is set to 1, so that, by rewriting equation (1), it is possible to express the dependent variable as a ratio of total violent events per municipality over municipal population. In regression (4) and (7), t-test statistics confirm that the coefficient for population size is not significantly different from one.

[19]For interpreting the results of the poisson and negative binomial regressions in percentage terms, one should take $\exp^{\beta} - 1$.

Table 2: Results from OLS, Poisson and Negative Binomial regressions

	Dependent variable: violent events							
	OLS	OLS	Poisson	Poisson	Poisson	NegBin	NegBin	NegBin
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prop. Hutu votes 1993	0.234	-1.681	0.809	0.374	0.530	1.169*	0.936	0.988
	(2.827)	(3.495)	(0.786)	(0.792)	(0.721)	(0.697)	(0.771)	(0.716)
Ethnic fract. 1993	0.814**	0.265	0.264**	0.104	0.106	0.285***	0.141	0.142
	(0.386)	(0.393)	(0.113)	(0.110)	(0.108)	(0.103)	(0.121)	(0.121)
Political fractionalization	-0.271	0.676	-0.131	0.046	0.090	-0.024	0.189	0.196
	(0.699)	(0.994)	(0.175)	(0.209)	(0.191)	(0.143)	(0.245)	(0.239)
Political polarization	0.420	0.388	0.135	0.092	0.067	0.069	0.020	0.012
	(0.670)	(0.804)	(0.138)	(0.156)	(0.142)	(0.110)	(0.162)	(0.154)
Nr. demob per 1000 inhab.	-0.096	0.282	-0.026	0.021	0.022	-0.056	-0.032	-0.033
	(0.300)	(0.444)	(0.062)	(0.093)	(0.092)	(0.057)	(0.081)	(0.078)
Demob. fractionalization	-1.366**	-0.511	-0.321***	-0.023	-0.022	-0.296**	-0.053	-0.050
	(0.522)	(0.491)	(0.125)	(0.116)	(0.114)	(0.134)	(0.124)	(0.122)
Demob. polarization	1.516***	1.165*	0.401***	0.303**	0.297**	0.453***	0.326**	0.323**
	(0.529)	(0.635)	(0.125)	(0.153)	(0.149)	(0.136)	(0.135)	(0.133)
Median Wealth Index	1.191**	0.126	0.359***	0.153	0.137	0.367***	0.112	0.102
	(0.512)	(0.849)	(0.117)	(0.137)	(0.121)	(0.133)	(0.146)	(0.128)
Past violence (log)	1.045*	0.740	0.243**	0.131	0.162	0.303***	0.226	0.241**
	(0.561)	(0.742)	(0.118)	(0.124)	(0.099)	(0.105)	(0.154)	(0.121)
Pop. size (log)	4.443***	5.321***	1.000***	1.189***		0.838***	1.075***	
	(1.621)	(1.653)	(0.287)	(0.284)		(0.254)	(0.322)	
Constant	-47.035***	-59.018***	-10.753***	-12.991***	-11.134***	-9.296***	-12.019***	-11.279***
	(16.599)	(17.308)	(2.972)	(3.095)	(1.027)	(2.593)	(3.314)	(0.871)
Province FE	No	Yes	No	Yes	Yes	No	Yes	Yes
Observations	123	123	123	123	123	123	123	123
R^2	0.244	0.400						
Deviance residuals			400.253	314.367	315.470	137.732	135.137	135.159
Pearson dispersion			3.646	3.279	3.187	1.022	1.174	1.152

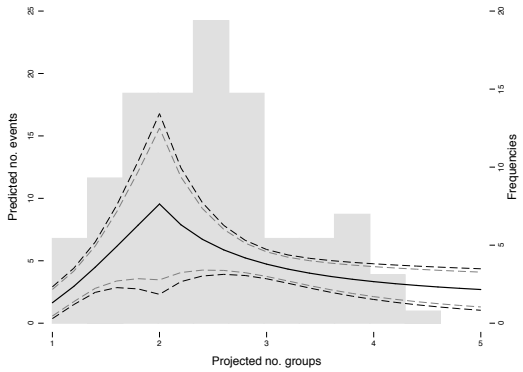
Note: robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

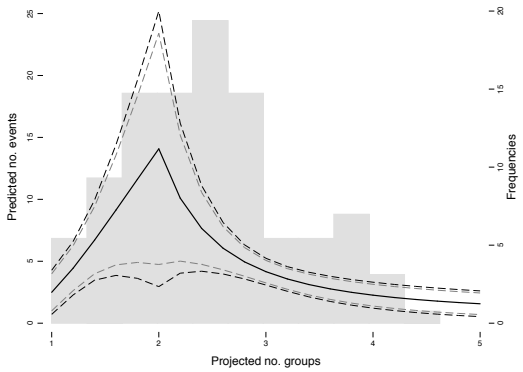
Figure 4 displays the predicted number of events when ex-rebels' polarization and fractionalization are considered simultaneously, as a function the projected number of groups of equal size in each municipality[20]. The predicted number of episodes is maximal when there are two groups of former combatants. This suggests that electoral violence is more likely to occur in municipality characterized by a bipolar distribution of ex-rebel groups. Interestingly, when ex-rebels' polarization and fractionalization are considered separately, both are significant (table 12 in appendix). However, when they are considered simultaneously in the regression, only polarization emerges as significant. This result reinforces our intuition that polarization better gauges the tensions between Hutu rebels. This is consistent with the literature on ethnic polarization and civil war (Horowitz 1985; Collier and Hoeffler 2004; Garcia-Montalvo and Reynal-Querol 2005), confirming that fractionalization does not effectively capture the impact of groups' heterogeneity on violence.

[20]Assuming that each group has the same size, we compute a "projected" number of group corresponding to the fractionalization index in each municipality. Mathematically, if groups are of equal size, frac$= 1 - \frac{1}{n}$ where n is the number of groups. The x-axis reports n for each municipality such that $n = \frac{1}{(1-\text{frac})}$.

Figure 4: Predicted no. of events in function of projected no. of groups of the same size



(a) With province fixed effects



(b) Without province fixed effects

Likewise, political polarization alone significantly explains electoral violence (table 12 in appendix). Yet, this effect disappears when we include the other covariates. Polarization between rebels' groups is the only index that is robust in all specifications.

Finally, there is some evidence suggesting that past violence and wealth are positively related to electoral violence. However, these relationships become insignificant when adding province fixed effects. The next section presents different specifications in which these relationships are significant, especially when observations from Bujumbura Mairie are excluded.

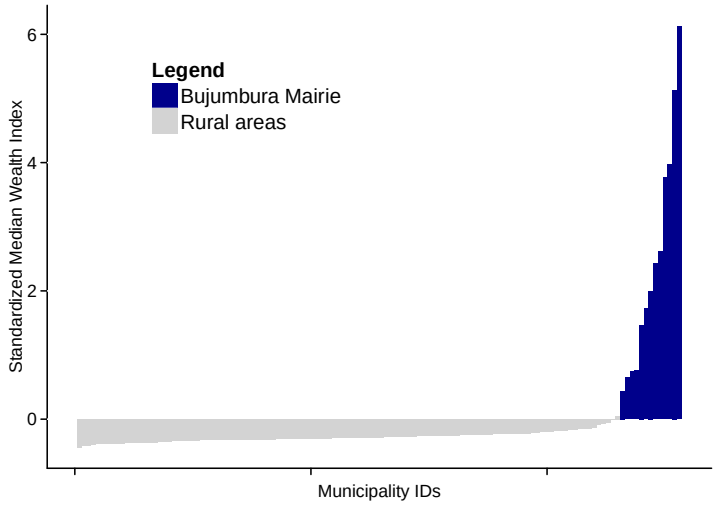
5 Refining the estimates

5.1 The peculiarities of Bujumbura Mairie

The results presented in table 2 do not take into account that Bujumbura Mairie is very different from rural municipalities. As the capital city, it hosts most Burundian institutions as well as the headquarters of International Organizations working in Burundi. For instance, inhabitants of Bujumbura Mairie were about 20 pp. more likely than the rural population to vote for a Tutsi candidate in 1993 ($p < 0.00$). Furthermore, municipalities located in Bujumbura Mairie are significantly richer than rural ones ($p < 0.00$). Figure 5 shows the (sorted) standardized median wealth index computed for 128 municipalities. It illustrates that the 13 municipalities of Bujumbura Mairie are by far the richest in Burundi, while all but one rural municipality exhibit below average wealth index. It is also worth noting that municipalities of Bujumbura Mairie host on average more demobilized ex-combatants than rural municipalities ($p = 0.079$).

These striking differences suggest that our estimates may be affected by the peculiar

Figure 5: Standardized Median Wealth Index by municipality



characteristics of the capital. In particular, according to the greed hypothesis of violence, the richest municipalities should be on average more affected by electoral violence than poorest ones since they offer more lootable resources (Collier and Hoeffler 2004). Nevertheless, this might not be true in the richest neighborhood of Bujumbura Mairie where most houses and businesses are surrounded by fences and under constant surveillance by guards.

The first two columns of table 3 illustrate to what extent results are affected by the inclusion of Bujumbura Mairie in the sample. The first column reproduces the results from negative binomial model with fixed effects and without offset (i.e. column (7) in table 2). In column (2), we present the results from the estimation of the same model obtained by excluding municipalities of Bujumbura Mairie[21]. The comparison of these two regressions shows that the positive correlation between electoral violence and polarization of ex-rebels' factions is strengthened by the removal of observations from Bujumbura Mairie. The coefficient associated with the standardized median wealth index at the municipal level increases and its associated standard error decreases when Bujumbura Mairie is excluded (p decreases from 0.445 to 0.127). The coefficient is almost significant at conventional levels. In line with the greed theory of violence, this could suggest that the richest municipalities in rural areas were more likely to be affected by electoral violence.

Finally, the measure of past violence based on ACLED data becomes significant when Bujumbura is removed from the sample, which is consistent with the literature on the causes of conflict (see e.g. Collier *et al.* (2008); Blattman and Miguel (2010)).

[21]Variables were re-standardized after having excluded Bujumbura Mairie to make the interpretation of the coefficients more intuitive.

Table 3: Results for different specifications

	Violent Events (total)		Violent Events (total)		Violent Events before elections		Violent Events after elections	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prop. Hutu votes 1993	0.936	0.840	0.890	1.012	1.600**	1.881*	0.508	0.138
	(0.771)	(0.819)	(0.798)	(0.842)	(0.814)	(0.976)	(0.913)	(0.905)
Ethnic fract. 1993	0.141	0.087	0.139	0.108	0.149	0.115	0.178	0.079
	(0.121)	(0.125)	(0.124)	(0.123)	(0.141)	(0.170)	(0.146)	(0.131)
Political fractionalization	0.189	0.160	0.182	0.261	-0.272	-0.187	0.366	0.198
	(0.245)	(0.269)	(0.285)	(0.277)	(0.291)	(0.450)	(0.255)	(0.265)
Political polarization	0.020	-0.018	0.079	-0.027	0.322*	0.224	-0.099	-0.074
	(0.162)	(0.180)	(0.186)	(0.193)	(0.184)	(0.278)	(0.170)	(0.179)
Nr. demob per 1000 inhab.	-0.032	-0.083	-0.000	-0.045	-0.114	-0.164	0.025	-0.043
	(0.081)	(0.093)	(0.073)	(0.090)	(0.100)	(0.120)	(0.088)	(0.100)
Demob. fractionalization	-0.053	-0.045	-0.024	-0.023	0.055	0.079	-0.078	-0.068
	(0.124)	(0.139)	(0.135)	(0.151)	(0.165)	(0.196)	(0.133)	(0.154)
Demob. polarization	0.326**	0.428***	0.295**	0.434***	0.301*	0.426**	0.327**	0.438***
	(0.135)	(0.145)	(0.149)	(0.149)	(0.173)	(0.201)	(0.151)	(0.155)
Median Wealth Index	0.112	0.151	0.143	0.178*	-0.009	0.190	0.187	0.138
	(0.146)	(0.099)	(0.142)	(0.097)	(0.240)	(0.148)	(0.159)	(0.114)
Past violence (log)	0.226	0.283**			0.040	0.103	0.323*	0.443***
	(0.154)	(0.133)			(0.140)	(0.165)	(0.187)	(0.155)
Pop. size (log)	1.075***	0.974***	1.425***	1.374***	1.041***	0.899***	1.075***	0.886**
	(0.322)	(0.313)	(0.238)	(0.245)	(0.313)	(0.344)	(0.379)	(0.357)
Constant	-12.019***	-10.726***	-15.212***	-14.432***	-11.884***	-10.378***	-13.002***	-10.737***
	(3.314)	(3.364)	(2.632)	(2.820)	(3.387)	(3.708)	(3.806)	(3.765)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	114	123	114	123	114	123	114
With Bujumbura Mairie	Yes	No	Yes	No	Yes	No	Yes	No
Deviance residuals	135.137	128.157	135.414	127.080	132.533	122.088	134.039	130.850
Pearson dispersion	1.174	1.305	1.240	1.337	1.226	1.315	1.170	1.347

Note: robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.2 Past violence as a bad control

As displayed in column (2) of table 3, municipalities that experienced more episodes of violence during the civil war were also more likely to suffer from electoral violence in 2010. However, similar factors, such as ethnic fragmentation or wealth, could explain electoral violence and past violence simultaneously. Therefore, the inclusion of past violence as a covariate in the regression might mask the importance of other variables in explaining electoral violence[22]. In this context, past violence would be a bad control (Angrist and Pischke 2008).

We therefore exclude past violence from the list of covariates in columns (3) and (4) of table 3 (with and without Bujumbura Mairie respectively). The correlation between ex-rebels' polarization and electoral violence is not affected by this change. However, the coefficient associated with the standardized median wealth index slightly increases and becomes significant at the 10% level ($p = 0.066$). In line with the greed theory of violence, this result suggests that richer municipalities were more prone to violence, both

[22]This is particularly true in this setting, given that the collection of data on wealth can be subject to measurement errors (Hausman 2001).

during the civil war and during the 2010 electoral process[23].

5.3 Before and after municipal elections

As explained in section 2, the 2010 elections were a succession of five ballots, starting with the election of municipal representatives. After the first ballot, the opposition accused the CNDD-FDD of massive frauds and irregularities and boycotted the coming rounds. Given this evolution, it is interesting to test whether the same covariates explain the incidence of violence before and after May 24, 2010, for which 196 and 323 episodes of violence were recorded respectively.

In columns (5) and (6) of table 3, the dependent variable is the number of violent episodes which occurred before the municipal elections. In columns (7) and (8), it is the episodes of violence that occurred only after the municipal elections. We find that splitting the sample according to the timing of elections does not change the positive and significant effect of the polarization of demobilized groups on electoral violence.

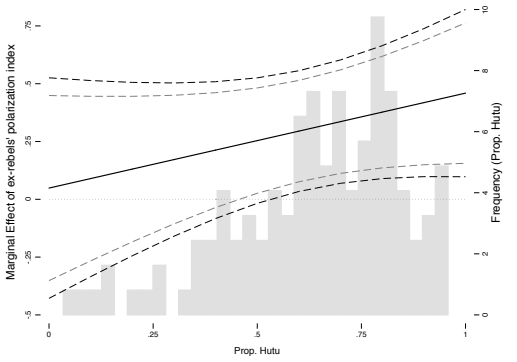
Interestingly, we find that electoral violence before the first ballot was significantly higher in pro-Hutu municipalities. After May 24, 2010, past violence seems to be an important predictor of electoral violence. This suggests that political competition between Hutu rebels has been the main driver before the CNDD-FDD victory. Then, after the first poll, frustrated rebel groups may have gone back to fight in their original violence-prone areas. This is in line with the reports of the ICG (2012, 2011) which points out that, "[...] rumors circulated from July about the presence of armed groups gradually settling themselves in Kibira forest, a traditional sanctuary for rebel movements. [...] the presence of the FNL on the Rusizi plain, on the DRC side of the border was reported by different witnesses." Households reporting looting, clashes between groups and attacks against the military confirmed these rumors (ICG 2012, 2011) .

5.4 Heterogenous effects

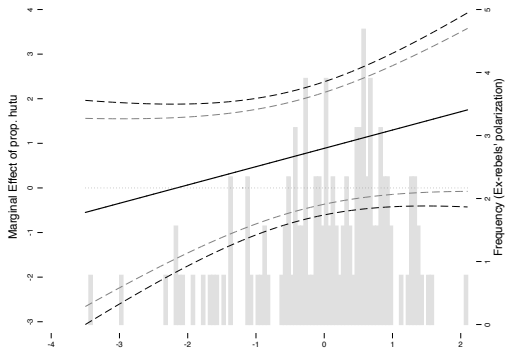
The intra-ethnic dimension of electoral violence. Given the particular evolution of the civil war in Burundi (Section 2), this paper aims at testing whether electoral violence was mainly driven by tensions between Hutu ex-rebel groups rather than inter-ethnic grievances. Phrased differently, municipalities prone to electoral violence should be those characterized by both a high level of polarization between demobilized factions and a high proportion of Hutu.

[23]This is confirmed by regressing past violence on the wealth index through a negative binomial estimation with province fixed effects and without Bujumbura Mairie.

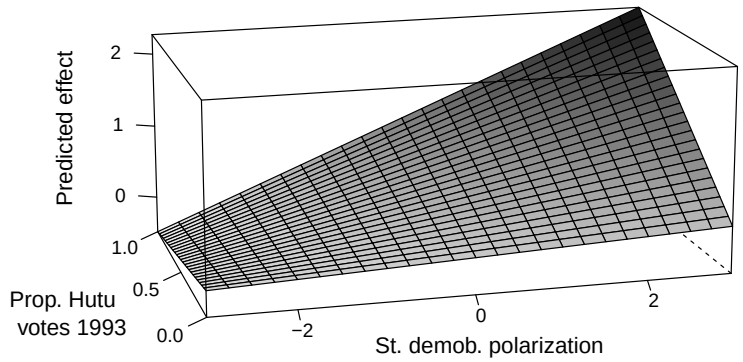
In order to test this hypothesis, we interacted the demobilized soldiers' polarization index with the percentage of Hutu derived from the results of the 1993 municipal election. The results of this regression are presented in the first two columns of table 13 in appendix. Marginal and total predicted effects are represented in figure 6. If our hypothesis is confirmed, we expect the marginal impact of the ex-rebels' polarization index to be close to zero in Tutsi municipalities, and then to be increasing in the proportion of Hutu. Similarly, the marginal impact of the proportion of Hutu should be close to zero in municipalities that are not polarized, and then be increasing in the ex-rebels' polarization index. Figures 6(a) and 6(b) confirm this intuition. This complementarity between the ex-rebels' polarization index and the proportion of Hutu in inducing electoral violence is well represented in figure 6(c) which displays the joint predicted effect of these two variables.



(a) Marginal effect of ex-rebels' polarization as a function of the proportion of Hutus



(b) Marginal effect of the proportion of Hutus as a function of ex-rebels' polarization



(c) Joint predicted effect of the proportion of Hutus and ex-rebels' polarization

Figure 6: Interaction between ex-rebels' polarization index and proportion of Hutu (black dashed lines = 95% CI; gray dashed lines = 90% CI)

Past violence and ex-rebels' polarization. Results in the third and fourth columns of table 13 in appendix are obtained by interacting demobilized soldiers' polarization

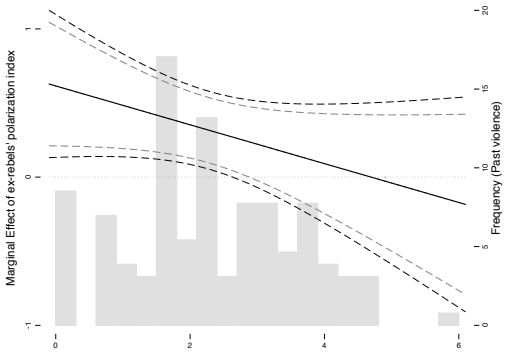
index and past violence. Marginal and total predicted effects are represented in figure 7.

Interestingly, figure 7(a) shows that the marginal impact of the ex-rebels' polarization index on electoral violence is positive, decreasing in past violence and significant when past violence is low, but not significantly different from zero in municipalities heavily affected by the civil war. Similarly, figure 7(b) shows that the marginal impact of past violence on the dependent variable is positive, decreasing in ex-rebels' polarization and significant when ex-rebels' polarization is low, but not significantly different from zero where rebel groups are highly polarized.

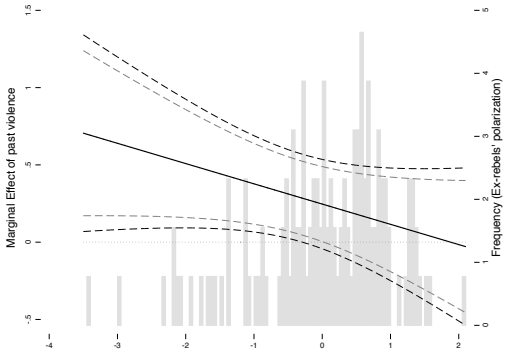
Figure 7(c) represents the joint predicted effect induced by these two variables on violence. One the one hand, electoral violence was not likely to emerge if both ex-rebels' polarization index and past violence were low. On the other hand, episodes of electoral violence were likely to occur in municipalities in which at most one of these two factors was high. Phrased differently, figure 7(c) suggests the existence of a saturation effect between these two factors: if either ex-rebels' polarization index or past violence are high, a further increase in one of these two variables would have no significant impact on electoral violence.

5.5 Instrumental variable approach

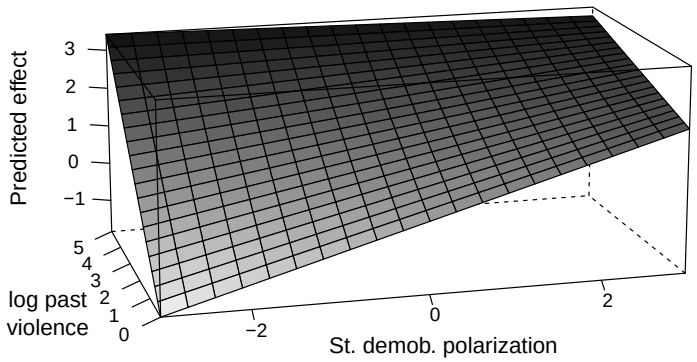
One of the objective of this paper is to test whether ethnic cleavages have triggered electoral violence in Burundi. As explained in section 3, the last official estimates of ethnic repartition in Burundi date back to the 1959 belgian census and suggest that there were about 85% of Hutu and 15% of Tutsi. As these estimates are only available at the national level, we proxied the ethnic composition of each municipality by using the results from 1993 presidential election. Indeed, the 1993 presidential election was deeply rooted in ethnicity. We therefore inferred Hutu proportion and ethnic fractionalization from the share of votes obtained by the Hutu and Tutsi candidates running for the presidential election. On average, 64% of the electorate voted for one of the two Hutu candidates, while 36% of the citizens voted for the unique Tutsi candidate. This measure seems to underestimate the true proportion of Hutu in the population. This can be either because more Tutsi went voting or because the Tutsi candidate was appreciated by some of the Hutu, as he had launched a process of democratization for the first time in the country's history (Vandeginste 2009). Therefore, while we expect this indicator of ethnic belonging to be a good proxy for the proportion of Hutu in a municipality, the coefficient associated with this variable is likely to be a biased measure of the true impact of the proportion of Hutu in municipalities. This bias is expected to be even more important for the coefficient associated with ethnic fractionalization as the latter is a non-linear function of



(a) Marginal effect of ex-rebels' polarization as a function of past violence



(b) Marginal effect of past violence as a function of ex-rebels' polarization



(c) Joint predicted effect of ex-rebels' polarization and past violence

Figure 7: Interaction between ex-rebels' polarization index and past violence (black dashed lines = 95% CI; gray dashed lines = 90% CI)

the proportion of Hutu. In this section, we propose a two-stage instrumental variable approach aiming to correct these biases.

We do so by using additional ethnic figures, released from the last wave of the Afrobarometer survey. Computing the proportion of Hutu from the sampled population, we estimate the proportion of Hutu in Burundi at 82%, which is closer to the census proportion. However, this estimate relies on 11 households per municipality on average. This figure is thus imprecise, as it is built on few observations per municipality. Directly using this variable will bias coefficients towards zero (Hausman 2001).

Our method propose to refine the estimates presented in table 2 by extracting useful information from our two imperfect measures of ethnicity[24]. The idea is to instrument the imprecisely measured proportion of Hutu from the Afrobarometer by running a first-

[24]Monte-Carlo regressions confirm that not taking into account the mismeasurement of our ethnic variables would lead to biased coefficients, especially for fractionalization. Simulations further show that our two-stage procedure performs better in approaching the true coefficients (available on demand).

stage regression where the proportion of individuals who voted for a Hutu candidate in 1993 is the instrument. This latter variable is indeed highly correlated with the true ethnic distribution in the population. We do not expect it to have a direct impact on violent episodes in equation (1) when ethnic dissensions and other controls are accounted for. In other words, we expect the proportion of pro-Hutu votes in 1993 to be correlated with the number of electoral violent episodes only through the variable it instruments for, implying that the exogeneity condition of the instrument is satisfied (Hilbe 2011).

In practice, the non-linear relationship between the proportion of Hutu and ethnic fractionalization requires using a control function approach, where the identifying instrument for the afrobarometer data is the 1993 presidential election results (Attanasio and Lechene 2014; Wooldridge 2010). Denote H^A, the proportion of Hutu computed from the Afrobarometer, H^P the proportion of Hutu taken from the 1993 elections and $\mathbf{X}$ the matrix of non-ethnic regressors in equation (1). In the first stage, we estimate:

$$H_m^A = \alpha_{0,m} + \alpha_{1,m} H_m^P + \mathbf{X}_m \beta + \epsilon_m \tag{4}$$

We obtain the predicted values of the proportion of Hutu and compute the corresponding predicted fractionalization index.

$$\widehat{\text{Frac}_m^A} = 2\widehat{H_m^A}(1 - \widehat{H_m^A}) \tag{5}$$

We then re-estimated equation (1) adding the residuals from these two steps as regressors, denoting them u_H and u_{frac}[25], as well as their squared value as recommended by Wooldridge (2010) and implemented by Attanasio and Lechene (2014)[26]. Results of these estimations are presented in Table 4.

The first-stage regression is presented in column (1). It shows that the proportion of Hutu computed from the 1993 elections is strongly correlated with the proportion of Hutu computed from the Afrobarometer (F-test = 11.7).

Columns (2) to (5) present the second-stage regressions, with and without fixed effects. It shows that electoral violence is increasing in the proportion of Hutu living in municipalities. The size of this effect is strikingly high. In the extreme case in which the proportion of Hutu increases from 0 to 1, the predicted number of events jumps from 0.14 to 34 events. The coefficient associated with ethnic fractionalization is positive and significant in most specifications, thereby showing that the effect of ethnicity is non-linear. The joint predicted effect of the proportion of Hutu and the ethnic fractionalization is

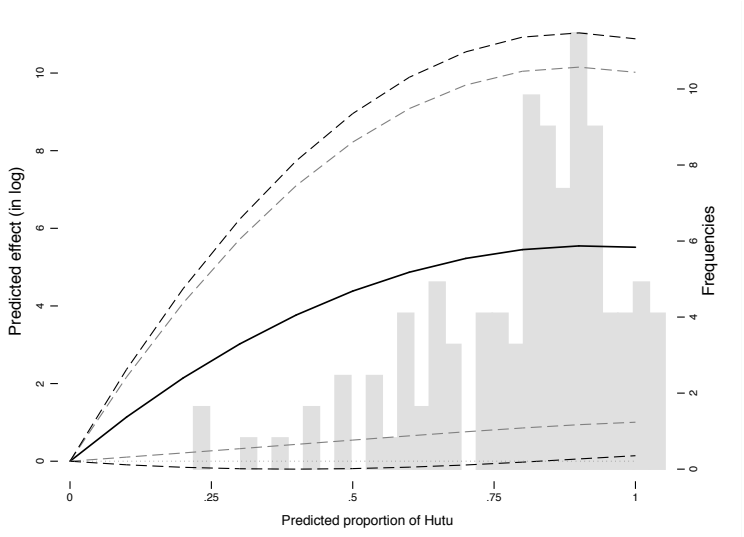
[25] $u_{frac} = \text{Frac}_m^A - \widehat{\text{Frac}_m^A}$

[26] We tested the inclusion of the third and fourth polynomials but they were not significant (not shown)

represented in figure 8. It shows that the role played by Hutu in triggering electoral violence is subject to a saturation effect. The likelihood of electoral violence is increasing in the proportion of Hutu when this proportion is low. However, when they constitute the majority, a marginal increase in their proportion does not have a significant impact on violence. Importantly, the other results are not affected by the two-stage procedure.

The fact that electoral violence is more likely to occur in Hutu municipalities is not surprising. Because they are the minority, the Tutsi had no chance to win the election and had therefore less incentive to engage in electoral violence. In contrast, pro-Hutu parties were hoping to win the elections. This, together with the high degree of uncertainty before the first poll (ICG 2011), implied that pro-Hutu parties had high incentives to engage in electoral malpractices to secure their position. This result is also consistent with the evolution of the Burundian civil war in the 2000s, which has evolved from an inter-ethnic conflict to an intra-ethnic one.

Figure 8: Predicted effect of the ethnic distribution on electoral violence (in log)



6 Robustness of results

6.1 Neighborhood fixed effects

The main specification introduced in equation (1) controls for many observable factors that may explain electoral violence as well as province fixed effects. Despite these precautions, one may still argue that unobservable characteristics of municipalities correlated with electoral violence and with explanatory variables may bias the estimates. In this

Table 4: Results from IV strategy

	First stage	Second stage			
	H^A	Violent Events			
	(1)	(2)	(3)	(4)	(5)
Prop. Hutu 1993 (H^P)	0.689***				
	(0.201)				
H^A		4.438***	4.809***	5.416**	5.512**
		(1.701)	(1.836)	(2.587)	(2.744)
frac^A		0.657**	0.682**	0.668*	0.607
		(0.264)	(0.285)	(0.372)	(0.385)
Political fractionalization	-0.032	-0.051	-0.021	0.207	0.321
	(0.040)	(0.171)	(0.169)	(0.340)	(0.348)
Political polarization	-0.003	-0.018	-0.020	-0.064	-0.113
	(0.030)	(0.122)	(0.123)	(0.204)	(0.200)
Nr. demob per 1000 inhab.	-0.010	-0.112	-0.097	-0.136	-0.116
	(0.009)	(0.070)	(0.071)	(0.092)	(0.093)
Demob. fractionalization	0.025	-0.268*	-0.299**	-0.034	-0.032
	(0.032)	(0.153)	(0.151)	(0.147)	(0.146)
Demob. polarization	-0.027	0.548***	0.570***	0.529***	0.574***
	(0.033)	(0.157)	(0.158)	(0.154)	(0.150)
Median Wealth Index	-0.039	0.625***	0.618***	1.201***	1.193***
	(0.038)	(0.137)	(0.145)	(0.447)	(0.438)
Past violence (log)	-0.008	0.357***	0.364***	0.207	0.197
	(0.019)	(0.117)	(0.117)	(0.142)	(0.137)
Pop. size (log)	0.004	0.957***	0.954***	1.308***	1.290***
	(0.063)	(0.281)	(0.279)	(0.345)	(0.333)
u_H		-5.093***	-4.858***	-7.283**	-7.418**
		(1.671)	(1.680)	(2.999)	(3.181)
u_{frac}		-4.075***	-3.510**	-5.152**	-4.270*
		(1.359)	(1.407)	(2.425)	(2.485)
u_H^2			0.424		-1.846
			(0.839)		(1.155)
u_{frac}^2			3.423		5.090**
			(2.317)		(2.351)
Constant	0.351	-13.865***	-14.296***	-17.578***	-17.636***
	(0.656)	(2.944)	(3.020)	(4.033)	(3.909)
Province FE	No	No	No	Yes	Yes
Observations	106	106	106	106	106
R^2	0.404				
F(1, 96)	11.70				
Deviance residuals		118.955	120.109	118.166	119.663
Pearson dispersion		1.112	1.155	1.370	1.410

Note: robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

section, we use the fact that neighboring municipalities[27] are more likely to be similar in order to minimize this potential source of bias. In particular, we will introduce four different specifications in which each municipality is linked to its neighbors and show that our results are robust to these tighter fixed effects.

Let $m \in [1, M]$ be a municipality, N_m being the set of neighbors of m and $n \in N_m$ being one particular neighbor of m. Let $\mathbf{X}$ be the matrix of regressors in equation (1) and denote violent events, VE, as the dependent variable.

Random pairs. In this first specification, we constitute a sample by matching each municipality m with one of its neighbor[28], selected randomly (Huillery 2009). We estimate equation (6) using this sample of $2 \times (M-1)$ observations.

$$\text{VE}_m - \text{VE}_n = (\mathbf{X}_m - \mathbf{X}_n)\,\beta + \epsilon_m - \epsilon_n \tag{6}$$

To avoid the effect being driven by particular neighborhood designs, we will estimate this regression 500 times and take the average of estimated coefficients and standard errors. Standard errors may not be independent within pairs and will thus be clustered at that level. Results are presented in columns (1) and (2) of table 5. It shows that our results are robust to this alternative specification. In particular, the coefficients associated with demobilized soldiers' polarization and past violence are positive and significant.

All pairs. In this second specification, instead of randomizing pairs, all pairs of neighbors are included in the sample. 702 pairs of neighbors are therefore obtained by matching each municipality with each of its neighbors. Estimations of equation (6) for this alternative sample are presented in columns (3) and (4) of table 5. Since municipalities have many neighbors and are neighbors of many other municipalities, standard errors are clustered at three levels (Cameron *et al.* 2011). The first level is the neighborhood. The second level accounts for the fact that each municipality may be the neighbor of several other municipalities. The third level captures the fact that municipalities are duplicated several times in the sample. Results are presented in columns (3) and (4) of table 5 and are consistent with the previous analysis.

Average characteristics of neighbors. An alternative specification has been proposed Goldstein and Udry (2008), who constructed a within estimator to difference away spatial fixed effects by relying on the average characteristics of neighbors. Similarly to Goldstein and Udry (2008), let us abuse of notation and define N_m to additionally denote the number of neighbors of m. We estimate the following equation.

[27] Neighboring is defined as sharing a common border.
[28] Municipalities have between 3 and 11 neighbors.

$$\mathrm{VE}_m - \frac{1}{N_m}\sum_{n\in N_m}\mathrm{VE}_n = \left(\mathbf{X}_m - \frac{1}{N_m}\sum_{n\in N_m}\mathbf{X}_n\right)\beta + \epsilon_m - \frac{1}{N_m}\sum_{n\in N_m}\epsilon_n \tag{7}$$

Results using this method are presented in columns (5) and (6) of table 5 and are similar to previous estimates.

Neighborhood Fixed Effects. In this alternative specification, we propose to replace the pair fixed effects in equation (6) by neighborhood fixed effects. The estimation of this specification requires a correction of standard errors at two levels to account for the fact that municipalities have many neighbors and are neighbors of many other municipalities. The results are shown in the last two columns of table 5. They are consistent with the results obtained so far.

Table 5: Tight Fixed Effects

	Dependent variable: violent events							
	Random pairs		All pairs		Goldstein and Udry		Neighborhood FE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hutu (prop.)	0.671	0.490	0.779	0.473	-0.020	-0.237	1.062*	0.948
	(0.824)	(0.881)	(0.624)	(0.668)	(1.001)	(1.095)	(0.573)	(0.606)
Ethnic fract. 1993	0.155	0.085	0.142	0.034	0.051	-0.038	0.196**	0.132
	(0.123)	(0.135)	(0.102)	(0.107)	(0.142)	(0.159)	(0.092)	(0.096)
Political fractionalization	0.080	-0.029	0.118	-0.028	0.320	0.214	0.184	0.100
	(0.238)	(0.275)	(0.174)	(0.205)	(0.271)	(0.323)	(0.169)	(0.180)
Political polarization	0.099	0.106	0.083	0.107	0.141	0.166	0.040	0.014
	(0.165)	(0.189)	(0.124)	(0.144)	(0.164)	(0.187)	(0.123)	(0.130)
Nr. demob./inhab.	-0.035	-0.103	-0.057	-0.132**	-0.035	-0.092	-0.058	-0.125*
	(0.067)	(0.077)	(0.053)	(0.057)	(0.081)	(0.107)	(0.055)	(0.066)
Demob. fractionalization	-0.051	-0.073	-0.041	-0.042	-0.048	-0.043	-0.130	-0.124
	(0.155)	(0.175)	(0.115)	(0.136)	(0.181)	(0.187)	(0.114)	(0.127)
Demob. polarization	0.364**	0.441***	0.374***	0.425***	0.382**	0.367**	0.377***	0.425***
	(0.154)	(0.165)	(0.113)	(0.126)	(0.180)	(0.186)	(0.115)	(0.120)
Median Wealth Index	0.184	0.166	0.103	0.151	-0.198	-0.106	0.166*	0.143
	(0.179)	(0.137)	(0.087)	(0.103)	(0.214)	(0.698)	(0.095)	(0.097)
Past violence	0.248*	0.345**	0.318***	0.402***	0.285**	0.356**	0.276**	0.369***
	(0.142)	(0.143)	(0.114)	(0.127)	(0.120)	(0.139)	(0.117)	(0.114)
Pop. size (log)	1.075***	0.938***	1.018***	0.842***	0.886***	0.905**	1.103***	0.944***
	(0.303)	(0.294)	(0.226)	(0.218)	(0.343)	(0.358)	(0.236)	(0.235)
Constant	-11.876***	-10.067***	-11.551***	-9.328***	-0.031	-0.075	-12.275***	-10.436***
	(3.182)	(3.114)	(2.399)	(2.257)	(0.099)	(0.103)	(2.428)	(2.447)
Observations	246	226	1342	1256	123	114	794	742
With Bujumbura Mairie	Yes	No	Yes	No	Yes	No	Yes	No

Note: reported results come from negative binomial regressions. Robust standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.2 Spatial correlation

In this section, we assess whether spatial correlation in the dependent variable could bias our estimates and thereby drive the results. This would occur if both electoral violence and the explanatory variables are spatially clustered. In this case, ignoring spatial interdependence in electoral violence would lead to inconsistent estimates. Reassuringly,

figure 2 does not indicate strong evidence of spatial correlation in electoral violence. This visual impression is confirmed by the fact that the Moran's statistic associated with the indicator of electoral violence is negative and not significant ($p = 0.330$). In other words, the occurrence of violence in one municipality did not seem to have affected electoral violence in neighboring municipalities. Problems of spatial dependence seem to be marginal for our study.

As a robustness check, we nevertheless estimated our model by accounting for spatial dependence. We are not aware of any studies that demonstrated how to obtain consistent estimates for negative binomial models with spatial correlation. We therefore relied on two second-best approaches. We first assessed how results are affected by the introduction of a spatial lag in the negative binomial model (Neumayer and Plümper 2010). Second, we estimated the models developed by Pisati (2010) for linear regression models. These two approaches were applied for two different weighting matrices: one identifying neighboring municipalities (table 6) and one based on latitude and longitude data (table 14 in appendix).

The first two columns of table 6 reproduce the results of the main specification with and without Bujumbura Mairie respectively. Columns (3) and (4) show how these results are affected when a spatial lag constructed with a weighting matrix identifying neighboring municipalities is included. Columns (5) and (6) present the results of a linear spatial lag regression model. Columns (7) and (8) show the results of a linear spatial error regression model. Table 14 in appendix has a similar structure, but the weighting matrix considered in the regressions was constructed with latitude and longitude data[29].

The different estimation strategies and the two different weighting matrices give similar results. Overall, we do not find any evidence that spatial dependence could drive the results. If anything, spatial correlation in the dependent variable seems to be negative, leading to the underestimation of the effect of the polarization of ex-rebel groups on electoral violence.

6.3 Propensity Score Matching

Assessing the impact of a treatment on an outcome variable may be complicated by non-random selection into treatment. Controlling for the variables affecting the selection process only solves the selection issue if they affect the selection process linearly. Propensity score matching (PSM) aims at correcting the selection bias that may arise if the selection into treatment is not random and following a complex nonlinear pattern which is function of observables. In the context of our study, such a selection bias would occur if

[29]In table 14, coordinates of municipalities and their power are included in the first two regressions.

Table 6: Accounting for spatial correlation

	Dependent variable: violent events							
	Main specification		Spatial Lag		Linear spatial lag		Linear spatial error	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prop. Hutu votes 1993	0.936	0.840	1.407*	1.748*	-0.734	0.596	-0.598	0.963
	(0.771)	(0.819)	(0.782)	(0.899)	(3.159)	(3.311)	(3.544)	(3.381)
Ethnic fract. 1993	0.141	0.087	0.213*	0.218*	0.335	0.249	0.403	0.358
	(0.121)	(0.125)	(0.114)	(0.120)	(0.342)	(0.309)	(0.378)	(0.335)
Political fractionalization	0.189	0.160	0.207	0.251	0.678	0.697	0.831	1.029
	(0.245)	(0.269)	(0.246)	(0.285)	(0.843)	(0.819)	(0.912)	(0.862)
Political polarization	0.020	-0.018	-0.059	-0.171	0.349	-0.102	0.253	-0.343
	(0.162)	(0.180)	(0.164)	(0.183)	(0.684)	(0.659)	(0.729)	(0.702)
Nr. demob per 1000 inhab.	-0.032	-0.083	-0.005	-0.065	0.316	-0.056	0.303	-0.016
	(0.081)	(0.093)	(0.082)	(0.092)	(0.393)	(0.328)	(0.392)	(0.310)
Demob. fractionalization	-0.053	-0.045	-0.068	-0.052	-0.591	-0.651	-0.618	-0.734*
	(0.124)	(0.139)	(0.132)	(0.143)	(0.435)	(0.472)	(0.419)	(0.440)
Demob. polarization	0.326**	0.428***	0.333**	0.464***	1.210**	1.670***	1.243**	1.863***
	(0.135)	(0.145)	(0.140)	(0.143)	(0.565)	(0.548)	(0.569)	(0.549)
Median Wealth Index	0.112	0.151	0.124	0.192**	0.212	0.804*	0.447	1.085**
	(0.146)	(0.099)	(0.146)	(0.092)	(0.740)	(0.412)	(0.805)	(0.438)
Past violence (log)	0.226	0.283**	0.160	0.160	0.637	1.092**	0.699	1.066*
	(0.154)	(0.133)	(0.152)	(0.121)	(0.661)	(0.551)	(0.675)	(0.549)
Pop. size (log)	1.075***	0.974***	1.023***	0.864***	5.216***	4.144***	5.303***	4.306***
	(0.322)	(0.313)	(0.316)	(0.297)	(1.457)	(1.369)	(1.476)	(1.430)
Spatial Lag violent events			-0.539***	-0.694***				
			(0.181)	(0.189)				
Constant	-12.019***	-10.726***	-11.078***	-8.961***	-57.555***	-45.295***	-59.566***	-48.777***
	(3.314)	(3.364)	(3.271)	(3.235)	(15.197)	(14.611)	(15.203)	(14.742)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	114	123	114	123	114	123	114
With Bujumbura Mairie	Yes	No	Yes	No	Yes	No	Yes	No
Deviance residuals	135.137	128.157	135.166	132.019				
Pearson dispersion	1.174	1.305	1.203	1.390				

Note: reported results in columns (1) to (4) come from negative binomial regressions. Columns (5) to (8) report estimates from OLS.

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

the difference in electoral violence between two groups of municipalities, characterized by low and high demobilized soldiers' polarization respectively, would be due to confounding variables that also affect the distribution of demobilized soldiers in a nonlinear way. In this case, PSM aims to create and compare treatment and control groups that have a similar propensity of being polarized conditional on the covariates in equation (1).

Table 7: Propensity Score Matching

	Full sample				
	N. Treated	N. Control	ATT	Std. error	t
Nearest Neighbour	56	63	2.20	1.00	2.19
Kernel	56	63	1.93	0.96	2.01
	Without Bujumbura Mairie				
Nearest Neighbour	38	57	2.24	1.28	1.74
Kernel	36	57	2.79	1.12	2.49

In order to take into account the aforementioned selection bias, we implement the nearest neighbor and kernel propensity score matching methods. In this way, we adjust for pre-treatment observable differences between the treatment (highly polarized municipalities) and the control groups (weakly polarized municipalities) (Becker and Ichino 2002; Leuven and Sianesi 2003). Highly polarized municipalities are identified by a dummy variable equal to 1 for municipalities characterized by demobilized soldiers' polarization above the median. We control for the treatment and the control groups being balanced and for complete overlapping in the common support.

The results from propensity score matching are presented in table 7. In accordance with previous results, both matching methods estimate a positive Average Treatment effect on the Treated (ATT), independently on whether Bujumbura Mairie is included or not in the sample. Highly polarized municipalities present on average two more violent episodes than if they were characterized by low demobilized soldiers' polarization.

6.4 Falsification and Placebo tests

Falsification and placebo tests aim at testing whether the relationships captured in our regressions may be induced by the specific nature of the variables of interest.

Falsification. The falsification test proposes to replace the dependent variable by another variable which is related in nature, but which is not expected to be affected by the same regressors of interest. Applied to our case, it aims to test whether the polarization of ex-combatants affects other types of violence (i.e. non political) when it should not.

First, an indicator of domestic violence was computed using data from the 2010 DHS survey. For each municipality where the DHS has been conducted, we compute proportion of individuals[30] who think that beating is justified in at least one of the five following situations: the wife goes out without telling her husband, she neglects children, she argues with her husband, she refuses to have sex with him or she burns the food.

Second, we rely on the fifth round of the Afrobarometer survey to build two proxies for crime prevalence. The first indicator measures how often households have feared crime in their own house[31]. The second proxy for crime is the proportion of people that have reported "crime and security" as one of the three most important problems faced by

[30]Interviews were conducted among men and women separately. Both give the same results. We only report women given that the sample was larger, and hence the proportion better estimated.

[31]Possible responses are never, just once or twice, few times, many times or always. For constructing the proxy for crime, we created a dummy variable equal to one if they already feared crime at least a few times. Results are robust to the alternative definition measuring the proportion of people who had feared crime at least once (not shown).

Table 8: Falsification tests

	Domestic violence		Fearing crime		Crime as important issue	
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Hutu votes 1993	0.065	0.047	0.085	0.081	-0.252**	-0.239**
	(0.102)	(0.101)	(0.078)	(0.073)	(0.115)	(0.119)
Ethnic fract. 1993	-0.022	-0.024	-0.001	-0.007	0.019	0.017
	(0.018)	(0.019)	(0.013)	(0.013)	(0.020)	(0.021)
Political fractionalization	0.042	0.021	0.009	-0.002	-0.078*	-0.075
	(0.038)	(0.045)	(0.025)	(0.023)	(0.047)	(0.048)
Political polarization	-0.028	-0.020	-0.023	-0.016	0.036	0.040
	(0.028)	(0.035)	(0.018)	(0.018)	(0.031)	(0.033)
Nr. demob per 1000 inhab.	0.019	0.021	-0.005	-0.007	-0.007	-0.010
	(0.012)	(0.013)	(0.010)	(0.010)	(0.014)	(0.014)
Demob. fractionalization	0.018	0.002	-0.008	-0.009	-0.022	-0.019
	(0.019)	(0.020)	(0.014)	(0.016)	(0.024)	(0.026)
Demob. polarization	-0.005	0.012	0.010	0.009	0.029	0.021
	(0.021)	(0.023)	(0.018)	(0.021)	(0.023)	(0.027)
Median Wealth Index	-0.072***	0.034**	-0.052***	0.013	0.035	0.008
	(0.021)	(0.017)	(0.010)	(0.016)	(0.022)	(0.019)
Past violence (log)	0.013	0.013	0.009	0.009	-0.001	-0.011
	(0.015)	(0.017)	(0.010)	(0.012)	(0.017)	(0.022)
Pop. size (log)	-0.027	-0.059	-0.060**	-0.075**	0.033	0.040
	(0.046)	(0.049)	(0.029)	(0.033)	(0.051)	(0.055)
Constant	0.716	1.102**	0.902***	1.100***	0.206	0.175
	(0.504)	(0.536)	(0.320)	(0.383)	(0.539)	(0.589)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	114	106	101	106	101
With Bujumbura Mairie	Yes	No	Yes	No	Yes	No
R^2	0.553	0.383	0.546	0.547	0.420	0.422

Note: reported results come from OLS regressions. Robust standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Burundi[32].

Results are reported in table 8. These regressions are estimated using Ordinary Least Squares. It shows estimates with and without Bujumbura Mairie. The first two columns use domestic violence as dependent variable, the next two use the proportion of people who have feared crime at least few times, and the last ones use the share of people thinking that crime and security is an important issue. The test is conclusive for all three indicators, as we do not find any impact of the polarization of ex-rebels on these alternative dependent variables.

Placebo. The placebo test consists of replacing the main regressor of interest by a variable of similar nature, but which is not expected to have predictive power on the

[32]Only 111 municipalities out of the 129 original were surveyed in the Afrobarometer, which decreases our sample size.

dependent variable. In our case, the placebo test looks at whether different polarization indexes matter in explaining electoral violence when it should not.

We test this with two different polarization indexes, based on age-groups and on religion respectively. The former stems from the hypothesis that youth bulges may be a source of conflict (Urdal 2006). Nonetheless, it is the bulge itself, not the age-group polarization that could eventually matter[33]. Then, religious diversity has been explored along ethnic diversity in the literature on the causes of civil conflict (see the review of Blattman and Miguel (2010)). However, neither religious beliefs nor the resulting polarization index should affect electoral violence in the context of Burundi, where ethnicity rather than religion fueled violence in the past.

In order to construct the age polarization index, we first divided the DHS sample into alternative age-group scenarios. Starting from individual ages, we assigned every individual in a group, and computed the proportion of individual in each group at the municipality level. These proportions were then used to compute an index of age polarization at the municipality level[34].

The religious polarization index also relies on DHS data, which classifies men and women into 7 groups according to their religion (no religion, catholic, protestant, muslim, adventist, jehova witness and other). Indexes of religious polarization were computed at the municipality level for both men and women by following the same steps as for age-group polarization. Results are presented in table 9. It only reports results with the men's index, but results are similar with the index from women. Reassuringly, none of the placebo polarization indexes enters significantly in the regressions.

7 Conclusion

In the last four decades, 80% of elections in sub-Saharan Africa suffered from some form of violence, bribery, intimidation or inequitable government interference (Bishop and Hoeffler 2014). Understanding the causes of electoral misconduct is of crucial importance for strengthening the legitimacy of young democracies, encouraging social cohesion and minimizing the risks of relapse into civil war. The current academic debate on the causes of electoral fraud and violence focused on five main triggers: ethnic grievances, political competition, struggle over resources, feasibility and weak institutions. This paper tested

[33]We tested this theory, and the number of young people has no impact on electoral violence when controlling for population size (not shown).

[34]Results are reported for a distribution of individuals according to the following categories: $[0, 15[$, $[15, 40[$, $[40, 60[$, $[60, 80[$, $[80, 99[$. Alternative scenarios give the same results (not shown).

Table 9: Placebo tests

	Dependent variable: violent events			
	(1)	(2)	(3)	(4)
Prop. Hutu votes 1993	0.792	0.534	0.831	0.585
	(0.758)	(0.812)	(0.773)	(0.839)
Ethnic fract. 1993	0.030	-0.036	0.046	-0.040
	(0.114)	(0.122)	(0.116)	(0.113)
Political fractionalization	0.064	-0.139	0.018	-0.121
	(0.226)	(0.239)	(0.220)	(0.234)
Political polarization	0.178	0.263	0.202	0.250
	(0.134)	(0.161)	(0.134)	(0.155)
Nr. demob per 1000 inhab.	-0.031	-0.129	-0.061	-0.138
	(0.088)	(0.092)	(0.077)	(0.092)
Median Wealth Index	0.061	0.105	0.114	0.108
	(0.142)	(0.108)	(0.144)	(0.101)
Past violence (log)	0.207	0.301**	0.202	0.323**
	(0.140)	(0.134)	(0.146)	(0.138)
Pop. size (log)	1.069***	0.874***	1.074***	0.887***
	(0.355)	(0.337)	(0.349)	(0.336)
Age-group fractionalization	-0.126	0.050		
	(0.111)	(0.173)		
Age-group polarization	-0.093	0.078		
	(0.099)	(0.165)		
Religious fractionalization			-0.032	0.026
			(0.217)	(0.239)
Religious polarization			0.007	-0.066
			(0.224)	(0.249)
Constant	-11.862***	-9.260***	-11.705***	-9.394***
	(3.684)	(3.430)	(3.628)	(3.552)
Province FE	Yes	Yes	Yes	Yes
Observations	123	114	123	114
With Bujumbura Mairie	Yes	No	Yes	No
Deviance residuals	135.416	126.178	135.237	125.780
Pearson dispersion	1.200	1.239	1.177	1.248

Note: reported results come from negative binomial regressions.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

these hypotheses by investigating the causes of 2010 electoral violence in Burundi.

Our study emphasized the involvement of ex-combatants in perpetrating electoral violence, a cause that has been neglected in the literature. In particular, our analysis showed that the violence which affected the 2010 electoral cycle in Burundi was mainly caused by old tensions between Hutu ex-rebel groups which recurred throughout electoral competition. We found that an acute polarization between ex-rebel groups was highly conducive to electoral violence. This effect was particularly strong in pro-Hutu municipalities. Furthermore, we showed that electoral violence was more likely to emerge in

municipalities which were already affected by violence during the 1993-2009 civil war.

In contrast, we did not find support for the ethnic hypothesis. Rather than ethnic grievances between the Hutu and the Tutsi, measured by an ethnic fractionalization index, it is the proportion of Hutu that has been driving electoral violence. While ethnic rivalries for holding power were the main causes of the 1965, 1972 and 1988 massacres and of the 1993-2009 civil war, ethnic cleavages did not trigger electoral violence in 2010. Interestingly, political competition between parties did not matter either, when tensions between ex-rebel groups are accounted for. Our results therefore indicate that the roots of violence in Burundi switched to an intra-Hutu competition between rebel groups to capture the benefit of power.

Our study conveys that demobilization programs alone may be insufficient to prevent the resurgence of violence. Policies aiming to facilitate the transition from rebellion to political competition are needed in post-conflict settings. In addition to prevention campaigns among civilians, campaigns against violence should be targeted more specifically to ex-combatants and their parties.

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Appendix

A Absolute vs. squared polarization indexes

In order to limit the influence of outliers, the ex-rebels' and the political polarization indexes were computed with an absolute value function rather than a square function. Formally, we define polarization as $1 - \sum_{i=1}^{N} \left| \frac{0.5-\pi_i}{0.5} \right| \pi_i$ instead of the usual formulation $1 - \sum_{i=1}^{N} \left(\frac{0.5-\pi_i}{0.5} \right)^2 \pi_i$ proposed by Garcia-Montalvo and Reynal-Querol (2005). Figure 9 illustrates the differences between these two definitions. While the two indexes are strongly correlated, it shows that the intermediate value of polarization increase when the square function is used, thereby increasing "artificially" the weight of observations characterized by low polarization in the regressions.

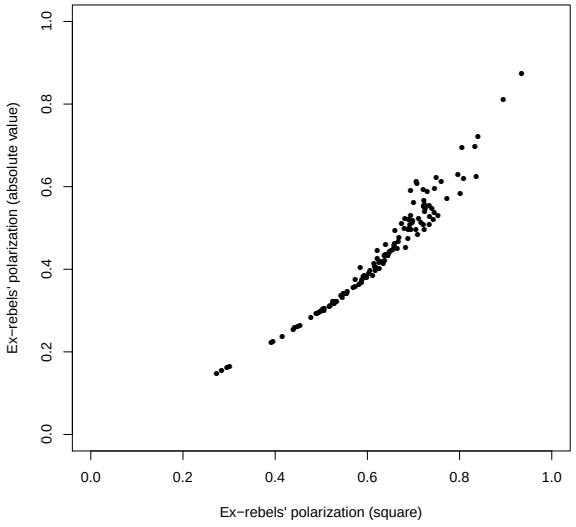

Figure 9: Comparison of ex-rebels' polarization indexes

Table 10 shows how our results are affected by the use of this alternative definition. The first column reproduces the results presented in table 2. In column (2), the polarization indexes with a square function are used. In column (3), the square definition is also used but outliers are removed from the sample. Outliers are defined as the observations whose standardized deviance residuals are greater than 2 (Hilbe 2011). In column (4), both outliers and observations from Bujumbura Mairie are excluded. In line with our expectation, results are similar, but less significant when the polarization index of Garcia-Montalvo and Reynal-Querol (2005) is used. However, when outliers are removed, both indexes measuring ex-rebels' polarization are positive and significant, confirming the robustness of our results. Removing observations from Bujumbura Mairie further strengthens this conclusion. The coefficient associated with the standardized index of wealth becomes significant at the 5% level, indicating that richer municipalities

were more subject to electoral violence. This is in line with the "greed" hypothesis: violence occurred in wealthier municipalities, where more resources are available for looting and rent-seeking.

Table 10: Robustness of results: polarization indexes

	Dependent variable: violent events			
	(1)	(2)	(3)	(4)
Prop. Hutu votes 1993	0.936	0.718	0.511	-0.363
	(0.771)	(0.796)	(0.741)	(0.785)
Ethnic fract. 1993	0.141	0.105	0.130	-0.035
	(0.121)	(0.127)	(0.123)	(0.134)
Political fractionalization	0.189	0.043	-0.098	-0.246
	(0.245)	(0.280)	(0.254)	(0.297)
Political polarization	0.020			
	(0.162)			
Nr. demob per 1000 inhab.	-0.032	-0.046	-0.023	-0.002
	(0.081)	(0.081)	(0.065)	(0.085)
Demob. fractionalization	-0.053	-0.009	-0.092	-0.081
	(0.124)	(0.140)	(0.125)	(0.135)
Demob. polarization	0.326**			
	(0.135)			
Median Wealth Index	0.112	0.105	0.094	0.280**
	(0.146)	(0.143)	(0.122)	(0.125)
Past violence (log)	0.226	0.194	0.275***	0.153
	(0.154)	(0.148)	(0.100)	(0.109)
Pop. size (log)	1.075***	1.089***	1.007***	1.204***
	(0.322)	(0.315)	(0.257)	(0.235)
Political polarization (sq.)		0.147	0.149	0.274
		(0.192)	(0.164)	(0.195)
Demob. polarization (sq.)		0.234*	0.301**	0.376**
		(0.141)	(0.129)	(0.173)
Constant	-12.019***	-11.888***	-11.905***	-13.276***
	(3.314)	(3.228)	(2.655)	(2.445)
Province FE	Yes	Yes	Yes	Yes
Observations	123	123	114	106
With Bujumbura Mairie	Yes	Yes	No	No
Excluding outliers	No	No	No	Yes
Deviance residuals	135.137	135.728	120.073	120.249
Pearson dispersion	1.174	1.168	1.260	1.445

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B Additional tables

Table 11: Clustering

	Dependent variable: violent events					
	Robust	Cluster-robust[1]	Pairs bootstrapping	Robust	Cluster-robust[1]	Pairs bootstrapping
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Hutu votes 1993	1.169*	1.169**	1.169*	0.936	0.936*	0.936
	(0.697)	(0.479)	(0.669)	(0.771)	(0.543)	(0.683)
Ethnic fract. 1993	0.285***	0.285**	0.285**	0.141	0.141	0.141
	(0.103)	(0.114)	(0.127)	(0.121)	(0.119)	(0.129)
Political fractionalization	-0.024	-0.024	-0.024	0.189	0.189	0.189
	(0.143)	(0.118)	(0.225)	(0.245)	(0.199)	(0.271)
Political polarization	0.069	0.069	0.069	0.020	0.020	0.020
	(0.110)	(0.086)	(0.131)	(0.162)	(0.125)	(0.186)
Nr. demob per 1000 inhab.	-0.056	-0.056	-0.056	-0.032	-0.032	-0.032
	(0.057)	(0.060)	(0.075)	(0.081)	(0.079)	(0.088)
Demob. fractionalization	-0.296**	-0.296**	-0.296**	-0.053	-0.053	-0.053
	(0.134)	(0.139)	(0.137)	(0.124)	(0.122)	(0.116)
Demob. polarization	0.453***	0.453***	0.453***	0.326**	0.326**	0.326**
	(0.136)	(0.127)	(0.153)	(0.135)	(0.136)	(0.163)
Median Wealth Index	0.367***	0.367***	0.367	0.112	0.112	0.112
	(0.133)	(0.088)	(1.144)	(0.146)	(0.095)	(1.299)
Past violence (log)	0.303***	0.303**	0.303**	0.226	0.226	0.226
	(0.105)	(0.119)	(0.143)	(0.154)	(0.153)	(0.161)
Pop. size (log)	0.838***	0.838***	0.838***	1.075***	1.075***	1.075***
	(0.254)	(0.288)	(0.316)	(0.322)	(0.346)	(0.356)
Constant	-9.296***	-9.296***	-9.296***	-12.019***	-12.019***	-12.019***
	(2.593)	(3.019)	(3.266)	(3.314)	(3.601)	(3.614)
Province FE	No	No	No	Yes	Yes	Yes
Observations	123	123	123	123	123	123
Deviance residuals	137.732	137.732	137.732	135.137	135.137	135.137
Pearson dispersion	1.022	1.022	1.022	1.174	0.998	1.174

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. With residuals and degrees of freedom corrections provided by STATA (Cameron *et al.* 2008) .

Table 12: Introducing variables one by one

	Dependent variable: violent events										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Prop. Hutu votes 1993	1.456**										0.936
	(0.587)										(0.771)
Ethnic fract. 1993		-0.000									0.141
		(0.120)									(0.121)
Political fractionalization			0.159								0.189
			(0.164)								(0.245)
Political polarization				0.255***							0.020
				(0.095)							(0.162)
Nr. demob per 1000 inhab.					0.097						-0.032
					(0.069)						(0.081)
Demob. fractionalization						0.270**					-0.053
						(0.116)					(0.124)
Demob. polarization							0.225**				0.326**
							(0.098)				(0.135)
Median Wealth Index								-0.286**			0.112
								(0.134)			(0.146)
Past violence (log)									0.432***		0.226
									(0.092)		(0.154)
Pop. size (log)										1.345***	1.075***
										(0.204)	(0.322)
Constant	-0.045	1.099**	1.126**	1.084**	0.406	0.838	1.081*	1.005*	-0.606	-13.755***	-12.019***
	(0.762)	(0.554)	(0.510)	(0.492)	(0.866)	(0.526)	(0.601)	(0.551)	(0.640)	(2.376)	(3.314)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	124	124	129	129	129	129	129	128	129	129	123
Deviance residuals	137.646	138.316	144.062	144.290	144.325	143.017	143.639	143.015	143.992	144.267	135.137
Pearson dispersion	1.109	1.092	1.096	1.124	1.107	1.081	1.119	1.086	0.983	1.146	1.174

Robust standard errors in parentheses. Sample size decrease by 5 when 1993 election data are used, and by one more when DHS data are used.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Heterogenous effects

	Dependent variable: violent events			
	(1)	(2)	(3)	(4)
Prop. Hutu votes 1993	0.888	0.739	0.659	0.641
	(0.762)	(0.822)	(0.830)	(0.865)
Ethnic fract. 1993	0.138	0.075	0.139	0.088
	(0.120)	(0.126)	(0.124)	(0.125)
Political fractionalization	0.090	0.036	0.072	0.095
	(0.245)	(0.294)	(0.277)	(0.286)
Political polarization	0.057	0.038	0.118	0.043
	(0.154)	(0.185)	(0.192)	(0.195)
Nr. demob per 1000 inhab.	-0.048	-0.107	-0.031	-0.077
	(0.083)	(0.101)	(0.080)	(0.092)
Demob. fractionalization	-0.026	-0.017	0.011	0.002
	(0.125)	(0.138)	(0.135)	(0.153)
Demob. polarization	0.049	0.118	0.615**	0.637**
	(0.243)	(0.268)	(0.246)	(0.269)
Median Wealth Index	0.151	0.179	0.118	0.130
	(0.146)	(0.109)	(0.153)	(0.108)
Past violence (log)	0.237	0.306**	0.247*	0.299**
	(0.152)	(0.133)	(0.147)	(0.135)
Pop. size (log)	1.132***	0.996***	0.990***	0.942***
	(0.325)	(0.312)	(0.311)	(0.306)
Demob. pol. * Prop. Hutu	0.411	0.445		
	(0.331)	(0.336)		
Demob. pol. * Past violence			-0.131	-0.093
			(0.090)	(0.094)
Constant	-12.585***	-10.845***	-11.022***	-10.371***
	(3.362)	(3.346)	(3.213)	(3.285)
Province FE	Yes	Yes	Yes	Yes
Observations	123	114	123	114
With Bujumbura Mairie	Yes	No	Yes	No
Deviance residuals	135.216	127.896	135.584	128.386
Pearson dispersion	1.203	1.325	1.206	1.335

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Accounting for spatial correlation based on coordinates

	Dependent variable: violent events							
	Negbin including polynomial coordinates		Negbin including Spatial lag		Spatial regression model		Spatial error model	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prop. Hutu votes 1993	1.127	1.076	0.978	0.822	-0.705	-0.894	-1.510	-0.990
	(0.790)	(0.842)	(0.777)	(0.824)	(3.086)	(3.130)	(3.129)	(3.162)
Ethnic fract. 1993	0.147	0.096	0.147	0.084	0.363	0.202	0.300	0.116
	(0.121)	(0.127)	(0.123)	(0.127)	(0.366)	(0.333)	(0.356)	(0.332)
Political fractionalization	0.281	0.286	0.194	0.146	0.861	0.751	0.816	0.610
	(0.249)	(0.260)	(0.240)	(0.268)	(0.873)	(0.836)	(0.911)	(0.865)
Political polarization	-0.034	-0.095	0.013	-0.014	0.233	-0.073	0.293	0.016
	(0.163)	(0.174)	(0.150)	(0.173)	(0.655)	(0.662)	(0.713)	(0.712)
Nr. demob per 1000 inhab.	-0.023	-0.072	-0.028	-0.090	0.230	-0.057	0.254	-0.087
	(0.082)	(0.095)	(0.079)	(0.094)	(0.361)	(0.328)	(0.392)	(0.335)
Demob. fractionalization	-0.049	-0.024	-0.082	-0.094	-0.792*	-0.904**	-0.609	-0.545
	(0.157)	(0.169)	(0.121)	(0.142)	(0.428)	(0.456)	(0.431)	(0.480)
Demob. polarization	0.284*	0.387**	0.368***	0.465***	1.548***	1.936***	1.334**	1.590***
	(0.162)	(0.170)	(0.132)	(0.146)	(0.561)	(0.572)	(0.540)	(0.574)
Median Wealth Index	0.070	0.138	0.210	0.191*	0.571	0.749*	0.300	0.744*
	(0.146)	(0.102)	(0.153)	(0.102)	(0.695)	(0.416)	(0.744)	(0.418)
Past violence (log)	0.230	0.280**	0.188	0.272**	0.700	1.176**	0.766	1.247**
	(0.157)	(0.130)	(0.151)	(0.129)	(0.598)	(0.527)	(0.623)	(0.562)
Pop. size (log)	0.895***	0.809**	1.093***	0.957***	5.172***	4.344***	5.192***	4.431***
	(0.333)	(0.318)	(0.314)	(0.312)	(1.417)	(1.364)	(1.440)	(1.393)
Latitude	-46.961	-50.801						
	(71.219)	(71.458)						
Latitude^2	0.784	0.851						
	(1.186)	(1.191)						
Longitude	-22.248	-13.870						
	(40.218)	(41.739)						
Longitude^2	-6.119	-3.542						
	(12.301)	(12.738)						
Longitude^3	-0.510	-0.253						
	(1.245)	(1.288)						
Spatial Lag violent events			-0.001*	-0.001				
			(0.001)	(0.001)				
Constant	667.611	732.255	-11.072***	-9.625***	-50.665***	-43.529***	-54.100***	-49.310***
	(1071.503)	(1071.454)	(3.246)	(3.585)	(15.545)	(15.470)	(15.982)	(15.489)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	123	114	123	114	123	114	123	114
With Bujumbura Mairie	Yes	No	Yes	No	Yes	No	Yes	No
Deviance residuals	134.534	127.845	137.249	128.983				
Pearson dispersion	1.222	1.366	1.211	1.312				

Robust standard errors in parentheses. Latitude^3 omitted as perfectly correlated with Latitude^2.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$