



**Violence Exposure and Welfare over Time :  
Evidence from the Burundi Civil War**

Marion Mercier

SBS-EM, ECARES, Université libre de Bruxelles and DIAL-IRD IZA

Rama Lionel Ngenzebuke

SBS-EM, ECARES, Université libre de Bruxelles

Philip Verwimp

SBS-EM, ECARES, CEB, Université libre de Bruxelles

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# Violence exposure and welfare over time: Evidence from the Burundi civil war\*

Marion Mercier<sup>†</sup> Rama Lionel Ngenzebuke<sup>‡</sup> Philip Verwimp<sup>§</sup>

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## *Abstract*

We investigate the relationship between exposure to conflict and poverty dynamics over time, using original three-waves panel data for Burundi which tracked individuals and reported local-level violence exposure from 1998 to 2012. Firstly, the data reveal that headcount poverty has not changed since 1998 while we observe multiple transitions into and out of poverty. Moreover, households exposed to the war exhibit a lower level of welfare than non-exposed households, with the difference between the two groups predicted to remain significant at least until 2017, i.e. twelve years after the conflict termination. The correlation between violence exposure and deprivation over time is confirmed in a household-level panel setting. Secondly, our empirical investigation shows how violence exposure over different time spans interacts with households' subsequent welfare. Our analysis of the determinants of households' likelihood to switch poverty status (i.e. to fall into poverty or escape poverty) combined with quantile regressions suggest that, (i) exposure during the first phase of the conflict has affected the entire distribution, and (ii) exposure during the second phase of the conflict has mostly affected the upper tail of the distribution: initially non-poor households have a higher propensity to fall into poverty while initially poor households see their propensity to pull through only slightly decrease with recent exposure to violence. Although not directly testable with the data at hand, these results are consistent with the changing nature of violence in the course of the Burundi civil war, from relatively more labour-destructive to relatively more capital-destructive.

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*Keywords:* Deprivation, Poverty dynamics, Civil war, Panel data, Burundi.

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<sup>†</sup>IRES, Université Catholique de Louvain; DIAL – IRD; IZA, Bonn. E-mail: marion.mercier@uclouvain.be.

<sup>‡</sup>SBS-EM, ECARES and CERMI, Université Libre de Bruxelles. E-mail: ngenzeramajlionel@yahoo.fr

<sup>§</sup>SBS-EM, ECARES, Université Libre de Bruxelles. E-mail: philip.verwimp@ulb.ac.be

# 1 Introduction and historical background

After a peak in the early nineties following the end of the Cold War and a decline thereafter, global conflict numbers have increased again since 2010 (see ACLED data (Raleigh et al., 2010), 2015 version). From 1946 to 2012, the world has witnessed more than 250 civil wars, civil conflicts have kicked off every year in 1 to 2% of countries, and have lasted 4 years on average (Simon Fraser University, 2013). Civil wars can affect outcomes as varied as poverty, institutions, human capital and economic growth, which are also potential factors of risk for the reoccurrence of conflict. Improving knowledge on the consequences of wars, identifying and understanding the various effects of conflicts and their persistence over time, thus appears as a key research challenge to enlighten post-conflict policy making and the management of conflict risk.

This paper investigates the legacies of violence on poverty, adopting a micro-level approach with data on Burundi. The civil war in Burundi started in 1993, following the assassination of the country's first democratically-elected president, Melchior Ndadaye, three months after his arrival in power. This murder triggered brutal attacks by Hutu groups followed by violent retaliation by the Tutsi-dominated army. The conflict, starting from the north-western parts of the country, soon spread toward the northeastern, central and southern provinces. Until 2005, the whole country was concerned by violence, though at different degrees and periods (United Nations, 1996; Chrétien and Mukuri, 2002; Bundervoet, Verwimp, and Akresh, 2009). Between 1993 and 2005, the conflict eventually left over 300,000 Burundians dead (Ngaruko and Nkurunziza, 2000).

The consequences of civil wars have received increasing attention from economists over the recent years. On the macro side, the literature notably shows that civil wars cause steep short-run falls in output (Cerra and Saxena, 2008), massive destruction of capital (Annan et al., 2006) and outflows of mobile capital (Collier, Hoeffler, and Pattillo, 2004). Although such effects are expected to affect the aggregate incidence of poverty, it is less clear how they persist over time. In particular, how the disruption of institutions and technology as well as the economic and political uncertainty that follow a conflict endanger the post-war recovery predicted by the neoclassical growth model remains understudied (Blattman and Miguel, 2010).

On the micro side, a nascent literature has started to investigate the consequences of civil wars.

Justino (2012) provides a thorough overview of the various effects of war on poverty. We do not claim to be as complete as the latter paper here. To enlighten the empirical investigation that follows, we simply recall four main (non-exclusive) micro-level mechanisms through which violence exposure is expected to affect welfare and poverty over time.

*First*, war-related deaths and casualties affect the composition of households and thus their labour endowment. Direct excess mortality has notably been shown to target young men (De Walque and Verwimp, 2010). Labour being the main input in the production function of many households, this could result into a shrink in the ratio of net producers to net consumers within the household, and eventually translate into a higher prevalence of poverty in war-affected areas. In addition to the direct deaths, referred to as the “missing males”, Guha-Sapir and D’Aoust (2011) underline the indirect deaths caused by disease, hunger or lack of care. Injuries, disability and post-war psychological trauma may also impede the working ability of the surviving household members. Finally, violence induces modifications of fertility behaviours (Lindstrom and Berhanu, 1999; Agadjanian and Prata, 2002; Blanc, 2004; Kalemli-Ozcan, 2003). These can also translate into demographic shifts which are likely to interact with households’ poverty over time.

*Second*, aside from its demographic effects, violence exposure might reduce the accumulation of human capital of those living in war-related areas, which can have persistent consequences on post-war micro-economic outcomes. It is in particular the case if dead or disabled adult workers are replaced by child labour, or if children are recruited as fighters (Justino, 2012). More generally, civil wars have been shown to impede children’s nutritional and health outcomes (Alderman, Hoddinott, and Kinsey, 2006; Bundervoet, Verwimp, and Akresh, 2009; Akresh, Verwimp, and Bundervoet, 2011), and schooling outcomes (Akresh and de Walque, 2008), with possible heterogeneity across gender and education cycle (Shemyakina, 2011; Chamarbagwala and Moran, 2011; Swee, 2015). Such effects might translate into long-run consequences, since childhood outcomes such as health status have been shown to affect economic outcomes during adulthood, notably income and labour supply (Smith, 2009). Pre-school malnutrition also has significant detrimental impacts on human capital formation (Alderman, Hoddinott, and Kinsey, 2006), and there is evidence that less education translates into lower labour market outcomes (Ichino and Winter-Ebmer, 2004), which can

eventually lead to increased poverty.

*Third*, conflict often causes the loss or destruction of productive assets such as land or cattle (Brück, 2001; González and Lopez, 2007; Shemyakina, 2011). This impedes on important sources of households' livelihood, and can thus affect critically their productive capacity. The literature suggests that the micro-level impact of conflict-related destruction of physical capital depends on households' characteristics. Asset endowment shapes households' vulnerability to conflict, as some assets may be more or less easily looted (Bundervoet, 2010). The household's own involvement in the conflict can also play a role: while war-passive households are vulnerable to the destruction of physical capital, groups which are actively engaged in conflict may take advantage of extortions during the war (Wood, 2003; Brockett, 1998; Keen, 1998).

*Fourth*, beyond physical and human capital, civil conflicts affect social capital and attitudes, which might have durable effects on household-level outcomes. In a theoretical paper, Rohner, Thoenig, and Zilibotti (2013b) show that violence erodes trust and social capital, a result which is empirically confirmed in the case of Uganda in Rohner, Thoenig, and Zilibotti (2013a). However, in different settings, Bellows and Miguel (2009) find that more victimized people during the Sierra Leone conflict became more likely to attend community meetings and to join social and political groups in the aftermath of the war, and Voors et al. (2012) show that individuals exposed to the civil war in Burundi subsequently displayed more altruism and risk-seeking behaviors. Although non-univocal regarding the direction of the effects, the literature thus suggests that exposure to violence can have long-run consequences on individuals' attitudes – for instance toward risk and cooperation – and on social capital, which could eventually affect poverty.

In addition to these four micro-level channels through which violence might affect poverty over time, the destruction of infrastructures at the meso-economic level, such as health or transportation facilities, might also affect the development of human and social capital and eventually lead to increased household deprivation (Ghobarah, Huth, and Russett, 2004; Lai and Thyne, 2007).

According to Justino (2012), “although there is a large body of evidence on the destructive effects of war, we are still far from understanding how these effects may or may not persist across time”. This paper aims at contributing to the micro-economic literature on the consequences of

civil wars by documenting the impact of exposure to violence on household-level poverty over time, relying on three waves of panel data collected in Burundi between 1998 and 2012. The longitudinal dimension of the data, as well as the local-level measure of violence that they provide, create a rare opportunity to investigate the legacy of war exposure at the micro level in the context of a poor economy. Two major challenges arise when trying to assess the effects of violence over time. *First*, violence is generally not random. Both on the macro and on the micro side, poor post-war macroeconomic performances and micro-level outcomes could reflect the prevailing conditions that triggered violence in the first place. In particular, the literature has identified poverty and slow growth among the factors that boost the likelihood of conflict onset (Fearon and Laitin, 2003), while they are also likely to be exacerbated by violence. *Second*, documenting the effects of violence over time requires observing longitudinal data, which is rare in post-conflict settings. In a micro-economic perspective, this involves the ability to track individuals and their outcomes over time.

The data that we rely on combine major advantages regarding these methodological concerns. Their first value-added is their longitudinal dimension. While the Burundi civil war broke out in 1993 and lasted until 2005, three waves of a nationwide survey have been conducted between 1998 and 2012. In the two first rounds, retrospective data on local violence exposure from the start of the civil war were collected. In addition, households and their split-offs were tracked from one wave of the survey to the other. These features of the data make it possible to: (i) re-build the history of households' composition and division over a fifteen-year period without 'losing' those who created their own household and/or migrated within the country, and (ii) measure the degree of exposure to conflict at the level of the localities starting from 1993 and over the whole duration of the war.

Moreover, as extensively argued by Voors et al. (2012), standard factors of greed and grievance are poorly explanatory of the pattern of violence in Burundi. Militia attacks, either from the army or from the rebels, indiscriminately brutal and random, affecting the entire country and causing profound fear among the whole population, reflect more accurately what happened (Uvin, 1999; Krueger and Krueger, 2007; Human Rights Watch, 1998). In such a setting, local-level exposure to violence has been shown to be near-exogenous to household characteristics and local economic conditions (Voors et al., 2012). To complement these qualitative and quantitative results, we rely

on data from 1990 and 1998 (ISTEEBU, 1993; Voors et al., 2012) to investigate the determinants of violence exposure at the level of the localities (see Table 9 in Appendix 7.1). The dependent variable is a dummy equal to one if at least one war-related death or casualty was reported in the locality, over each sub-period of the war. No systematic correlation appears between, on the one hand, violence exposure between 1993 and 1998 and between 1998 and 2007 and, on the other hand, the socioeconomic characteristics of the localities. Although only suggestive, combined with the previous literature this result allows to be more confident over the fact that it is possible to exploit the timing of local exposure to violence to investigate the effect of conflict on household welfare and poverty dynamics in Burundi, and that the risk that the estimated correlations will be driven by the non-randomness of violence or ‘selection into violence’ is low.

These peculiarities of the data and context allow us to document the relationship between violence exposure and welfare at the household-level and overtime, and to provide suggestive evidence that violence exposure has persistent effects on household deprivation. We first observe that the prevalence of poverty has been rather stable in Burundi between 1998 and 2012 while its average intensity has deepened and numerous transitions into and out of poverty have occurred. Moreover, we show that households exposed to the war exhibit significantly lower levels of welfare than non-exposed households, this difference being persistent and robust to a multivariate panel analysis. Finally, the results suggest that initially poor households have seen their welfare relatively more affected by the first period of the war (before 1998), and initially non-poor households by the second period of the war (after 1998), which is consistent with the change in the nature of violence during the civil war, from relatively more labour-destructive to relatively more capital-destructive.

In the next section, we describe in details the survey and data at hand and draw an overview of poverty over the period of analysis. Sections 3 and 4 then display the empirical results, first exploiting the longitudinal dimension of the data to document the relationship between violence exposure and deprivation over time, and second investigating which households have been particularly vulnerable, in terms of poverty status, to violence exposure. Section 5 discusses the interpretation of the results, and Section 6 finally concludes.

## **2 An overview of poverty in Burundi between 1998 and 2012**

### **2.1 The Three-round Panel Priority Survey**

We rely on a fifteen-year panel with three rounds of data collection, 1998, 2007 and 2012. In 1998, with support from the World Bank, the Government of Burundi undertook a study named ‘Enquête Nationale sur les Conditions de Vie de la Population’. The ISTEERU, Burundi’s national statistics institute, conducted the underlying LSMS-type survey, named Priority Survey (henceforth 1998 PS), over more than 6,000 households living in 391 randomly selected rural and urban survey sites (in what follows, we use the generic term ‘locality’ to refer to these survey sites). In 2007, a Panel Priority Survey (henceforth 2007 PPS) was designed as the second wave of the 1998 PS and targeted to re-interview 1,000 households from 100 randomly selected rural localities of the original sample, as well as the so-called ‘split-off’ households, which were formed between 1998 and 2007 by members of the original households. A total of 874 original households and 534 split-offs were re-interviewed. The third round was implemented in 2012, allowing to build a three-wave panel and follow the evolution of households’ consumption patterns relying on fully comparable questions. Out of the 1,408 households of 2007, 1,263 were re-interviewed in 2012, i.e. a resurvey rate of 89.7%. As in 2007, the 2012 wave was conducted by an experienced interviewers team, with a 5-day training on the questionnaire, a pilot test, and close supervision of the field work. The team leader, the local survey manager as well as several interviewers were the same in 2007 and 2012.

### **2.2 Measuring welfare**

#### **2.2.1 Valuing household consumption**

In each round of the survey, an identical module asked interviewees about their consumption of a range of food and non-food items. For each food item, respondents declared the quantity consumed by their household over the last seven days in the unit of their choice,<sup>1</sup> and the price per unit on the local market. To compute the nominal value of households’ food consumption, we first express all the quantities consumed in kilograms (or liters). We then compute household-level prices per

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<sup>1</sup>Including quantity bought, produced, and received as gift.



kilograms (or liters) for each item, which allow us to calculate country-level median prices. We eventually use these prices to compute the total value of households' food consumption per month, that we express per adult equivalent. In the absence of market price data, we use the prices declared by the households which may contain important measurement errors. Taking the median of declared prices, instead of using for each household the price that it declared, allows to mitigate this issue.

The total value of households' consumption is finally the sum between households' food consumption, valued with the vector of country-level median prices, and non-food consumption. The value of the latter is directly derived from the expenditures declared in the questionnaire. Non-food consumption is priced using households' declarations because, as opposed to food items, it is not possible to derive country-level median prices for non-food items such as 'clothing' or 'cell phones': indeed, households declare the total amount spent for each category without specifying a quantity.

### **2.2.2 Poverty line**

We compute the poverty line relying on the 'cost of basic needs' method (Ravallion, 1994, 1998; Ravallion and Bidani, 1994), according to which poverty is "a lack of command over basic consumption needs, and the poverty line the cost of those needs" (Ravallion and Bidani, 1994). This minimal level of consumption must encompass food and non-food consumption.

To estimate the food component of the basic consumption needs, we specify a consumption bundle deemed adequate to satisfy physical needs in terms of caloric value, and then estimate its cost. The composition of the basket of goods is derived from the food consumption of the 50% households which have the lowest level of total consumption per month and per adult equivalent. We then calculate the caloric value of the average basket of goods that these households consume, and re-scale it so as to reach the caloric requirement considered as minimum in the context of Burundi (namely, 2,500 calories per day and per adult equivalent (Minecofin, 2002)<sup>2</sup>), without changing the proportions of the different items. This allows us to derive a basket of goods which exactly corresponds to 2,500 calories per day per adult equivalent, and which is consistent with the consumption habits and preferences of the 50% poorest households. The food component of the

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<sup>2</sup>Minimum caloric requirement in the case of Rwanda, which is a very similar context.

poverty line is the value of this basket based on country-level median prices.

Estimating the minimal non-food requirements is trickier than estimating the minimal food requirements in the absence of an equivalent to caloric intake for non-food consumption. To compute the non-food component of the poverty line, we follow Bundervoet (2006) and Verwimp and Bundervoet (2009). Based on the previously cited literature, and using the first two waves of the panel data that we rely on, they estimate the share of non-food spending of Burundian households whose total level of consumption is very close from the food poverty line. These households could exactly fit their caloric needs, but instead of doing so they decide to sacrifice a part of their food consumption in favor of non-food consumption. Eventually they do not fulfil their minimal caloric requirements, thus it is arguable that their non-food expenditures correspond to what they consider as absolutely necessary. We use the food share that they estimated for the Burundi context (namely, 82%) to derive the non-food component of the poverty line. In the end, the poverty line equals the addition between the food and non-food components, and the household's poverty status is determined by the difference between its monthly consumption per adult equivalent and the poverty line.

### 2.3 Sample and attrition

Most of the empirical analysis displayed hereafter relies on the sample of households for which data on consumption as well as socioeconomic and demographic characteristics introduced as control variables are available. This sample consists of 943 original households in 1998, 751 in 2007 and 595 in 2012.<sup>3</sup> Additionally, we observe 327 split-offs in 2012<sup>4</sup> and 287 in 2007, and we can impute the data of their household of origin for 279 of them in 1998. For sake of consistency with the empirical analysis, and given that they are found to be very similar if the whole sample is considered, the descriptive statistics that follow are displayed over this core sample.<sup>5</sup>

The overall re-contact rate of the survey was 87.4% between 1998 and 2007 and 89.7% between

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<sup>3</sup>Among the 751 original households of 2007, 741 are tracked from 1998 and 10 are unobserved in 1998 because of missing data. Among the 595 original households of 2012, 542 are tracked from 2007 and 53 are unobserved in 2007 because of missing data.

<sup>4</sup>Of which 188 are tracked from 2007 and 139 are unobserved in 2007 because of missing data.

<sup>5</sup>The descriptive statistics considering the whole available sample are available upon request.

2007 and 2012, which can be considered as a success given the time interval between each round and widespread violence between the first two waves. Still, some households are lost from one wave of the panel to the next one. This attrition could bias the results, in particular if non-tracked households have specific characteristics which are correlated with consumption or violence exposure. To document this issue, we look at the differences of means of the main characteristics of tracked and non-tracked households in Table 10 in Appendix 7.2. We document households' socioeconomic and demographic characteristics, welfare, and exposure to violence. Welfare is measured through households' average monthly consumption (in logarithm) and poverty status, and violence exposure through a dummy equaling one if the locality recorded at least one war-related death or casualty.

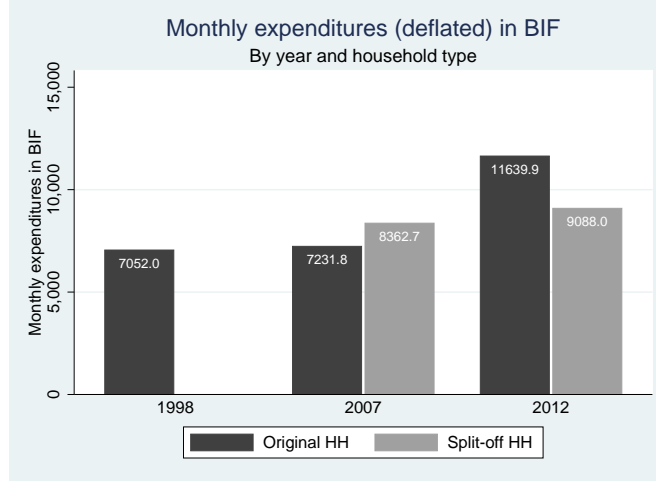
Some characteristics are different between households tracked from one wave of the panel to the next one and households who exit the sample. In particular, households who were larger at time  $t$  are significantly more likely to be tracked at time  $t + 1$ . To a lesser extent, the occupation, age and gender of the household head turn out to be slightly different between tracked and non-tracked households. These results confirm the importance of controlling for socioeconomic and demographic characteristics in the analysis. It also appears that households who exit the sample (in 2007 and in 2012) were living in localities that had been on average less exposed to violence between 1993 and 1998, but not significantly differently exposed between 1998 and 2007. Finally, the t-tests do not reveal any significant difference in terms of consumption and poverty status between tracked and non-tracked households, neither in 2007 nor in 2012.

## 2.4 Descriptive statistics

Figure 1 displays the level of households' monthly expenditures per adult equivalent (expressed in Franc Burundi (BIF) in 1998 prices) in 1998, 2007 and 2012, distinguishing original and split-off households. The average original household spends 7,052 BIF per month and adult equivalent in 1998, 7,232 in 2007 and 11,640 in 2012, while the average split-off household consumes 8,363 BIF per month and adult equivalent in 2007 and 9,088 in 2012. Monthly expenditures have thus undergone an upward trend which has been more pronounced after 2007 for original households.

Table 1 presents the first-, second- and third-degree Foster-Greer-Thorbecke poverty mea-

Figure 1: **Monthly expenditures in BIF, deflated.**



asures (Foster, Greer, and Thorbecke, 1984), by household type and over time. For a continuous expenditure distribution, the FGT-index is given by:

$$P_\alpha = \int_{i=1}^z \left\{ \left( \frac{z - y_i}{z} \right)^\alpha f(y) \right\} dy \quad (1)$$

where  $z$  and  $y$  are, respectively, the poverty line and amount of expenditures. For  $\alpha = 0$  and 1, the index measures, respectively, the prevalence of poverty (poverty headcount) and the intensity of poverty (poverty gap), while for  $\alpha = 2$  it provides a measure of the poverty severity (Ravallion, 1992; Bigsten et al., 2003).

Overall, around 69% of the households of the sample are poor in 1998. The headcount ratio very slightly decreases afterward, to reach a bit less than 68% in 2012. While we observe almost constant headcount poverty over fifteen years, there is a clear upward increase in the poverty gap (from nearly 31% in 1998 to nearly 39% in 2012) and poverty severity (from 18% in 1998 to more than 26% in 2012), which corresponds to an increase of inequalities. Indeed, the Gini index consistently increases over time, for both original and split-off households (see Table 11 in Appendix 7.3).

The poverty profile is different by household type: the prevalence of poverty, poverty gap and poverty severity are higher among original than split-off households across the whole period.

Table 1: **Poverty by household type and year.**

Type of HH	Statistics	Year		
		1998	2007	2012
All	Number of HH	943	1,038	922
	Headcount ratio	69.14	68.98	67.68
	Poverty gap	30.91	36.14	38.89
	Poverty severity	18.00	23.29	26.49
Original	Number of HH		751	595
	Headcount ratio		70.57	69.41
	Poverty gap		37.84	40.10
	Poverty severity		24.81	27.50
Split-off	Number of HH		287	327
	Headcount ratio		64.81	64.53
	Poverty gap		31.67	36.71
	Poverty severity		19.33	24.66

Note: There is no split-off household in 1998 since it was the first round of survey.

However, the difference between the two groups decreases between 2007 and 2012. Taken together with Figure 1, these results are consistent with inequality having increased relatively more among original households than among split-off households (see Table 11 in Appendix 7.3).

In the course of the panel, some households fall into poverty whereas others escape it. Table 2 maps these movements into and out of poverty across time. Panel A is the poverty state-transition matrix between 1998 and 2007. Nearly 59% of the non-poor households in 1998 fall into poverty by 2007, while less than 28% of the poor households of 1998 escape poverty in 2007. Focusing on transitions between 2007 and 2012, Panel B reveals that less than 44% of non-poor households in 2007 remain so in 2012, while less than 25% of the poor households in 2007 escape poverty by 2012. Last, Panel C shows that less than 38% of non-poor households in 1998 are still non-poor by 2012, while nearly 71% of poor households in 1998 remain so by 2012.

Another angle to view poverty dynamics is to look at the distribution of households at the lens of a threefold poverty status. Table 3 gives the shares of households who are permanently non-poor (i.e., non-poor in 1998, 2007 and 2012), chronically poor (i.e., poor in 1998, 2007 and 2012), and so-called ‘switchers’ (i.e., one time poor (non-poor) and two times non-poor (poor), regardless of the sequence of the switch(es) across the three observations). Computing these shares require to observe households’ poverty status across the three points of the panel. There are 1,223 households

Table 2: **Poverty transition matrices between 1998, 2007 and 2012.**

<b>Panel A. Transition matrix 1998-2007.</b>			
	<b>Poverty status in 2007</b>		
<b>Poverty status in 1998</b>	Non Poor	Poor	Total
Non Poor	41.26	58.74	100.00
Poor	27.54	72.46	100.00
Total	31.17	68.83	100.00

<b>Panel B. Transition matrix 2007-2012.</b>			
	<b>Poverty status in 2012</b>		
<b>Poverty status in 2007</b>	Non Poor	Poor	Total
Non Poor	43.91	56.09	100.00
Poor	24.80	75.20	100.00
Total	30.82	69.18	100.00

<b>Panel C. Transition matrix 1998-2012.</b>			
	<b>Poverty status in 2012</b>		
<b>Poverty status in 1998</b>	Non Poor	Poor	Total
Non Poor	37.93	62.07	100.00
Poor	29.16	70.84	100.00
Total	31.50	68.50	100.00

whose poverty status is observed three times (Column (1)). In the second part of the empirical analysis (Section 4), we will investigate the determinants of poverty status switches. We will thus focus on households whose poverty status is observed three times, but also whose socioeconomic and demographic characteristics are observed in 1998. There are 996 such households. To have an idea of their degree of representativeness, Column (2) of Table 3 displays their distribution by threefold poverty status. The distribution is very similar between the two samples. Over the period, there are only as few as 6% of households which have never been poor, while around 39% are in chronic poverty and the remaining 55% are households whose poverty status switched at least once.

Table 3: **Threefold poverty status in 1998, 2007 and 2012.**

	(1)	(2)
	Number of HH (%)	
	Whole sample	Sub-sample
Permanent non poor	76 (6.21)	58 (5.82)
Switchers	676 (55.27)	546 (54.82)
Chronic poor	471 (38.51)	392 (39.36)
Total	1,223 (100)	996 (100)

### 3 Violence exposure and deprivation

The descriptive statistics show that, over the period, the incidence of poverty did not change much in the aggregate while its severity has deepened and transitions in and out of poverty have been numerous. Table 4 displays the average level of consumption and prevalence of poverty in each of the three survey waves, distinguishing households who have been exposed to violence and households who have not. The dummy variable of violence exposure equals one if at least one war-related death or casualty was reported over the past in the locality where the household lives, and zero otherwise.

Table 4: **Violence exposure and deprivation – Differences of means.**

		Not exposed to violence	Exposed to violence	Difference
<i>Panel A: 1998</i>	Consumption (in log)	8.743	8.515	0.228*** (0.049)
	Poverty	0.627	0.742	-0.115*** (0.030)
	<i>Number of households</i>	<i>416</i>	<i>527</i>	<i>943</i>
<i>Panel B: 2007</i>	Consumption (in log)	8.634	8.400	0.235*** (0.062)
	Poverty	0.618	0.733	-0.115*** (0.029)
	<i>Number of households</i>	<i>390</i>	<i>648</i>	<i>1,038</i>
<i>Panel C: 2012</i>	Consumption (in log)	8.725	8.478	0.246*** (0.077)
	Poverty	0.628	0.706	-0.078** (0.032)
	<i>Number of households</i>	<i>341</i>	<i>581</i>	<i>922</i>

Significance of the difference between exposed and non-exposed households using a paired t-test. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1. Standard errors in parentheses.

Violence exposure is computed over the past, i.e. between 1993 and 1998 for Panel A, and between 1993 and 2007 for Panels B and C.

Households exposed to violence over the past exhibit a significantly lower average level of consumption and higher incidence of poverty in the subsequent years, the difference between exposed and non-exposed households being similar in 1998 and 2007. Moreover, while no violence is observed between 2007 and 2012, the group of households exposed to violence before 2007 still exhibits a significantly lower consumption and gathers a significantly higher share of poor in 2012. This suggests that the decrease in welfare associated with violence exposure persists over time.

Still, the gap between exposed and non exposed households attenuates in 2012, as the difference of means of poverty incidence decreases; and the standard error of the difference of both poverty

incidence and consumption increases. Based on these uncontrolled differences of means, we run a simple simulation exercise aiming at estimating the date at which the gap between exposed and non-exposed households would close based on the trend observed until 2012. Said differently, the date at which the differences between these two groups would no longer be significantly different from zero. We do so by assuming that the yearly growth rates of the difference of means and of its standard error after 2012 would equal their observed values over the most recent period, once violence has stopped, i.e. between 2007 and 2012.<sup>6</sup> The results of this simulation are displayed in Table 5. It turns out that if the trend observed between 2007 and 2012 continues, the convergence between households who were exposed to the civil war and households who were not is predicted in 2017 in terms of poverty incidence and not before 2034 in terms of consumption.

Table 5: **Simulated convergence speed.**

		Year	Difference	Std error
<i>Panel A: Consumption (in log)</i>	Observed	1998	0.228***	0.049
		2007	0.235***	0.062
		2012	0.246***	0.077
	<i>Simulated:</i>	...	...	...
		2033	0.303*	0.183
		2034	0.306	0.191
<i>Panel B: Poverty</i>	Observed	1998	-0.115***	0.030
		2007	-0.115***	0.029
		2012	-0.078**	0.032
	<i>Simulated:</i>	...	...	...
		2016	-0.057*	0.034
		2017	-0.053	0.034

Differences of means (and their standard errors) between households exposed and not exposed to violence as displayed in Table 4.

*Simulated* figures assume that the yearly growth rates (of the difference and of its standard error) after 2012 are equal to those observed between 2007 and 2012.

\*\*\*p<0.01, \*\*p<0.05, \*p<0.1.

We investigate further the correlation between violence exposure and households' deprivation over time in a multivariate setting by estimating Equation (2):

<sup>6</sup>Alternatively, we could assume that the yearly growth rates of the difference of means and of its standard error after 2012 could equal their observed values over the whole period, i.e. between 1998 and 2012. This yields more pessimistic estimates, given that the difference and its standard error are roughly stable between 1998 and 2007. Specifically, we predict convergence in 2037 for consumption and in 2027 for poverty under this assumption.



$$Y_{i,j,t} = \alpha + \gamma X_{i,t} + \delta ViolenceExposure_{j,t-1,t} + \lambda_i + \varepsilon_{i,j,t}, \quad (2)$$

with  $i$  indexing households,  $j$  indexing localities, and  $t$  indexing time. Index  $t$  can take three values: 1998, 2007 and 2012. We explore two different dependent variables  $Y_{i,j,t}$ :

1. *Consumption* is the level of monthly consumption per adult equivalent (in logarithm), expressed in deflated BIF (in 1998 prices). This variable provides information on the global level of welfare of the households.
2. *Poverty status* is the dummy variable equal to one if the household's monthly consumption per adult equivalent is below the poverty line, and zero otherwise. This variable provides information on the level of deprivation of the household with respect to the food and non-food requirements considered as minimal in the context of Burundi.

We are interested in the correlation between deprivation and exposure to war over the past. Violence exposure is measured by the dummy variable  $ViolenceExposure_{j,t-1,t}$  which is equal to one if at least one war-related death or casualty was reported in locality  $j$  between  $t-1$  and  $t$ . Two periods of violence exposure are observed: 1993 – 1998 and 1999 – 2007. Between 1993 and 1998, 679 of the 1,222 households of the sample of interest (55.56%) were exposed to violence. Between 1999 and 2007, violence was less spread with 192 of the 1,038 households of the sample exposed (18.50%). After 2007, no violence was to deplore anymore, and  $ViolenceExposure_{j,2007,2012}$  is equal to zero.

We introduce the following vector  $X_{i,t}$  of control variables, measured for household  $i$  at time  $t$ :

- The number of members,
- The age of the household's head,
- A dummy indicating whether the head of the household is a woman,
- A dummy indicating whether the head of the household has some education (versus no education whatsoever),
- Two dummies capturing the occupation of the head of the household: agriculture with at least one export crop, and non agricultural occupation (agriculture with no export crop being the

omitted category),

- A dummy indicating whether the household migrated between two waves, based on the *commune* of residence which is the third degree of territorial disaggregation in Burundi (the territory being composed of *sous-collines*, *collines*, *communes*, and *provinces*).<sup>7</sup>

As argued in Section 1, the location of violent events during the Burundi civil war was poorly related to pre-war economic conditions, and as such we are reasonably confident over the fact that households living in exposed localities did not have ex-ante specific characteristics making them subsequently exhibit specific consumption patterns. However, once violence occurs, people do react to it and they may adapt their behaviour in a way that depends on household-level characteristics. The time-varying control variables introduced in Equation 2 capture part of these characteristics. As a first, naive, approach, we estimate Equation 1 using OLS and controlling for province dummies. In a second step, to rule out the time-invariant household-level characteristics that affect consumption patterns, we introduce household fixed effects  $\lambda_j$ . This leads us to estimate the *within-household* correlation between violence exposure and consumption pattern over time.

Even though *Poverty status* is a binary dependent variable, we display the results of linear probability models so as to keep all the observations in the sample. However, Logit and Logit with fixed effects regressions yield virtually similar results.<sup>8</sup> Finally, for each dependent variable and estimation method, two specifications are tested. We first estimate Equation 2 over the sub-sample of original households, and then over the complete sample, which gathers these original households and their split-offs. In the latter case, we additionally control for a dummy indicating whether the household is a split-off.<sup>9</sup> The results are displayed in Table 6.

The coefficients associated with the socioeconomic and demographic variables are very much in line with the previous literature on poverty. In particular, deprivation is significantly correlated with the number of members: larger households tend to consume less (per adult equivalent) and to be more likely to be poor. Households headed by an older person are characterized by a slightly

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<sup>7</sup>The *Migrant* dummy thus does not consider as migrants households which moved within the same *commune*. The rationale behind this choice is based on the context under study, movements within the same *commune* being very frequent (including on a temporary basis) and difficult to accurately capture in the data.

<sup>8</sup>Not shown for brevity, available upon request.

<sup>9</sup>Note that this variable is always equal to zero in 1998.

higher average consumption, but the significance of this coefficient decreases when the poverty status is considered. Households headed by a woman are significantly worse off on average. The opposite is true for households whose head has some education, whose head's occupation is not related to agriculture and, to a lesser extent, whose head is involved in at least one culture of exportation (as opposed to agriculture without any export crop). No correlation between the *Migrant* dummy and welfare appears to be statistically significant over time. This might however hide endogeneity issues, which are beyond the scope of this paper, given that poverty is likely to affect simultaneously people's propensity and capacity to migrate, and to be subsequently affected by the migration experience.

The coefficient associated with *Split-off* is also likely to be affected by endogeneity issues since splitting-off from the original household may well be a strategy to cope with poverty and/or violence exposure. In particular, the significant correlation emerging in Column (8) could both reveal that split-offs emanate from relatively less poor households and/or that splitting-off allows to mitigate the vulnerability to poverty.<sup>10</sup>

Turning to the variable of interest, Table 6 reveals a significant correlation between violence exposure in the past and subsequent deprivation: households living in exposed localities in the past are characterized by a significantly lower average level of consumption and by a higher likelihood of being poor. Although the fixed-effects specifications yield less significant coefficients, they are very consistent with the OLS results. The point estimates suggest in particular that the switch of the locality from the non-exposed to the exposed status is associated with a 9% to 13% decrease in a household's level of consumption and with a 5% to 8% increase in its likelihood to be poor.

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<sup>10</sup>One of the authors of this paper is performing a separate analysis of the determinants of household splitting in Burundi, see Verwimp (2016).

Table 6: Violence exposure and welfare over time.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)			
	Consumption (in log)						Poverty status											
	Original HH			All			Original HH			All			Original HH			All		
	LPM	FE	LPM	FE	LPM	FE	LPM	FE	LPM	FE	LPM	FE	LPM	FE	LPM	FE		
Number of members	-0.0748*** (0.00878)	-0.107*** (0.0153)	-0.0750*** (0.00789)	-0.100*** (0.0127)	0.0341*** (0.00439)	0.0499*** (0.00736)	0.0333*** (0.00420)	0.0415*** (0.00671)										
Head - Age	0.00330** (0.00151)	0.00697** (0.00341)	0.00267** (0.00132)	0.00451* (0.00239)	-0.000590 (0.000739)	-0.00126 (0.00190)	-0.000678 (0.000674)	-0.00205 (0.00132)										
Head - Female	-0.211*** (0.0564)	-0.300*** (0.110)	-0.200*** (0.0507)	-0.286*** (0.0805)	0.0717*** (0.0241)	0.156*** (0.0557)	0.0656*** (0.0229)	0.123*** (0.0411)										
Head - Educ	0.290*** (0.0428)	0.107 (0.0753)	0.268*** (0.0351)	0.0866 (0.0578)	-0.130*** (0.0211)	-0.0625* (0.0326)	-0.112*** (0.0184)	-0.0647** (0.0312)										
Head - AgrExp	0.163*** (0.0475)	0.120 (0.0725)	0.139*** (0.0410)	0.117* (0.0632)	-0.0194 (0.0191)	-0.00531 (0.0322)	-0.00382 (0.0167)	0.000940 (0.0259)										
Head - NonFarm	0.437*** (0.106)	0.253** (0.114)	0.432*** (0.0862)	0.230** (0.0977)	-0.155*** (0.0451)	-0.0371 (0.0638)	-0.153*** (0.0356)	-0.0176 (0.0509)										
Migrant	-0.0681 (0.104)	-0.0495 (0.104)	-0.0694 (0.0857)	-0.0814 (0.0975)	0.0130 (0.0419)	0.00402 (0.0434)	0.00401 (0.0362)	0.0112 (0.0426)										
Split-off			-0.0293 (0.0599)	0.124 (0.0957)			0.0261 (0.0273)	-0.0951* (0.0505)										
Violence exposure	-0.102** (0.0506)	-0.133* (0.0804)	-0.111** (0.0483)	-0.0934 (0.0692)	0.0587** (0.0279)	0.0843** (0.0387)	0.0531** (0.0257)	0.0655* (0.0345)										
Constant	9.273*** (0.123)	8.893*** (0.172)	9.259*** (0.116)	8.911*** (0.133)	0.323*** (0.0594)	0.433*** (0.0926)	0.356*** (0.0588)	0.550*** (0.0729)										
HH fixed effects	No	Yes	No	Yes	No	Yes	No	Yes										
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Province dummies	Yes	No	Yes	No	Yes	No	Yes	No										
Observations	2,289	2,289	3,182	3,182	2,289	2,289	2,289	2,289										
R-squared	0.149	0.067	0.141	0.067	0.117	0.047	0.110	0.055										

Robust standard errors clustered at the level of localities in parentheses. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1.

Head - Female equals one if the household head is a woman, zero otherwise. Head - Educ equals one if the household head ever went to school, zero otherwise. Head - AgrExp equals one if the household head's main occupation is agriculture with at least one export crop, zero otherwise. Head - NonFarm equals one if the household head's main occupation is not related to agriculture, zero otherwise. The omitted occupation is agriculture without export crop.

## 4 The dynamics of poverty

The previous results emphasize a negative correlation between exposure to the war and welfare over time. This section aims at going further in the analysis of the interaction between violence exposure and the household-level dynamics of poverty by investigating how violence exposure correlates with the patterns of transition into and out of poverty.

Specifically, we document how households' initial characteristics (in 1998) and exposure to violence are related to their subsequent likelihood to switch poverty status, i.e. become poor while they used to be non-poor in 1998 and *vice versa*. We estimate the following equation:

$$Switch_{i,j,p} = \alpha + \gamma X_{i,1998} + \delta ViolenceExposure_{j,p,1998,2007} + \mu_p + \varepsilon_{i,j,p}, \quad (3)$$

with  $i$  indexing households,  $j$  indexing localities, and  $p$  indexing provinces.

The dependent variable,  $Switch_{i,j,p}$ , is a dummy that takes the value one if household  $i$  from locality  $j$  in province  $p$  has seen its poverty status switch after 1998, as compared to its poverty status in 1998. Said differently,  $Switch_{i,j,p}$  equals one for households who were poor in 1998 and became non-poor in 2007 and/or 2012, and for households who were non-poor in 1998 and became poor in 2007 and/or 2012; while it is equal to zero for households who remain poor over the three points (the 'chronic poor') and for households who remain non-poor over the three points (the 'permanent non-poor'). Since transitions into and out of poverty are likely to follow different patterns, and since chronic poor and permanent non-poor do not form an homogenous group for comparison, we estimate Equation 3 separately over the sub-samples of initially poor and initially non-poor households. *First*, we analyze the likelihood to escape poverty of households who were poor in 1998, by comparing those who remained in their initial poverty status to those who subsequently became non-poor (regardless of whether it happened in 2007 or in 2012). Over the 724 households of the sample which were poor in 1998, 332 (45.86%) became non-poor afterwards. *Second*, we investigate the determinants of the risk to fall into poverty by comparing households who were non-poor in 1998 and remained so in 2007 and 2012, to households who were non-poor but fell into poverty in 2007 or 2012. Over the 272 households of the sample which were non-poor in 1998, 214

(78.68%) became poor afterwards (either in 2007 or in 2012).

Since the variable on which the sample is split – the poverty status in 1998 – is likely to be affected by pre-1998 violence exposure, we focus on the correlation between poverty switches and post-1998 violence exposure and omit pre-1998 violence exposure from the right-hand side. The control variables are measured in 1998, except the *Split-off* and *Migrant* dummies which are only revealed afterwards. Last, we control for the vector  $X_{i,1998}$  of characteristics of the households measured in 1998, and for province dummies  $\mu_p$ . The sample of analysis gathers the households for which all the control variables are available in 1998, and whose poverty status is available in 1998, 2007 and 2012.<sup>11</sup> There are 996 such households, among which 760 are original households.

The results are displayed in Table 7, Columns (1) and (2) focusing on transitions out of poverty and Columns (3) and (4) on transitions into poverty. In each case, two specifications are estimated, first relying only on original households and second including the split-off households. As for Table 6, we display the results of linear probability models which allow to keep all the observations, but Logit regressions yield virtually similar results.<sup>12</sup>

The vector of households' characteristics performs less well in explaining poverty status switches than in explaining the dependent variables related to welfare investigated in Table 6. This is likely to be linked to the fact that we are here only controlling for initial characteristics (measured in 1998), while Table 6 relied on the panel dimension of the data to document the joint evolution of, on the one hand, socioeconomic and demographic characteristics, and, on the other hand, welfare. Still, the coefficients that are significantly correlated with the likelihood of poverty status switches are consistent with the results of Table 6. In particular, poor households whose head is educated as well as poor households whose head is older are more likely to escape poverty, and non-poor households whose head has a non-agricultural occupation are less likely to fall into poverty.

The results suggest that households who were poor in 1998 and exposed to violence between 1998 and 2007 tend to be less likely to escape poverty, while households who were non-poor in 1998 and exposed to violence between 1998 and 2007 tend to be more likely to fall into poverty, but the

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<sup>11</sup>We do not restrict the sample to 'purely tracked' households here, i.e. whose complete set of characteristics (poverty and control variables) are available in 2007 and 2012. We only impose the socioeconomic and demographic variables to be observed in 1998 and the poverty status to be observed at each period.

<sup>12</sup>Not shown for brevity, available upon request.

Table 7: **Violence and poverty status switches.**

	(1)	(2)	(3)	(4)
	Out of poverty		Into poverty	
	Original HH	All	Original HH	All
Number of members	-0.0133 (0.00992)	-0.0103 (0.00922)	0.0117 (0.0119)	0.0187 (0.0113)
Head – Age	0.00387** (0.00166)	0.00210 (0.00141)	-0.00100 (0.00202)	-0.00184 (0.00198)
Head – Female	0.00879 (0.0621)	-0.0120 (0.0501)	-0.00606 (0.0737)	0.00152 (0.0715)
Head – Educ	0.120** (0.0469)	0.104** (0.0441)	-0.101* (0.0579)	-0.0704 (0.0556)
Head – AgrExp	0.0111 (0.0569)	-0.0388 (0.0530)	-0.0544 (0.0785)	-0.0419 (0.0731)
Head – NonFarm	0.0667 (0.0920)	0.0496 (0.0846)	-0.240** (0.109)	-0.195* (0.106)
Migrant	-0.00645 (0.0613)	-0.00434 (0.0534)	-0.0975 (0.0793)	-0.138* (0.0764)
Split-off		0.113*** (0.0431)		0.00949 (0.0757)
Violence exposure	-0.0723 (0.0550)	-0.0835* (0.0457)	0.185*** (0.0577)	0.164*** (0.0524)
Constant	0.608*** (0.139)	0.643*** (0.142)	0.645*** (0.162)	0.660*** (0.153)
Province dummies	Yes	Yes	Yes	Yes
Observations	526	724	234	272
R-squared	0.078	0.081	0.224	0.193

Robust standard errors clustered at the level of localities in parentheses.  
\*\*\*p<0.01, \*\*p<0.05, \*p<0.1.

Head – Female equals one if the household head is a woman, zero otherwise.  
Head – Educ equals one if the household head ever went to school, zero otherwise.  
Head – AgrExp equals one if the household head’s main occupation is agriculture with at least one export crop, zero otherwise.  
Head – NonFarm equals one if the household head’s main occupation is not related to agriculture, zero otherwise.  
The omitted occupation is agriculture without export crop.

Columns (1) and (2) estimate the determinants of the probability of a subsequent transition out from poverty over the sample of households who were poor in 1998. Columns (3) and (4) estimate the determinants of the probability of a subsequent transition into poverty over the sample of households who were non-poor in 1998.

latter correlation is strongly significant while the former is not.

The specifications displayed in Table 7 can raise the concern that households’ past experience of violence (i.e., exposure between 1993 and 1998) might affect the correlation between their likelihood

to switch poverty status and their exposure to violence after 1998. To deal with that concern, we re-estimate Equation 3 and further split the sample between households who had been and households who had not been exposed to violence between 1993 and 1998. The results are displayed in Table 12 in Appendix 7.4. They prove to be very stable, both for initially poor and initially non-poor, across the samples of pre-exposed and non pre-exposed households.

## 5 Discussion

While Tables 4, 5 and 6 put forward a significant correlation between violence exposure over time, Table 7 suggests that mostly the non-poor suffer from post-1998 violence exposure and that the likelihood to pull through for initially poor households is not strongly correlated with post-1998 exposure to violence. This heterogeneity in the correlation between recent violence exposure and the likelihood to subsequently switch poverty status depending on the household's initial level of poverty is intriguing. Unfortunately, we cannot test whether such an heterogeneity also exists for pre-1998 violence exposure, since no measure of household-level poverty is available before 1998.

To go further in the investigation of this issue, we document the correlation between violence exposure and welfare across the distribution of consumption by implementing quantile regressions focusing successively on each sub-period. Table 8 displays the results. In this table, each column corresponds to a different estimation, and we reproduce the coefficients of interest (associated with the violence variable) per quintile of consumption. In Columns (1) and (2), the dependent variable is consumption in 1998 (in logarithm), the variable of interest is pre-1998 violence exposure, and the set of controls is the same as in Table 7 (measured in 1998). In Columns (3) and (4), the dependent variable is consumption in 2007 (in logarithm), the variable of interest is post-1998 violence exposure, and we control for the vector of control variables measured in 2007 and for pre-1998 violence exposure. Each specification is ran successively over original households only and over all the households.

The results of Columns (1) and (2) suggest that pre-1998 violence exposure is significantly correlated with a reduced level of consumption in 1998 over the entire distribution. The size and significance of the coefficient remain pretty stable across all the quintiles. On the other hand, in



Columns (3) and (4), post-1998 violence exposure appears to be significantly correlated with a decrease in consumption in 2007 mostly for the upper tail of the distribution. Consistently with the results of Table 7, this suggests that pre- and post-1998 violence exposure are heterogeneously correlated with deprivation at the household level.

Table 8: **Violence exposure over each time span – Quantile regressions.**

	(1)	(2)	(3)	(4)
<i>Dependent variable:</i>	<i>Consumption (in log), 1998</i>		<i>Consumption (in log), 2007</i>	
<i>Variable of interest:</i>	<i>Violence exposure, 1993 – 1998</i>		<i>Violence exposure, 1999 – 2007</i>	
	Original HH	All	Original HH	All
Q10	-0.328*** (0.102)	-0.262** (0.115)	0.001 (0.116)	0.014 (0.075)
Q25	-0.232*** (0.059)	-0.226*** (0.069)	-0.247* (0.133)	-0.127 (0.085)
Q50	-0.214*** (0.039)	-0.209*** (0.048)	-0.099 (0.153)	-0.095 (0.128)
Q75	-0.190*** (0.054)	-0.226*** (0.039)	-0.260*** (0.087)	-0.224*** (0.079)
Q90	-0.208*** (0.071)	-0.161*** (0.039)	-0.486*** (0.150)	-0.367*** (0.083)
Observations	760	996	751	1,038

Bootstrap standard errors in parentheses (20 replications). \*\*\*p<0.01, \*\*p<0.05, \*p<0.1. The set of controls includes: Number of members, Head – Age, Head – Female, Head – Educ, Head – AgrExp, Head – NonFarm, Migrant and Split-off measured in 1998 in Columns (1) and (2) and in 2007 in Columns (3) and (4), and Violence exposure between 1993 and 1998 in Columns (3) and (4).

The heterogenous correlations between violence and welfare for poor and non-poor households over time might be linked to a change in the nature of violence and relative intensity of labour versus physical capital destruction. As discussed in the literature (see Section 1), the micro-level effects of conflict-related destructions depend on household characteristics. If labour is more destroyed (meaning, people killed), it is likely that the welfare of poor households suffers relatively more than that of non-poor, as the former only have their labour force to live off. If physical capital is more affected (assets destroyed), the non-poor are likely to suffer relatively more. This relative intensity of the destruction of labour versus physical capital seems to have changed over the course of the war, from more destructive in terms of labour between 1993 and 1998 to more destructive in terms of physical capital afterwards.

The UN Security Council reports on Burundi of 2004, 2005 and 2006 reveal this shift (United Nations, 2004, 2005, 2006). The report of 2004, while signaling a general decrease in hostilities during the preceding years and significant progresses in achieving peace, underlines a rise in criminality. The year after, it emphasizes the persistence of banditry and looting, and in 2006 it highlights that “criminality has risen throughout Burundi, with widespread incidents of armed banditry, intimidation, looting”. Consistently, Cazenave-Piarrot (2004) explains that the destruction of cattle significantly intensified after 1996 in comparison to what had been observed between 1993 and 1996. He underlines that cattle has constituted one of the main resources of the rebels, while, taking advantage of the climate of fear and impunity, criminal bands did ally with the rebels to loot cattle, food stocks, or shops.

Thus, while poor and non-poor both suffered from exposure to violence during the civil war, it is plausible that the poor have suffered relatively more in the first period and the non-poor in the second period because of this changing nature of violence. The change in the relative intensity of labour and capital destruction cannot be directly captured in the data, violence exposure being proxied by war-related deaths or casualties in the locality. Still, it is consistent with the pattern we observe, namely (i) a persistent correlation between violence exposure and deprivation over time, (ii) a strong correlation between post-1998 violence exposure and non-poor households’ propensity to fall into poverty, versus a weak correlation between post-1998 violence exposure and poor households’ propensity to escape poverty, and (iii) a stable correlation between pre-1998 violence exposure and consumption in 1998 across the entire distribution, versus a correlation between post-1998 violence exposure and consumption biased toward the upper tail of the distribution.

## 6 Conclusion

Relying on rich panel data on Burundi, we analyze the correlation between violence exposure and households’ welfare. Locality-level data on war-related deaths and casualties provide a measure of exposure to war since the very beginning of the conflict in 1993, while three survey waves allow to follow the evolution of poverty starting in 1998 and over fifteen years. To the best of our knowledge, this is the first paper that analyzes violence and welfare over time in Burundi. The evolution and

spread of the civil conflict has been shown by both historical and econometric analyses to be poorly determined by pre-war local economic conditions. This attenuates the risk that the correlations we observe between war exposure and poverty dynamics are driven by the endogenous location of brutal events – and thus that some household-level characteristics simultaneously determine the probability to be exposed and the subsequent consumption pattern.

The incidence of poverty in Burundi has been almost constant from 1998 to 2012, while its severity – and, at the same time, inequalities – have increased. At the micro-level, we also observe a lot of descents into and escapes from poverty. This makes it even more crucial to understand the dynamics of poverty in order to enlighten post-conflict recovery policies. We find that households who suffered violence exposure are characterized by a significantly higher level of deprivation. This difference appears to persist over time. It is still visible in 2012, more than seven years after the end of the war, and predicted to disappear not before 2017. Panel estimations, controlling for a range of covariates and for households' time-invariant unobservable characteristics, confirm a persisting adverse correlation between violence exposure and welfare over time.

Finally, the investigation of the determinants of descents into and escapes from poverty suggests that the risk to fall into poverty for initially non-poor households is significantly boosted by recent violence exposure (while poor households' chances to pull through are only slightly correlated with recent violence exposure). Moreover, quantile regressions reveal that the correlation between pre-1998 violence exposure is strongly correlated with consumption across the entire distribution, while post-1998 violence exposure is significantly correlated with reduced consumption only in the upper tail. We argue that this set of results can be linked to the evolution of the nature of violence over time – from relatively intense in labour destruction before 1998 to relatively intense in physical capital destruction (and thus relatively more costly for non-poor households) after 1998.

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## 7 Appendix

### 7.1 The determinants of violence exposure

Table 9: **The determinants of violence exposure – violence dummy.**

<i>Dependent variable:</i>	(1)	(2)	(3)	(4)
<i>Violence exposure dummy</i>	1993 – 1998		1999 – 2007	
Distance to Bujumbura	0.0782 (0.194)	0.0549 (0.201)	0.0555 (0.207)	0.0909 (0.207)
Altitude	0.643 (0.491)	0.654 (0.502)	0.370 (0.488)	0.371 (0.472)
Literacy HHH – 1990	0.0229* (0.0134)	0.0200 (0.0143)	0.00969 (0.0152)	0.00425 (0.0155)
Resources (log) – 1990	-0.693 (0.494)	-0.710 (0.507)	-0.665* (0.386)	-0.568 (0.406)
Population density – 1990	0.0450 (0.125)	0.0268 (0.130)	-0.0703 (0.122)	-0.0688 (0.117)
% HHH farmer – 1990	0.0320 (0.0202)	0.0291 (0.0212)	0.0224 (0.0149)	0.0225 (0.0151)
% HHH under 30 – 1990	0.0185 (0.0175)	0.0158 (0.0182)	0.0162 (0.0157)	0.0188 (0.0154)
% HHH under 50 – 1990	-0.0188 (0.0179)	-0.0207 (0.0183)	0.0117 (0.0237)	0.0161 (0.0227)
Share votes Ndadaye – 1993	0.00385 (0.00337)	0.00383 (0.00352)	0.000427 (0.00317)	-0.000559 (0.00317)
% HHH women – 1998		-0.00257 (0.00323)		-0.00246 (0.00252)
Socioeconomic homogeneity – 1998		0.0116 (0.0557)		0.0832* (0.0441)
Constant	-0.108 (8.514)	0.718 (8.910)	2.389 (5.787)	1.027 (5.611)
Observations	94	93	94	93
R-squared	0.250	0.254	0.195	0.230

OLS estimations. Robust standard errors in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Literacy HHH measures the share of household heads who are literate. Resources (log) measures the average yearly amount of resources per household and per year. % HHH under 30 – 1990 (respectively, % HHH above 50 – 1990) measures the share of household heads aged under 30 (respectively, aged below 50). Share votes Ndadaye – 1993 measures the share of votes obtained by Melchior Ndadaye, the first democratically-elected president, whose assassination a few months after his arrival in power triggered the beginning of the war.

Distance to Bujumbura, Altitude, Population density – 1990, Share votes Ndadaye – 1993, % HHH women – 1998 and Socioeconomic homogeneity – 1998 are provided by Voors et al. (2012) at the level of the localities.

Literacy HHH – 1990, Consumption (log) – 1990, % HHH farmer – 1990, % HHH under 30 – 1990 and % HHH above 50 – 1990 are provided by ISTEERU (1993) at the province level.

## 7.2 Testing for selective attrition

Table 10: **Testing for selective attrition.**

<i>Characteristics in 1998</i>	Tracked in 2007	Drop out in 2007	Difference
Number of members	5.115	4.371	0.743***
Head – Age	40.36	50.97	-10.60***
Head – Female	0.220	0.347	-0.127***
Head – Educ	0.343	0.282	0.061
Head – AgrNoExp	0.312	0.361	-0.050
Head – AgrExp	0.605	0.520	0.085**
Head – NonFarm	0.084	0.119	-0.035
Consumption (in log)	8.611	8.633	-0.022
Poverty status	0.696	0.673	0.023
Violence exposure before 1998	0.588	0.450	0.138**
Violence exposure after 1998	0.181	0.144	0.037
<i>Number of households</i>	<i>741</i>	<i>202</i>	<i>943</i>
<i>Characteristics in 2007</i>	Tracked in 2012	Drop out in 2012	Difference
Number of members	5.314	4.870	0.444***
Head – Age	42.25	42.78	-0.529
Head – Female	0.225	0.169	0.056**
Head – Educ	0.441	0.455	-0.013
Head – AgrNoExp	0.452	0.497	-0.045
Head – AgrExp	0.455	0.370	0.085**
Head – NonFarm	0.093	0.133	-0.040*
Migrant	0.092	0.101	-0.009
Consumption (in log)	8.487	8.493	-0.006
Poverty status	0.685	0.701	-0.016
Violence exposure before 1998	0.595	0.519	0.075**
Violence exposure after 1998	0.184	0.188	-0.005
<i>Number of households</i>	<i>730</i>	<i>308</i>	<i>1,038</i>

Significance of the differences using a paired t-test. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1.

## 7.3 Gini coefficients

Table 11: **Gini coefficients by household type and year.**

Type of HH	Year		
	1998	2007	2012
All	0.360	0.485	0.613
Original HH		0.488	0.651
Split-off HH		0.473	0.521

Note: There is no split-off household in 1998 since it was the first round of survey.

## 7.4 Violence and poverty status switches – Distinguishing pre-1998 exposed and non-exposed households.

Table 12: Violence and poverty status switches – Distinguishing pre-1998 exposed and non-exposed and non-exposed households.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
	Out of poverty		Not exposed before 1998		Into poverty		Into poverty		Out of poverty		Exposed before 1998		Original HH		Into poverty
	Original HH	All	Original HH	All	Original HH	All	Original HH	All	Original HH	All	Original HH	All	Original HH	All	All
Number of members	-0.0327** (0.0154)	-0.0374** (0.0150)	0.0221 (0.0205)	0.0361** (0.0161)	0.00522 (0.0138)	0.00522 (0.0138)	0.0136 (0.0126)	0.0136 (0.0126)	0.00522 (0.0138)	0.00522 (0.0138)	0.0136 (0.0126)	0.0136 (0.0126)	-0.00103 (0.0111)	-0.00103 (0.0111)	-9.60e-05 (0.0133)
Head – Age	0.00372 (0.00262)	0.00436** (0.00213)	-0.00212 (0.00426)	-0.00370 (0.00365)	0.00274 (0.00225)	0.00274 (0.00225)	0.000635 (0.00169)	0.000635 (0.00169)	0.00274 (0.00225)	0.00274 (0.00225)	0.000635 (0.00169)	0.000635 (0.00169)	0.00192 (0.00192)	0.00192 (0.00192)	0.00138 (0.00167)
Head – Female	0.0422 (0.0985)	0.000995 (0.0932)	-0.0358 (0.108)	-0.0158 (0.107)	0.0112 (0.0835)	0.0112 (0.0835)	0.00669 (0.0634)	0.00669 (0.0634)	0.0112 (0.0835)	0.0112 (0.0835)	0.00669 (0.0634)	0.00669 (0.0634)	0.0367 (0.0924)	0.0367 (0.0924)	0.0652 (0.0861)
Head – Educ	0.158** (0.0772)	0.123 (0.0732)	-0.142 (0.0980)	-0.118 (0.0973)	0.0850 (0.0614)	0.0850 (0.0614)	0.0807 (0.0566)	0.0807 (0.0566)	0.0850 (0.0614)	0.0850 (0.0614)	0.0807 (0.0566)	0.0807 (0.0566)	-0.0649 (0.0666)	-0.0649 (0.0666)	-0.0544 (0.0618)
Head – AgrExp	0.0459 (0.0762)	0.00541 (0.0755)	-0.152 (0.134)	-0.113 (0.124)	-0.00829 (0.0769)	-0.00829 (0.0769)	-0.0786 (0.0652)	-0.0786 (0.0652)	-0.00829 (0.0769)	-0.00829 (0.0769)	-0.0786 (0.0652)	-0.0786 (0.0652)	0.0868 (0.0912)	0.0868 (0.0912)	0.0981 (0.0879)
Head – NonFarm	0.318** (0.127)	0.306*** (0.0993)	-0.353** (0.157)	-0.277** (0.143)	-0.154 (0.135)	-0.154 (0.135)	-0.236** (0.114)	-0.236** (0.114)	-0.154 (0.135)	-0.154 (0.135)	-0.236** (0.114)	-0.236** (0.114)	0.0916 (0.119)	0.0916 (0.119)	0.154 (0.131)
Migrant	-0.0607 (0.0677)	-0.0614 (0.0716)	-0.214* (0.126)	-0.318*** (0.112)	0.0335 (0.0851)	0.0335 (0.0851)	0.0318 (0.0711)	0.0318 (0.0711)	0.0335 (0.0851)	0.0335 (0.0851)	0.0318 (0.0711)	0.0318 (0.0711)	0.103 (0.0841)	0.103 (0.0841)	0.145* (0.0848)
Split-off		0.192*** (0.0649)		0.0475 (0.0894)		0.0475 (0.0894)		0.0475 (0.0894)		0.0475 (0.0894)		0.0450 (0.0547)		0.0450 (0.0547)	-0.0858 (0.0977)
Violence exposure	0.0465 (0.145)	0.0411 (0.0809)	0.452*** (0.0939)	0.275*** (0.0940)	-0.0414 (0.0477)	-0.0414 (0.0477)	-0.0715† (0.0468)	-0.0715† (0.0468)	-0.0414 (0.0477)	-0.0414 (0.0477)	-0.0715† (0.0468)	-0.0715† (0.0468)	0.176*** (0.0537)	0.176*** (0.0537)	0.183*** (0.0510)
Constant	0.686*** (0.198)	0.657*** (0.202)	0.721*** (0.246)	0.726*** (0.228)	0.0757 (0.213)	0.0757 (0.213)	0.316 (0.220)	0.316 (0.220)	0.0757 (0.213)	0.0757 (0.213)	0.316 (0.220)	0.316 (0.220)	0.990*** (0.0687)	0.990*** (0.0687)	0.500* (0.259)
Province dummies	Yes 201	Yes 281	Yes 114	Yes 138	Yes 325	Yes 325	Yes 443	Yes 443	Yes 325	Yes 325	Yes 443	Yes 443	Yes 120	Yes 120	Yes 134
Observations	0.171	0.158	0.289	0.277	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.136	0.136	0.133

Robust standard errors clustered at the level of localities in parentheses. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1, †p=0.133.  
Head – Female equals one if the household head is a woman, zero otherwise. Head – Educ equals one if the household head ever went to school, zero otherwise. Head – AgrExp equals one if the household head's main occupation is agriculture with at least one export crop, zero otherwise. Head – NonFarm equals one if the household head's main occupation is not related to agriculture, zero otherwise. The omitted occupation is agriculture without export crop.  
Columns (1) and (2) estimate the determinants of the probability of a subsequent transition out from poverty over the sample of households who were poor in 1998 and not exposed to violence before 1998. Columns (3) and (4) estimate the determinants of the probability of a subsequent transition into poverty over the sample of households who were non-poor in 1998 and not exposed to violence before 1998. Columns (5) and (6) estimate the determinants of the probability of a subsequent transition out from poverty over the sample of households who were poor in 1998 and exposed to violence before 1998. Columns (7) and (8) estimate the determinants of the probability of a subsequent transition into poverty over the sample of households who were non-poor in 1998 and exposed to violence before 1998.