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Consumption Growth, Household Splits and Civil War

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Household Splits and Civil War

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Abstract: We analyse the effect of civil war on household welfare. Using Burundian panel data for the 1998-2007 period in which we re-interviewed original as well as newly formed households (split-offs), we show that headcount poverty decreased by 3.5 % points when split-off households are taken into account and 1% when splits are left out. Poverty is persistent while prosperity is not, in particular in war-affected areas. We find that 25 war-related deaths or wounded at the village level reduce consumption growth by 13%. We also find that violence afflicted on household members decreases growth whereas membership of rebel groups increases it. Apart from such war-related effects - and controlling for initial levels of consumption - we find that temporarily famine-induced migration and illness decrease growth while good harvests, more split-offs and higher initial levels of education increase it. Good harvests are found to have persistent positive effects on growth. Our results are robust for different household and province fixed effects specifications.

Keywords: consumption, growth, split-off households, civil war, panel data, Africa

JEL codes : C81, I32, O12, N47

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1   Introduction

A growing body of empirical literature uses longitudinal data to examine the impact of household specific and village level shocks on household consumption. Since the livelihoods of the majority of rural populations in poor developing countries depend on rainfed agriculture, most studies have focused on the welfare-impact of climatic shocks. The literature, which is now matured, shows that climatic shocks have negative and persistent effects on households' welfare levels. Dercon and Krishnan (2000) examine the evolution of welfare among a panel of Ethiopian households and find that rural households' welfare levels are affected by climatic shocks and livestock diseases, testifying for the importance of uninsured risk in their setting. In another study on Ethiopia, Dercon, Hoddinott and Woldehanna (2005) find that climatic shocks and severe illness adversely impact household consumption levels. The lack of insurance against adverse shocks may set a poverty trap in itself because social, human and physical capital may be lost reducing access to profitable opportunities. Such losses add to the ex-ante behavioural response in a risky environment, to wit the avoidance of risky but high-yielding economic activities for the sake of a lower but more secure return.

Several empirical studies (Rosenzweig and Binswanger (1993), Alderman et al (2001), Hoddinott and Kinsey (2001)) find evidence consistent with persistent effects of temporary events such as drought. Using the same Ethiopian data to study the effects of rainfall shocks on household consumption growth, Dercon (2004) finds that consumption levels are not only impacted by recent rainfall shocks, but also by such shocks occurring several years (four to five years) before. Moreover, he finds evidence that a severe famine that happened a *decade* before still negatively influences consumption growth of households that were affected by it.

Micro-level research on the welfare impact of civil war in general and violence in particular is much scarcer. On the one hand this is surprising given the pervasiveness of civil war and violence in Africa in the past two decades, on the other hand it is not surprising given the difficulties of data collection. Deininger and Okidi (1999) examine the evolution of welfare in Uganda and find a strong negative impact of initial civil strife on subsequent consumption growth. In another study on Uganda, Deininger (2003) finds that presence of civil strife at the community level reduces subsequent household level investment. Rural households that experienced civil strife were also less likely to start a small non-farm enterprise or, if they already had a small enterprise, were more likely to shut it down. Deininger interprets the

results by arguing that households who have been confronted with civil strife refrain from productive investments since these are too risky and vulnerable to war-related destruction. Bundervoet et al (2008), using variation in fighting over time and space in Burundi's civil war, show that children who are exposed to the civil war are smaller compared to those who are not exposed.

Cross-country time-series research on civil war is more readily available. It shows that long and bloody civil wars are usually followed by a period (of about five years) of sharp increases in prosperity and growth, commonly called the peace dividend (Collier, 1999; Collier et al, 2003).

In this paper, we study the evolution of individual and household welfare in Burundi between 1998 and 2007. We focus on the role of the civil war as a covariate village level shock and of various types of violent and non-violent idiosyncratic shocks in explaining household consumption paths. We use household private consumption per month per adult equivalent as a measure of welfare in a reduced-form econometric approach. Thanks to the panel nature of our data, we can study the determinants that explain welfare dynamics over the period under consideration.

Our paper contributes to the debate on the welfare impact of violence and civil war in Africa in four ways. *First*, we show that initial households can be tracked and re-interviewed in a very poor country even after a prolonged period of civil war. We show that the civil war did not affect attrition in our sample. *Second*, we account for the split-off households in our consumption measure. These are members of the original households in the first round of the survey who in the meantime started their own household. Most panel data studies, in particular in Africa, do not track nor interview newly formed households in between the two survey rounds.[3] Using the first panel data survey collected in rural Burundi through the Burundi Priority Household Survey (BPHS) we show that neglecting to account for split-off households in panel data studies may bias poverty results. *Third*, we use community measures of the intensity of the war as indicators of violence next to subjective indicators together with data on victimisation collected at the household and individual level. In the Deininger and Okidi (1999) study for example, the violence indicator is a first-period dummy variable that takes on the value one if the household reported to have been affected by the civil war. We

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[3] We refer to Foster and Rosenzweig (2002) for a detailed argument in favor of tracking and interviewing newly formed households between two survey rounds in a panel.

use much more fine-grained measures of violence. And *fourth*, we present results on the welfare impact of civil war related violence and other violent and non-violent shocks. Despite the salience of civil war in Africa in the past two decades, we are not aware of other studies using a household panel to study the impact of war on consumption growth. In the case of Burundi, we present the first analysis of changes in welfare over time which includes both split-off households as well as measures of the intensity of violence in the civil war.

Our findings are six-fold. <u>First</u>, we show that the inclusion of the newly formed households in our analysis of welfare changes over time decreases headcount poverty by 3.5% instead of 1%. This sheds light on the extent of the potential bias in studies which do not interview split-off households. <u>Second</u>, we find that the original household do better themselves after the split, even when we do not account for the welfare level of their split-offs. <u>Third</u>, we find that 25 war-related deaths or wounded at the village level reduce consumption growth by 13%. However difficult a peace settlement may be to achieve, the policy relevant prescription of our finding is clear: failing to find a settlement has direct negative implications for household welfare. <u>Fourth</u>, we find that violence afflicted on household members decreases consumption whereas membership of rebel groups increases it. War thus has winners and losers, which we are able to profile with our data. <u>Fifth</u>, apart from the war related effects and controlling for initial levels of consumption, we find that temporarily famine-induced migration and illness decrease consumption whereas good harvests, more split-offs and higher initial levels of education increase it. These findings confirm earlier results in the literature. And <u>sixth</u>, we find persistent effects of good harvest on consumption several years prior to the second round of the survey. Our results are robust for different household and province fixed effects specifications.

The paper is structured as follows. In section 2, we describe the civil war in Burundi and the data we use in this study. We analyse drop out during the second wave of the survey and potential selection bias. Section 3 details the calculation of the welfare measure and the procedure we used to account for the welfare of the split-off households. Section 4 starts with the econometric models that we estimate and continuous with the presentation of our main empirical results. This section also includes robustness checks with alternative measures for the intensity of civil war as well as an analysis of the persistence of shocks. Section 5 concludes.

2 Setting the stage

2.1 Burundi's Civil War

The latest episode of civil war in Burundi began in October 1993, when the first democratically elected president – and for the first time a Hutu president – was assassinated by paratroopers from the Tutsi-dominated army in a failed coup d'etat. This was followed by large-scale massacres in the countryside, with peasant-supporters of the president killing Tutsis and *UPRONA*-Hutus, and the army killing all Hutus in sight in an operation to 'restore order'[4]. In a matter of days, 100,000 people lost their lives in what the UN calls a genocide (UN, 1996). The massacres were followed by the spread of violence and warfare throughout the country, with several Hutu rebel factions opposing the regular government (Tutsi) army. This marked the beginning of one of the most brutal and bloody civil wars in recent history (Uvin, 1999)

In August 2000, some minor rebel groups signed the Arusha peace agreements with the still Tutsi dominated Burundian government. This had little effect on the security situation in the field since the two major rebel groups, CNDD-FDD and FNL, were not involved in the peace talks. In 2003, the new president (Hutu) announced a one-sided cease fire and allowed the largest rebel group CNDD-FDD to descend from the hills and march victoriously on Bujumbura. Rebel leader Nkurunziza was incorporated in the government and rebel combatants were integrated in army and police forces. The intensity of the civil war decreased dramatically and in 2005 Nkurunziza was elected as the new president. One rebel group (FNL) remained outside the peace process and continued murdering and pillaging, as a result of which pockets of insecurity still exists throughout the country.

Human rights organizations describe the Burundian war as a war against civilians (Human Rights Watch, 1998; 2003). Civilians were widely used as proxy targets, with both sides (rebel groups and the regular army) targeting civilians deemed supportive of the other group. Direct battles between the army and the rebel forces were relatively rare despite the duration of the war. Both sides of the conflict engaged in massive looting of civilian property and massive human rights violations. The forced regroupment of the rural Hutu population between 1996 and 2001 was associated with a lot of brutality by the regular army, resulting in thousands of deaths and rapes (Human Rights Watch, 2000). According to a UNFPA (2002) survey, 50% of the rural population has been displaced at least once during the war. Between the onset of the war in 1993 and 2002, 250,000 people were killed (UNFPA, 2002). Given the

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[4] UPRONA-Hutus are Hutus loyal to the Tutsi-dominated political party UPRONA, and are therefore seen as traitors to the Hutu cause.

low-intensity of the war after 2002, the widely claimed mortality figure of 300,000 deaths between 1993 and 2007 seems plausible. These figures only concern the persons who were directly killed in the violence. The indirect mortality resulting from the breakdown of the economy and the health-care system is bound to be a lot higher.

The war had devastating effects on the economy. Income per capita halved from USD 162.7 in 1993 to USD 82.6 in 2003. Rural poverty headcount increased from 39.6% in 1993 to just over 70% in 2003, making Burundi the world's poorest country (IMF, 2007). Social indicators also worsened: life expectancy fell from 51.1 in 1993 to 46.3 in 2003, and the prevalence of undernourishment increased with 20 percentage points (67% in 2003). Although real GDP per capita in Burundi increased since the ceasing of major hostilities (in 2003), it has done so at a moderate rate of per 1.6% per annum (IMF, 2008). Moreover, economic growth in the post-war period was fuelled almost entirely by the reconstruction of major infrastructure that was destroyed during the war. Growth in agriculture, which provides the livelihood for 95% of the population in Burundi, has faltered. In 2005, agricultural growth amounted to -6.6%. The peace dividend seems to be absent.[5]

2.2 The Burundi Household Priority Survey 1998-2007

The data we use in this paper consist of a nine-year panel with two data points, 1998 and 2007. In 1998, the World Bank and the Burundi Institute of Statistics and Economic Studies (BISES) conducted a nationally representative general-purpose household survey to analyse living standards. For this survey, 3908 rural households were interviewed (Republic of Burundi, 1998). We designed the 2007 Priority Survey (henceforth PS07) as a follow-up to the 1998 Priority Survey (henceforth PS98). Due to budget limitations, it was impossible to try to track and re-survey all 3908 rural households (391 survey sites) included in the PS98. Therefore, we decided to randomly draw 100 of the 391 baseline sites with the purpose to track and re-survey all 1000 original (1998) rural households in these sites.[6] We trained 65 interviewers during a one-week training during which we improved the questionnaire. The questionnaire was pilot tested in an out of sample village and final corrections were made. 50 interviewers were selected in a competitive exam that included a case study on household

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[5] For an analysis of the longer-term effects of Burundi's civil war, we refer to Voors, M.J. and E.H. Bulte. (2008). Unbundling Institutions at the Micro Level: Conflict, Institutions and Income in Burundi, Wageningen University, HiCN Working Paper 49

[6] To choose which hills to revisit and to end up with the same ratio of selected to unselected sites in each province as in the 1998 survey, we listed, per province, all hills surveyed in 1998 and picked each fourth hill until we selected 100 hills. In the 1998 survey, 10 households were chosen randomly in each survey site. The survey site was the hill (*sous colline*), the smallest administrative unit.

composition, consumption and production as well as a range of questions on research ethics. Each team of 5 interviewers was supervised by a team leader. Two out of five team members were women. The interviewers were instructed to track and re-interview, within each hill, the 10 original households.

Besides tracking and re-surveying 1000 original households, we decided also to track and interview the new households that have been formed between 1998 and 2007 by members of the selected 1000 original households[7]. For instance, if a son or daughter of a household that was interviewed in 1998 got married in the meantime and constituted his/her own household (between the two waves of the survey), this new household was tracked and surveyed. Overall we managed to locate and re-interview 874 of the 1000 selected household and trace and interview 534 splits. In sum, we interviewed 1408 households during the 2007 survey. The supervisor of each team of interviewers undertook a village level community survey in which (s)he asked questions on infrastructure, history, population, attacks and war-related violence.

2.3 An analysis of attrition in the sample

I   In the 2007 survey, we managed to track and re-interview 87.4% of the original households and 82% of all individuals interviewed in 1998. These are reasonable figures after a period of 9 years in between the survey rounds, a period characterised by civil war. Well-known panels in developing countries such as the Kenya Life Panel Survey 1998-2003/2005 (84%), the Indonesian Family Life Survey 1993,1998, 2000 (88%); and the KwaZulu-Natal Income Dynamics Study 1993-1998 (84%) have similar attrition rates. Baird, Hamory and Miguel (2008) signal the lower re-contact rates for panels who do not track individual members who moved between survey rounds.

For 113 of the 126 of the drop out households we were able to find out the reason why they dropped out, by asking neighbours and village authorities about their whereabouts. The drop outs in the second round can be divided into four groups: (1) all original household members deceased (24.8%). This mostly concerns small households with old members, (2) the household moved to another place, but we were unable to find where (22.1%), (3) the household disappeared all of a sudden and nobody knows its current whereabouts (21.2%) or (4) the household dissolved (31.9%), mostly parents deceased and children went their own way.

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[7] These are so-called "split-off" households.

This kind of drop out is not different from drop out in other panel surveys. Important is to find out whether or not the drop out households differ from the tracked households, which would bias subsequent estimation results. In Appendix 1 we explore potential selection bias in two ways. First, we examine mean differences on observables between tracked and drop out households and second we perform a probit analysis of attrition similar to Fitzgerald, Gottschalk, and Moffit (1998). We find that drop out households were on average smaller, were more likely to have an older, female or less educated head of the household and had lower total income and less cattle. In terms of poverty, measured as consumption per adult equivalent, the drop outs do not differ from the tracked households. We do not observe a difference for the intensity of violence, measured as the number of deaths and wounded at the village level. The drop out households did have a slightly worse access to markets in 1998.

The fact that the violence in the civil war did not influence or, worse jeopardize our tracking of households is an important finding in itself. It means that panel surveys can be conducted safely and with low drop-out rates in a war-affected country, with selection effects not different from those in other panel surveys and with no selection, at least not in our Burundi sample, on violence in civil war. The results of the FGM-method imply that we will use Heckman's method to correct for sample selectivity in subsequent analysis working with the variables that are statistically significant in explaining attrition.

3 Welfare and Poverty Transitions, 1998-2007

3.1 Welfare Evolution of the Original Households

Table 1 shows the 2007 consumption expenditures per adult equivalent of the 872 original households with complete consumption data who were interviewed in both rounds. The average consumption per adult equivalent of the 872 panel households amounted to BIF 16,789.85 per month during the 2007 survey. This translates in USD 14.47 using the October 2007 official exchange rate. We find considerable differences across provinces: households in Bururi had an average consumption level that exceeded three times the consumption of households in Ruyigi. As the figures in the first column of Table 1 are not comparable with the 1998 consumption levels in column two, the third column expresses the 2007 consumption levels in constant 1998 prices. Average consumption per adult equivalent of the panel households increased by over 13 percent between 1998 and 2007 (from BIF 7,084 in 1998 to BIF 8,033 in 2007). However, the 2007 average consumption level of BIF 8,033.42 (in 1998 prices) still falls short of the poverty line (BIF 8,173.15). A salient feature of Table 1

is that despite the 13% increase in average consumption, the incidence of poverty decreased by only one percentage point. While in some provinces poverty levels among the panel households declined drastically (for instance in Bururi and Muyinga), panel households in other provinces have been confronted with a substantial increase in poverty between 1998 and 2007 (for instance Kirundo, Ngozi and Muramvya). Higher average consumption levels do not necessarily translate into lower poverty levels: although on average the panel households in Cankuzo have increased their consumption levels by almost 31%, poverty incidence has *increased* with over two percentage points. This suggests a greater inequality in the distribution of consumption.

Figure 1 shows the change in the distribution of consumption levels between 1998 and 2007. While there are more households with high or very high consumption levels in 2007 than in 1998, there are also more households that have to manage with lower levels of consumption. The mode of the distribution is lower in 2007 than in 1998. The overall picture is one of a 13% increase in average consumption levels but a 16% *decrease* in the median consumption level: while the median consumption level of the 872 panel households amounted to BIF 6,119.89 in 1998, it fell to BIF 5,151.16 in 2007. The pattern in Figure 1 is mirrored by the evolution of the Gini-coefficient of consumption per adult equivalent: in 1998, the Gini-coefficient among the panel households amounted to *0.33*. In 2007, this had risen to *0.44*. This confirms the sharp increase in inequality of the 1998-2007 period. Overall, 54.1% of panel households had a lower consumption level in 2007 than in 1998. The shift in the distribution of consumption levels translates in a rising incidence of extreme poverty or food poverty. While the overall poverty headcount dropped one percentage point between 1998 and 2007 (see Table 1), the incidence of extreme poverty increased from 56.0% in 1998 to 59.2% in 2007. The poor households in 2007 are worse off in terms of consumption than the poor households in 1998, with an average consumption level of BIF 3,682.54 in 2007 and BIF 4,570.64 in 1998. In contrast, the mean consumption expenditure of the non-poor in 2007 (BIF 17,184.21) is much higher than that of the non-poor in 1998 (BIF 12,569.69).

There is however an important caveat to this, the poor and non-poor are not necessarily the same in both years. As Table 2 shows, economic mobility among the panel households is considerable. 35% of household switched from one economic category (poor or non-poor) to another between 1998 and 2007. Nevertheless, poverty is persistent: 74% of households that were poor in 1998 still are in 2007. In contrast, prosperity is less persistent, with over half of households (54.4%) that were non-poor in 1998 falling into poverty by 2007. This can be

corroborated by looking at the bottom and upper quintile levels: while the bottom quintile in the 1998 survey had a consumption expenditure of BIF 2,121.28 in 1998-1999, their consumption level in 2007 amounted to BIF 5,086,95, a 140% increase. These households have converged to the mean. Similarly, the upper quintile in the 1998 survey had an average consumption level of BIF 14,574.35 in 1998. In 2007, they had BIF 10,840.39, a 29% decrease. We thus observe convergence to the mean welfare level in the data. This convergence effect seems to be at odds with Figure 1 and the Gini-coefficients, which showed that the consumption distribution was more unequal in 2007 than in 1998. However, although the poor in 2007 are poorer than the poor in 1998 (and the rich are richer, hence the higher Gini-coefficient), the poor in 1998 are not the poor in 2007.

Table 3 completes to picture by comparing the growth in welfare for poor and non-poor households in peaceful areas and in war-affected areas. The battle variable is a dummy variable capturing whether or not at least one battle between the army and the rebel groups occurred. We observe strong growth in the consumption of the poor, both in peaceful as well as war-affected areas. Consumption growth of the non-poor is moderately negative in peaceful areas and worse in war-affected areas. The difference in consumption growth between the poor and the non-poor is statistically significant in peaceful as well as in war-affected areas, but the effect of the war is only statistically significant for the non-poor. The difference-in-differences estimator is however based on a two-by-two crossing of a poverty dummy variable with a war dummy. While based on the same logic, in the regression framework below we will be using a continuous measure of consumption as well as a continuous measure of the intensity of war, thereby preventing the loss of information.

3.2   Accounting for the Split-off Households

Most studies that use panel data to examine welfare and poverty dynamics do not take account of the new households that are formed between the survey rounds by members of an original (first period) household. If the new households (split-off households) are systematically poorer or richer than their original household, a comparison between the original household's welfare level in period 1 and period 2 will over- or underestimate the second-period welfare of the original household.[8] To see this, imagine a household that consisted of four members in 1998. Consumption per adult equivalent of the household was, say, BIF 6000. Between 1998 and 2007, the two sons of the household got married and

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[8] While we study the welfare of split-off households and their impact on the welfare of the reconstituted households, the formation process of new households as such is not the topic of this paper.

constituted their own households. Meanwhile, the mother and father of the original household adopted a war orphan. Consumption per adult equivalent in 2007 of the original household, which now consists of three members, amounts to BIF 5000 (in 1998 prices). Naïve comparison of the two consumption figures suggests that the original household became poorer between 1998 and 2007. However, imagine that the new households of the two sons who got married have expenditures per adult equivalent of BIF 10,000 and BIF 7000 BIF. When comparing the welfare of the original household in 1998 and 2007, one needs to take into account the current (2007) welfare level of *all* individuals who were member of the household in 1998. Proceeding in this way, the welfare level of the reconstituted *original* household in 2007 is calculated as $\frac{2}{4}*5000+\frac{1}{4}*10000+\frac{1}{4}*7000=6750$ BIF per adult equivalent. Using this method, the original household is *better-off* in 2007 than in 1998.

To capture this in a stylized fashion, consider a simple two-period model where HM_{1ij} denotes the number of household members in household i in period 1. J is the index for the household's status and ranges from 0 to N, with N being the number of new households that are formed between period 1 and period 2 by members of the original household i. Note that j=0 is the index for the original household. Let HM_{2ij} be the number of original household members in the j-th split-off of household i (j=0,...,N) in period 2, so that $\sum_{j=0}^{N} HM_{2ij} + number\_of\_deaths = HM_{1ij}$. Finally, C_{2ij} denotes the consumption expenditure per adult equivalent in period 2 of household j (j=0,...,N). The welfare measure of the original household in time period 2 is calculated as

$$W_{2i0} = \sum_{j=0}^{N} \frac{HM_{2ij}}{HM_{1i0} - Number\_of\_Deaths} C_{2ij} \qquad (1)$$

When we include all original households in the analysis irrespective of having an interviewed split-off (N=872), we find that the mean consumption level in 2007 of the reconstituted households, calculated according to equation (1), does not differ with (BIF 16,771.69) or without (BIF 16,789.85) the splits. However, the median consumption level increases with 3.6% (BIF 5,334.95 (in 1998 prices) with split-offs vs. BIF 5,151.16 without split-offs). Poverty headcount in 2007 is 65.4% for the reconstituted households compared to 67.8%

when splits are not taken into account. The incidence of extreme poverty also lowers (59.2% without split-offs vs. 56.9% with split-offs) but remains higher than in 1998.

We find that taking account of the split-off households to calculate overall poverty decreases headcount poverty by 3.5% instead of 1%. Given the relatively high welfare level of the newly formed households (BIF 18,473 on average), this difference of (only) 2.5% seems small. However, one has to take two issues into account. *First*, the poverty headcount in 2007 of the original households who split already declines from 79.9% to 66%, even before we account for the consumption level of their splits. This means that the newly formed households are not the only beneficiaries of the split, the households from which they originate clearly benefit too. This is confirmed by the (albeit smaller) decrease in poverty from 72.8 to 69.2% for the 92 original households who had at least one split but where no split-off household could be interviewed. *Second*, the impact of the welfare level of the split-off member on the welfare level of the reconstituted household is limited because each split-off represents only 1 member in equation 1. The larger the number of household members who remained in the original household, the smaller the impact of the split on the welfare level of the reconstituted household.

We found 431 original households with at least one split-off and with an average number of 1.8 splits. From a total of 774 split-offs, we were able to interview 534 and collect information on the whereabouts of the non-interviewed splits when visiting their original households. We performed an analysis of attrition among splits (not shown), much in the same way as we did with selection into the second round for the original households in section (2.3). Again, we are interested to know whether or not the profile of our interviewed split-off households is different or not from the non-interviewed. We found that married splits, sons and daughters of the head, nearby living splits and splits of less educated heads where more likely to be interviewed by us. This may be important for our consumption measure as we do not know what the consumption of the non-interviewed splits is. From the profile of our interviewed splits however, we know that splits living outside their commune of origin are on average better-off (higher consumption) compared to those who stayed. We do not find a similar difference in welfare over the other three variables which were statistically significant in the selection equation. Thus, our calculation of the consumption per adult equivalent of the reconstituted households may underestimates consumption for those households having non-interviewed splits residing outside of the commune of residence. One in four (25%) splits resided outside of the commune of residence of the original household.

We interviewed 35% of them, compared to 85% of the splits who did not leave their commune. The degree of underestimation however is limited: While the average consumption per adult equivalent of the out-migrated splits is 25.000 BIF, the median is only 15.000 BIF, the later being under the poverty line. Of the 66 interviewed splits living outside of their commune of origin, 32 (48%) are non-poor (expenditures per adult eq. > 16,570 BIF). This means that approximately half of the non-interviewed out-migrated splits have the potential to lift their original household out of poverty. Of the 90 original households with non-interviewed out-migrated splits, 56 (62%) live in poverty. Including the consumption of their non-interviewed splits would potentially increase the welfare in 48% of these households, meaning in 27 cases. As some non-interviewed splits live in poverty, their inclusion would decrease the welfare of the reconstituted non-poor households. The net result would be that only a handful of households, to wit those living just under the poverty line, would be lifted out of poverty.

In Table 4 we present a poverty profile of the reconstituted households for 1998 and 2007 distinguishing between households who did and did not split, using the same poverty lines as in Table 1. The first two columns show an 8 percentage point *increase* in poverty for those households who did not split. The last two columns show a 17 percentage point *decrease* in poverty for households with splits. Among the latter, households with younger, female, educated or farming heads of the original household have increased their welfare more then others. Results are even more outspoken when we further divide the households who did not split in households who had at least one adult son or daughter (a potential split) and households who did not (not shown). While the poverty headcount of the first group remains stable between 1998 and 2007 (69 and 71%), the latter group impoverishes (54 and 68%).

These findings allow three intermediate observations: (1) Panel surveys in developing countries that do not track or interview split-off households may yield biased results. In our survey the failure to account for the welfare level of splits overestimates overall headcount poverty by 2.5%. (2) The bias may remain limited since original households may (at least in our survey) also benefit from the split. This can be captured even by panels who do not track splits. However, the effect of not been able to interview out-migrated splits may add further bias as some of them may be better-off than the average split. And (3) we observe large discrepancies in welfare transition over time between household who split and those who do not split. This opens a path of research that until now has been largely neglected in the study of poverty in developing countries.

We can go a step further by looking at welfare and poverty at the individual level. Since poor households usually have more members, consumption expenditures are lower and poverty incidence is higher at the individual than at the household level. In the survey we have 3813 individuals with two observations on consumption. Overall, the average consumption expenditure at the individual level increased with 14.7% between 1998 and 2007. This increase in consumption translates into a four percentage point-decline in poverty incidence. While in 1998 73% of the panel individuals lived in poor households, this had decreased to 69% in 2007.

4   Violence, Shocks and the Evolution of Welfare in Burundi

4.1 The Econometric Models

In this section we examine the impact of war-related violence and various types of shocks on the evolution of households' welfare levels. Panel households have been confronted with various types of shocks between the two survey rounds. To examine whether and to what extent these shocks have affected consumption growth, we estimate standard micro-level growth models augmented for the presence of specific shocks and events during the 1998-2007 period. The dependent variable in the analysis is the change in real consumption expenditure per adult equivalent (expressed in BIF 1998) between 1998 and 2007, accounting for the welfare level of the split-off households (using equation (1)). The first model explains consumption growth between 1998 and 2007 based on initial household and village characteristics and on a vector of specific shocks and events that happened between 1998 and 2007. This model can be written as: (2)

$$\ln(\exp\_ad)_{ij,2007} - \ln(\exp\_ad)_{ij,1998} = \ln(\exp\_ad)_{ij,1998} + \alpha.H_{ij,1998} + \beta.S_{ij,98-07} + \gamma.V_{j,1998} + \eta + \varepsilon_{ij,2007}$$

With $\ln(\exp\_ad)_{ij,1998}$ being the natural log of the expenditures per adult equivalent for household i in village j in 1998, $H_{ij,1998}$ being initial household characteristics of household i in village j, $S_{ij,98-07}$ the shocks and events that happened to household i in village j between

1998 and 2007 and $V_{j,1998}$ a set of initial village characteristics in village j. η are the province fixed effects and $\varepsilon_{ij,2007}$ is the white noise error term[9].

Initial household characteristics ($H_{ij,1998}$) are characteristics of the head (age, sex and education), the stock of capital in the household, both human and physical (proportion of literate household members and value of livestock per adult) and demographic composition of the household (proportion of children, adults and elderly). We also control for the number of male and female adults that died non-violently between 1998 and 2007. The shocks ($S_{ij,98-07}$) include both household shocks and the individual shocks. At the household level, we include shocks related to climate and agriculture (harvest failures, exceptionally good harvests, crop pests and diseases, destruction of house due to climatic events and loss of land due to erosion) and shocks related to the war (destruction and looting of household assets). During the survey, households were instructed to specify for each year between 1999 and 2007 whether they were confronted with a specific shock or event. To make sure that respondents only marked those years during which the shock was most pervasive (had the most impact on the household), respondents could on maximum specify three of the nine years as "shock-years". Rainfall shocks are not included due to their frequent nature: since over 90% of panel households reported these shocks, identification of their impact is not possible in our sample Finally, we include a variable capturing whether or not members of the household had temporarily migrated between 1999 and 2007.

At the individual level, we include shocks that happened to the members of the household between 1998 and 2007 and potentially impact the welfare of the household (mainly through influencing the supply of family labour). These shocks include ill health of household members (serious illness of adults) and events related to the war (forced and unpaid labour for armed movements, kidnappings of household members, torture or more generally violence towards household members, and imprisonment). We include dummy variables indicating whether or not an adult household member became handicapped between 1998 and 2007, whether or not an adult member was killed and whether or not a household member joined the rebellion. This latter variable is included to test for a *positive* welfare effect: the integration in the government of former rebel leader Pierre Nkurunziza in 2003 and the integration of his

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[9] Correlation among the error terms of households in the same hill who have experienced the same shocks might bias OLS standard errors downwards. Therefore, standard errors are clustered at the level of the hill (Moulton, 1986; Bertrand, Duflo, and Mullainathan, 2004).

troops in police and army forces (and in thriving private security companies) meant the accession to a steady and relatively high-paying job for most former rebel fighters. The remaining combatants who had to be demobilized profited from the considerable reinsertion payments they received in the framework of the World Bank's Multi-Country Demobilization and Reintegration Program (MDRP)[10]. In short, we investigate if membership of rebel groups was a lucrative strategy during Burundi's civil war.

At the level of the village ($V_{j,1998}$), we include the standard variables capturing the initial access to key infrastructure (electricity, health centre, paved road, and national road). To examine the impact of violence related to the civil war on consumption growth of exposed households, we include the number of war-related deaths and wounded in the village. To explore the robustness of this relationship, we will also use a variable on the subjective appraisal of the level of violence in the village. This variable was obtained from the community survey, during which village authorities rated the 1998 security situation in their village on a four-point ordinal scale ranging from "very peaceful" to "very violent".

In the section on attrition we have seen identified some observables responsible for non-random selection into the second round of the survey. We will use Heckman's sample selection model to address this issue in our estimation. Selection bias can be thought of as a form of omitted variable bias (Heckman, 1979).

The results produced by econometric model (2) may be suspect if there are unobservable factors that simultaneously influence the dependent variable and the right-hand-side variables. In this case, the relation between the right-hand-side variables and consumption growth is spurious. Panel data offer a powerful tool to remove this omitted variable bias. This is known as fixed-effects regression (or the within-estimator) and exploits *only* the within household variation over time (the variation across households is not used to estimate the regression coefficients). First differencing the variables sweeps out all time-invariant effects, both observable as well as the unobservable: (3)

$$\ln(\exp\_ad)_{ij,2007} - \ln(\exp\_ad)_{ij,1998} = \alpha.(H_{ij,2007} - H_{ij,1998}) + \beta.(S_{ij,98-07}) + \gamma.(V_{j,2007} - V_{j,1998}) + (\varepsilon_{ij,2007} - \varepsilon_{ij,1998})$$

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[10] This reinsertion payment amounted to at least 556,000 BIF and increases with rank. Anyone above the rank of corporal received 600,000 BIF on minimum (Uvin, 2007).

H_{ij} is a vector of household characteristics that can change over time and includes the proportion of adults who are literate and the value of livestock holdings. This vector also contains controls for the changes in household composition (number of children, adults and elderly, deaths of male and female adults, violent death of adults). $S_{ij,98-07}$ is the vector of shocks between 1999 and 2007 and contains the variables used in the previous analyses. V_j captures the characteristics of the village that can change over time and includes access to health care, electricity and a paved road (we cannot include the access to a national road since this had not changed at all between 1998 and 2007 and is swept out as a fixed effect). This vector also includes the number of war-related deaths and wounded in the village between 1999 and 2007 and (alternatively) between 1997 and 1999. As a robustness check, we also use the change in the ordinal variable measuring the change in intensity of violence in the village between 1998 and 2007.

4.2 Empirical Results

Table 5 shows the results of estimating equation (2). In line with the new growth literature, we find strong conditional convergence: richer household grow slower. A salient feature of the analysis in column 1 of Table 5 is the relative *unimportance* of most shocks. Crop diseases, destruction of the house (rugo), and erosion are small and statistically insignificant. Harvest failures between 1998 and 2007 considerably decreased household consumption growth. According to the estimated coefficient, two harvest failures decrease consumption growth by over 11%. Exceptionally good harvests boost consumption growth: one such harvest between 1999 and 2007 increases growth by 9%. Ill health of household members, defined as the average number of months that sick individuals could not work due to their illness, significantly decreased household welfare growth. However, the impact is rather modest: at the mean of the sample, 11 months, consumption growth decreases by 2.2%. The death of female adults in the household increases consumption growth. This is related to the decrease in adult equivalents (the denominator in equation (1)) with few impact on the expenditures of the household (the nominator) due to the old age of the deceased person. Other shocks to the supply of household labour (imprisonment and loss of bodily functions of household members) do not influence consumption in our sample.

Turning to conflict shocks, we find that exposure to violence significantly lowers household consumption growth. The number of times household members have been mistreated or have been the victim of violence during the conflict exercises a statistically significant negative

impact on the welfare of the household. The coefficient however is very small (*-0.004*). At the village level, violence during the civil war, measured as the number of deaths and wounded per year, had a strong negative effect on consumption growth: 25 war-related deaths or wounded in the village between 1998 and 2007 lowered households' consumption growth by 10%. Other conflict-related shocks – theft of assets, ambush of household members and the violent death of an adult – do not significantly affect consumption growth.

When a member of the household joined the rebellion between 1999 and 2007, household consumption growth is increased by almost 29%. Although this effect might seem surprising, research on ex-combatants in Burundi has shown that many of them now belong to the highest economic category in rural Burundi, and that there is "no reason to assume that this is the result of their better initial conditions" (Uvin, 2007, p. 13)[11].

Temporary migration due to the conflict does not appear to have influenced consumption growth. If the household was forced into a regroupment camp, consumption growth is lower but the effect is not statistically significant (the baseline for the migration variable is "no migration of household members"). We find a strong negative effect of migration due to a localized famine, which reduces consumption growth by 52%.

Among the initial household characteristics, we find that initial levels of education matter much for future growth: controlling for the initial level of expenditure, we find that if all adults in the households were literate in 1998, consumption growth over the subsequent period increased by 39%. Confirming an earlier observation made in Table 4, households who were headed by a woman in 1998 experienced higher consumption growth. The initial value of livestock also exercises a positive effect on subsequent growth, though this effect is not statistically significant. Concerning the initial conditions at the level of the village, a relatively good access to the nearest paved road in 1998 is associated with higher consumption growth between 1998 and 2007. This effect is considerable: a relatively good initial access to a paved road boosts consumption growth by 16%.

One might argue that there is an endogeneity problem with the variable that captures village-level intensity of the war (number of war-related deaths and wounded between 1998 and

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[11] There seems however to be a difference between the demobilized in the North and the South of the country. In the South, where many homes were destroyed during the war, demobilized soldiers had to use their reinsertion payments to rebuild their houses. As such they could not use this money for more profitable investments (Uvin, 2007).

2007): the negative effect of village-level violence on household consumption growth may reflect the possibility that villages where household consumption growth has faltered were more likely to experience war related violence. This is however unlikely to be the case given the nature of the violence: in the survey, we asked for the number of deaths and wounded in the village resulting from (1) confrontations between army and rebels that took place in or near the village, (2) rebel attacks on the village (because the villagers were believed to support the government) or (3) army attacks on the village (because the army believed the villagers provided shelter and support to the rebels). This variable does not include other types of violence, such as disputes between neighbours or families that resulted into violence and deaths or poverty-induced violence (this is the subject of other questions in the survey). It is unlikely that household consumption growth in the village determines whether the village will become the scene of battles between army and rebel forces.

We ran province fixed-effect regressions (not shown) with the occurrence of confrontations (logit) and the number of deaths and wounded (OLS) as dependents and with average expenditures at the village level as explanatory variables, including consumption in 1998, in 2007 as well as consumption growth 1998-2007. The variables have no statistically significant effect on the occurrence of battles or the number of deaths and wounded at the village level.

Hence, endogeneity is not likely to pose a serious threat. In order the check the results, the second column of Table 5 uses the number of war-related deaths between 1997 and 1999 as a measure of initial village-level violence. Here, causality can only run one way, since household consumption growth between 1998 and 2007 cannot influence the number of war-related deaths and wounded in the village between 1997 and 1999. We find that village-level violence between 1997 and 1999 considerably lowers household consumption growth between 1999 and 2007: 25 war-related deaths and wounded in the village decrease subsequent household consumption growth by 12%. This effect is statistically significant with *p.=0.074*. The coefficients of the other explanatory variables remain virtually unchanged. This confirms the results of the first column.

The third analysis in Table 5 provides another robustness check for the effect of violence. The variable capturing the level of violence in the village in 1998 is an ordinal variable with baseline "village peaceful in 1998'. The results show that the initial level of violence in the village considerably influenced subsequent consumption growth. Households who lived in a

violence-ridden village in 1998 saw their subsequent consumption growth reduced by over 20% (ceteris paribus), an effect statistically significant at the 5% level.

Due to the relatively high number of explanatory variables in the analysis there is bound to be multicollinearity in the data. Collinearity does not bias the estimates but inflates the standard errors, resulting in smaller t-statistics and hence a higher probability of accepting the null hypothesis. In the data, the right-hand-side variables that co-vary most are the intensity of the civil war in the village ("deaths and wounded in the village"-variable) and conflict-induced migration of the household. Replicating the analysis with either one of the two variables does not change the results: the magnitudes of estimated coefficients remain approximately the same; standard errors become a little bit smaller but do not change significance levels.

The results of Table 5 suggest that household consumption growth is affected by a number of household and village level shocks. Harvest failure, illness of household members, violence towards household members, and famine-induced migration between 1998 and 2007 negatively and significantly affect welfare growth. Good harvests boost consumption (growth), and having a household member who fought in the rebellion seems to positively influence household expenditure growth. The results of the analyses provide micro-level evidence on the impact of war-related violence on household consumption growth. Both the initial intensity of violence in the village and the intensity *between* the two surveys significantly and considerably reduce household consumption growth. This effect is robust to different specifications.

To correct for sample selectivity, we use Heckman's (1979) two-stage sample selection method. In the first stage, a probit model estimates the probability to be interviewed during the 2007 survey based on the four significant variables in the FGM analysis (household size, age and sex household head, and number of cattle). In the second stage, we estimate equation (2) to which the estimated probability of a household being interviewed in 2007 is added as an extra explanatory variable. The last column of Table 5 presents the results of the Heckman correction. Using the Heckman correction does not considerably affect the results. Compared to the baseline regression in column 1, the proportion of literate adults in the households (in 1998) and the number of war-related deaths and wounded in the village between 1999 and 2007 are more important using the Heckman correction. The impact of other variables remains quantitatively and qualitatively the same.

Table 6 shows the results of estimating our household fixed effects model (equation (3)). Consistent with the results of Table 5, we find a strong welfare-decreasing effect of violence: 25 war-related deaths between 1998 and 2007 decrease household consumption growth over the same period by 13%. This effect is statistically significant at the 5% level. According to the specification, a household living in the most violent village would see consumption growth decreased by 50.8%, a formidable change. The second column in Table 6 uses the number of war related deaths and wounded in the village between 1997 and 1999 to explain household consumption growth between 1998 and 2007. The impact of violence remains virtually the same: 25 war-related deaths and wounded between 1997 and 1999 decreased subsequent household consumption growth by 14%.

Turning to shocks related to climate and agriculture, the incidence of harvest failures is more important in the household- than in the province fixed effects specification: one harvest failure between 1999 and 2007 reduced consumption growth by over 8% and the effect is statistically significant at the 1% level. The effects of exceptionally good harvests are also more important in the household fixed effects specification: a good harvest boosts growth by 13%.

In the households fixed effects specification the shocks related to labour supply have small coefficients and never reach statistical significance. Turning to conflict shocks, we find that two other variables have a statistically significant effect on consumption growth: violence towards household members and having a household member who joined the rebellion. The effect of violence towards household members is negative and rather modest. In contrast, the impact of having a household member who joined the rebellion between 1998 and 2007 is positive and strong, increasing consumption growth by almost 37%. Again, this can probably be explained by the accession to a steady job and the reception of considerable reinsertion payments.

Conflict-induced migration decreased household consumption growth by almost 14%. This effect is however not statistically significant. The category of conflict-induced migration includes migration to a displacement camp, a regroupment camp and violence-induced migration to another location that is not a camp. If a household migrated due to famine in the village, its consumption growth decreases by over 50%, an enormous change.

Education plays an important role in raising welfare levels: if the proportion of literate adults increases from *0* (no literate adults) to *1* (all adults are literate), consumption growth increases by 70%. We cannot include the level of education of the household's head in this regression, as this is a fixed effect that is swept out by taking first differences[12]. An increase in assets boosts consumption growth. Results in Table 6 show that one additional cow increases household consumption growth by 8.2% (the value of livestock is expressed in 100,000 BIF, or exactly the price of one cow in 1998).

Consistent with results in Table 5, the number of split-off households increases household consumption growth. Although the coefficient is smaller in the household fixed effects regression (*0.091*) than in the province fixed effects regression (*0.131*), the impact remains considerable and statistically significant at the 1% level. An additional split-off increased consumption growth by 9%.

Turning to village infrastructure, improved access to a paved road increases consumption growth by 2.9% (when access to infrastructure is improved, the difference in value between 2007 and 1998 is negative). Changes in access to a health centre or electricity have no or only marginal effects.

The last column of Table 6 provides a robustness check for the effect of village-level violence. In the framework of the household fixed effects specification, the self-reported level of violence in the village in 1998 is subtracted from the level in 2007. The results show that a lowering intensity of violence in the village spurs household consumption growth. If violence in the village decreased by one level between 1998 and 2007 (from 'very violent to 'violent', from 'violent' to 'relatively peaceful' or from 'relatively peaceful' to 'peaceful') growth increased by 3.9%. If violence decreased by two levels (from 'very violent' to 'relatively peaceful' or from 'violent to peaceful'), growth increased by over 11%, statistically significant at the 10% level. If the village evolved from very violent to peaceful, growth increases by 9.5%, though this effect (closely) misses statistical significance at the 10% threshold. In this specification, conflict-induced migration significantly decreased household consumption growth: if a household was forced to flee the violence, consumption growth decreased by 18.4%, statistically significant at the 10% level.

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[12] Of course, if the head of household changed between 1998 and 2007, this is no longer a time-invariant effect.

Similar to the province fixed-effects specification, there is some multicollinearity in the household fixed effect regression. The correlation matrix shows that the explanatory variables that are most correlated are the 'Fled Violence'-variable and the 'Deaths/Wounded in the Village'-variable. Contrary to the province fixed effects specification, leaving either one of the two correlated variables out of the model changes (albeit modestly) the result on the remaining variable: if the 'Deaths/Wounded in the Village (1997-1999)'-variable is excluded from the model, the coefficient of the 'Fled Violence'-variable increases and is statistically significant at the 10%-level (coefficient of *-0.200* and p.-value of *0.057*). If the 'Fled Violence'-variable is dropped, the adverse impact of the 'Deaths/Wounded in the Village (1997-1999)'-variable increases (coefficient of *-0.006* statistically significant at the 1%-level).

4.3   The Persistence of Shocks

The previous analyses pool all shocks over the 1999-2007 period and do not take account of their specific timing. However, the impact of shocks may differ according to the year the shock manifested itself. For instance, harvest failures in 1999 or 2000 might have a smaller impact on household consumption compared to harvests failures in recent years (2006 or 2007). To examine whether the impact of recent shocks differs from that of past shocks, we estimate the household fixed effects specification (equation (4)) where the shock variables are broken up according to their specific timing. We consider three specifications. In the first specification, the shocks are broken up in two groups whether they occurred between 1999 and 2003 or after 2003. The second specification divides the shocks in three groups of three years (1999-2001, 2002-2004, 2005-2007). The third specification also uses three groups but focuses on the shocks that occurred in 2006 and during the first half of 2007 (that is, during the *impeshi* season)[13]. The shocks are divided in three groups: 1999-2005, 2006, and 2007.

Table 7 shows the results from estimating a household fixed effects regression of the three specifications. The first specification (two groups: 1999-2003, 2004-2007) suggests that harvest failures do not have persistent effects. Only such failures that occur after 2003 significantly affect household consumption growth. One harvest failure after 2003 diminishes growth by 8.3% (statistically significant at the 5% level).

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[13] The data for the 2007 survey were collected in August and September 2007, just after the main agricultural season (the *impeshi* season). The *impeshi* season lasts from February till June and accounts for about 50% of total annual production.

A harvest failure before 2003 reduced household consumption growth by 0.3%, a negligible and statistically insignificant effect. In contrast, the positive effects of exceptionally good harvests do persist into the future: one good harvest in the 'early' period (1999-2003) increases growth by over 10%. A good harvest in the recent period boosts growth by 18%. The results show no effects of crop diseases, the destruction of the household *rugo*, and the theft or destruction of household assets.

The second specification (with shocks divided in three groups of three years) confirms the findings of the first specification. Only the harvest failures that occurred in the most recent period (2005-2007) had an adverse and statistically significant impact on consumption growth (they reduced growth by 8.3%). On the contrary, exceptionally good harvests had positive and statistically significant impacts in all three periods. The size of the coefficient increases in each period: a good harvest during 1999-2001 increased consumption growth by 8.9%; a good harvest during 2002-2004 increased growth by 14.7%, and a good harvest in the most recent period (2005-2007) boosted growth by 16.4%. Surprisingly, we find that the (partial) destruction of the household *rugo* in the most recent period increased consumption growth[14].

The third specification focuses on shocks that occurred in 2006 and 2007. We find that a harvest failure in 2006 decreased consumption growth by over 15%, but that harvest failure just before (or during) the survey did not significantly affect growth. It is possible that the adverse effect of a very recent harvest failure will manifest itself some time after the shock has materialized, that is, after the survey. In line with previous results, harvest failures in past times (before 2006) did not influence consumption growth. An exceptionally good harvest in the 2007 *impeshi* season spurred consumption growth by over 20%. Past good harvests also significantly increased growth. A new result is that crop diseases during the agricultural season preceding the survey negatively affected consumption growth. The incidence of crop disease during the 2007 *impeshi* season diminished growth by almost 15%, statistically significant at the 10% level.

The effects of other explanatory variables in Table 7 are approximately the same as in Table 6. Each additional split-off household boosted consumption growth by nine to ten percent, while having a former rebel in the household increased growth by 36 to 40%. Consumption

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[14] A possible explanation for this finding is that households whose *rugo* had been destroyed in recent years had to rebuild their *rugo*. This reconstruction may be associated with a temporary increase in household expenditures as households have to purchase materials to reconstruct their houses.

growth of a household who had to migrate due to a famine in the village is reduced by 50 to 60%. The effect of violence-induced migration is negative and flirts with the threshold of statistical significance. In the second specification of Table 7, violence-induced migration is significant at the 10% level. In the first and third specification, statistical significance is closely missed. The torture or mistreatment of household members during the war decreased household consumption growth, but this effect is small. In line with the previous results, the incidence of war-related violence in the village considerably decreased consumption growth. 25 war-related deaths and wounded decreased household consumption growth by over 12%. To anticipate discussions on endogeneity, we also estimated all regressions in Table 7 with the number of war-related deaths and wounded in the village between 1997 and 1999. Results (not reported) show a coefficient ranging between *-0.005* and *-0.006*, always statistically significant at the 5% level. Finally, a better access to a paved road increased consumption growth by approximately 3%.

5   Conclusions

In this paper we study the evolution of welfare of a panel of 872 Burundian households between 1999 and 2007. We find that average consumption levels of the panel households increased considerably and median consumption levels decreased considerably, resulting in rising inequality in the distribution of consumption. Our panel data differ from other panels from developing countries as we also interviewed the persons who had left their original 1998 household to constitute their own proper households. We argue that in order to study the evolution of households' welfare throughout time in a methodologically sound fashion, one has to take account of the welfare levels of the newly formed or split-off households. We find that accounting for the welfare levels of the split-off households positively influences the welfare levels of the reconstituted households in 2007: failing to account for the split-off households results in an underestimation of panel households' welfare in 2007, in particular when a lot of splits migrated out of the commune of residence.

The paper is essentially concerned with the impact of war-related violence on household consumption growth. This relation is under-researched, and if researched, the war indicators that are used are at best dummy variables capturing whether a household has been affected by war. Using the number of war-related deaths and wounded in the village between 1999 and 2007 as an indicator for village-level intensity of the civil war, we find a considerable and statistically significant negative effect on household consumption growth. In our preferred household fixed effects specification, we find that 25 war-related deaths and wounded

diminished household consumption growth by 13%. Consumption growth of a household living in the most violent village was reduced by over 50%. To test for robustness, we used two alternative specifications of village-level war intensity: the number of deaths and wounded in the village between 1997 and 1999 and a self-reported ordinal variable capturing the violence level in the village in the 1998 survey. We find that both variables considerably lower subsequent consumption growth. Together, these results provide strong micro-level evidence on the on the adverse welfare-effects of violent conflict.

At the level of climate and agriculture we find that harvest failures between 1999 and 2007 reduced growth while exceptionally good harvest boosted growth in consumption levels. Results suggest that the positive effect of good harvests is more important than the negative effect of harvest failures. Examining the specific timing of those shocks, we find that harvest failures did not have persistent effects: only recent harvest failures affected consumption. In contrast, exceptionally good harvests did have persistent effects. These seem to put households on higher growth paths.

Specific types of migration strongly reduced household consumption growth: if a household had to migrate due to famine in the village, consumption growth was reduced by over 50%. Violence-induced migration also reduced growth, but the statistical significance of this effect depends on the model specification. At the level of community infrastructure, a good access to a paved road increased consumption growth.

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Table 1: Household Consumption per Month per Adult Equivalent and Poverty Incidence of Original Households in 1998 and 2007, by Province of Residence

Province	Consumption Level 1998 (1998 BIF)	Consumption Level 2007 (2007 BIF)	Consumption Level 2007 (1998 BIF)	Poverty Incidence 1998 (%)	Poverty Incidence 2007 (%)
Bururi	9479.83	29720.93	14220.54	49.4	30.4
Cankuzo	9329.83	25531.64	12216.10	50.0	52.3
Cibitoke	6571.40	20218.24	9673.80	71.1	57.8
Gitega	4443.31	14121.24	6617.08	90.2	81.2
Karuzi	5604.18	13829.71	6617.08	76.9	76.9
Kayanza	7271.63	15121.84	7235.33	63.2	72.6
Kirundo	7604.21	13055.82	6246.80	63.6	78.2
Muramvya	9619.66	18628.88	8913.34	52.5	61.6
Muyinga	6563.87	20287.74	9707.05	77.2	48.1
Ngozi	8093.07	9856.72	4716.13	55.6	86.7
Rutana	5970.48	14542.94	6958.34	81.8	70.5
Ruyigi	4161.91	9051.02	4330.63	96.2	90.4
Mean	7084.10	16789.85	8033.42	68.8	67.8
N	872	872	872	872	872

Notes: In columns one and two, consumption per adult equivalent is expressed in actual prices. The poverty incidence in 1998 is based on the rural poverty line of BIF 8,173.15. The poverty incidence in 2007 is based on the same poverty line but updated with product-specific 2007 prices. This updated 2007 poverty line amounts to BIF 16,560.64. Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998), Bundervoet (2006) and author's own calculations.

Table 2: Economic Mobility of the Original Households, 1998-2007

1998	2007		Total
	Poor	Non-Poor	
Poor	442 (73.9%)	156 (26.1%)	598
Non-Poor	149 (54.4%)	125 (45.6%)	274
Total	591	281	872

Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998).

Table 3: Difference in Differences Comparing Consumption Growth per Adult Equivalent 1998-2007 for Poor and Non-Poor Original Households, across Civil War Areas

Poverty Status in 1998	No Battle N=685	At least 1 Battle N=184	Difference
Poor	+96.43 (13.31)	+119.58 (43.95)	+23.15 (50.11)
Non-Poor	-7.58 (0.079)	-38.42 (12.87)	-30.84** (14.59)
Difference	-104.0*** (13.91)	-158.0*** (52.44)	-54.0 (53.2)

Notes: Standard errors between brackets. ***significant at 1% level; **significant at 5% level; *significant at 10% level. Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998).

Table 4: Poverty Profile of the Reconstituted Households
(Weighted Average of Original and their Split-off Households), comparing
Households with and without Splits (+)

Characteristics of the Head of the Original Household in 1998	Headcount Poverty			
	HH who did not split		HH who split	
	1998	2007	1998	2007
Age				
<50	61.0	69.3	84.6	62.6
>50	55.5	61.9	75.2	59.5
Gender				
Male	60.1	71.8	76.7	62.5
Female	60.6	54.2	89.7	61.5
Schooling				
None	67.8	70.7	84.1	67.2
At least some	44.8	63.0	72.3	53.6
Occupation				
Farmer	61.2	69.2	82.7	63.9
Non-Farmer	52.7	60.0	63.8	53.2
Cattle ownership				
None	63.3	73.0	83.6	66.3
At least one	44.0	42.7	63.8	44.8
Mean of Sample	60.2	68.2	79.9	62.3
N	466	466	314	314

(+) we found 431 original households who had at least one split-off household. The splits of 92 of these 431 could not be interviewed and in 25 cases the original household was dissolved. This means that we could reconstitute 314 household and measure the welfare of its original members.

Table 5: Determinants of Consumption Growth, Province Fixed Effects (1999-2007)

	(1) Consumption Growth	(2) Consumption Growth	(3) Consumption Growth	(4) Heckman Correction
Ln(Consumption 1998)	-0.802***	-0.800***	-0.798***	-0.774***
	(0.051)	(0.051)	(0.052)	(0.049)
Characteristics of the Head				
Education Household Head	0.132**	0.133**	0.136**	0.137**
	(0.058)	(0.058)	(0.058)	(0.056)
Age Household Head	0.009	0.010	0.009	0.009
	(0.010)	(0.010)	(0.010)	(0.011)
(Age Household Head) Squared	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Household Head Female (1 if yes)	0.183**	0.180**	0.189**	0.171**
	(0.078)	(0.078)	(0.078)	(0.081)
Head of Household Farmer (1 if yes)	-0.046	-0.046	-0.047	0.007
	(0.097)	(0.097)	(0.096)	(0.023)
Capital Endowments				
Proportion of Literate Members	0.389***	0.386***	0.375***	0.487***
	(0.125)	(0.125)	(0.127)	(0.116)
Value of Livestock (per Adult)	0.182	0.181	0.182	0.227
	(0.126)	(0.126)	(0.126)	(0.277)
Household Composition				
Number of Children	0.155	0.159	0.229*	0.182
	(0.138)	(0.137)	(0.125)	(0.167)
Number of Adults	0.275**	0.279**	0.374***	0.228
	(0.136)	(0.134)	(0.124)	(0.211)
Number of Elderly	0.937***	0.942***	1.022***	0.853***
	(0.279)	(0.279)	(0.281)	(0.309)
Number of Male Adults who Died	0.003	0.007	0.009	0.032
	(0.095)	(0.096)	(0.097)	(0.097)
Number of Female Adults who Died	0.211**	0.209**	0.213**	0.220**
	(0.087)	(0.088)	(0.089)	(0.088)
Number of split-off households	0.131***	0.130***	0.131***	0.142***
	(0.033)	(0.032)	(0.032)	(0.032)
Climate and Agriculture Shocks				
Crop Pests, Diseases	-0.026	-0.027	-0.027	-0.024
	(0.031)	(0.031)	(0.030)	(0.030)
Harvest Failure	-0.059*	-0.059*	-0.056	-0.066*
	(0.034)	(0.034)	(0.034)	(0.034)
Very Good Harvests	0.085***	0.085***	0.083***	0.087***
	(0.030)	(0.030)	(0.029)	(0.029)
Destruction of Rugo	-0.031	-0.029	-0.038	-0.023
	(0.051)	(0.051)	(0.051)	(0.052)
Loss of Land to Erosion	0.018	0.018	0.017	0.016

	(0.041)	(0.041)	(0.041)	(0.041)

Labour Supply Shocks

Household Members very Ill	-0.002***	-0.002***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Became Handicapped 99-07	0.016	0.020	0.007	0.011
	(0.076)	(0.077)	(0.075)	(0.075)
Household Member(s) in Prison	0.060	0.057	0.062	0.073
	(0.053)	(0.054)	(0.054)	(0.052)

Conflict Shocks

Deaths/Wounded in Village (99-07)	-0.004**			-0.005**
	(0.002)			(0.002)
Deaths/Wounded in Village (97-99)		-0.005**		
		(0.002		
Destruction/Theft Assets	-0.040	-0.040	-0.027	-0.014
	(0.039)	(0.040)	(0.039)	(0.042)
Violent Death Adult (1 if yes)	0.061	0.047	0.046	0.028
	(0.198)	(0.181)	(0.185)	(0.190)
Household Member(s) Ambushed	0.094	0.092	0.096	0.110
	(0.071)	(0.070)	(0.069)	(0.069)
Forced Labor	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Household Member(s) Mistreated	-0.004**	-0.004**	-0.004**	-0.004***
	(0.001)	(0.002)	(0.001)	(0.002)
Member Joined Rebellion (1 if yes)	0.287*	0.297**	0.284*	0.258*
	(0.151)	(0.149)	(0.159)	(0.151)

Migration (baseline: no migration)

Left Looking for Work	0.026	0.022	0.037	0.012
	(0.088)	(0.089)	(0.090)	(0.091)
Left for Regroupment Camp	-0.209	-0.184	-0.258	-0.219
	(0.220)	(0.228)	(0.205)	(0.222)
Left for Displacement Camp	0.141	0.135	0.181	0.199
	(0.156)	(0.158)	(0.151)	(0.175)
Fled Violence (not in camps)	-0.042	-0.037	-0.045	-0.030
	(0.113)	(0.113)	(0.111)	(0.109)
Fled Famine in Village	-0.520**	-0.520**	-0.513**	-0.526**
	(0.216)	(0.216)	(0.222)	(0.212)

Village Characteristics (1998)

Health Centre < 1 hour walk	0.027	0.029	0.063	0.039
	(0.089)	(0.089)	(0.087)	(0.087)
Electricity < 1 hour walk	-0.034	-0.034	-0.072	-0.044
	(0.114)	(0.111)	(0.114)	(0.114)
Paved Road < 1 hour walk	0.123	0.116	0.103	0.136
	(0.091)	(0.089)	(0.086)	(0.091)

Violence Robustness Check

Village less Peaceful in 1998			-0.230**	
			(0.103)	
Village Violent in 1998			-0.119	

			(0.099)	
Village Very Violent in 1998			-0.205**	
			(0.099)	
Province Fixed Effects	Yes	Yes	Yes	Yes
R²	0.41	0.41	0.41	
N	862	862	862	1000

Notes: The first three regressions differ only in their use of alternative indicators for village-level violence. The fourth regression accounts for selective attrition by using Heckman's selection model. Standard errors are robust and clustered at the level of the hill. ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998).

Table 6: Households Fixed-Effects Regression of Consumption Growth, 1998-2007

	(4)	(5)	(6)
Δ Proportion of Literate Members	0.703***	0.703***	0.699***
	(0.090)	(0.090)	(0.089)
Δ Value of Livestock (BIF 1998)	0.084***	0.083***	0.082***
	(0.018)	(0.019)	(0.017)
Δ Proportion of Children	-0.052	-0.050	-0.039
	(0.199)	(0.199)	(0.200)
Δ Proportion of Adults	-0.183	-0.178	-0.169
	(0.218)	(0.218)	(0.219)
Δ Proportion of Elderly	0.169	0.179	0.179
	(0.238)	(0.238)	(0.219)
Δ Household Size	-0.062***	-0.061***	-0.063***
	(0.010)	(0.010)	(0.010)
Number of Split-off Households	0.091***	0.083***	0.090***
	(0.028)	(0.028)	(0.029)
Climate and Agriculture Shocks			
Crop Pests, Diseases	-0.012	-0.011	-0.012
	(0.032	(0.032)	(0.032)
Harvest Failures	-0.082***	-0.083***	-0.081**
	(0.032)	(0.032)	(0.032)
Very Good Harvests	0.129***	0.131***	0.133***
	(0.031	(0.031)	(0.031)
Destruction of Rugo	0.000	-0.001	0.002
	(0.048)	(0.049)	(0.048)
Labour Supply Shocks			
Household Members very Ill	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Became Handicapped 98-07	0.076	0.092	0.066
	(0.067)	(0.069)	(0.066)
Household Member(s) in Prison	0.017	0.009	0.026
	(0.053)	(0.054)	(0.053)
Conflict Shocks			
Deaths/Wounded in Village (1999-2007)	-0.005**		
	(0.002)		
Deaths/Wounded in Village (1997-1999)		-0.005**	
		(0.002)	
Destruction/Theft Assets	-0.001	-0.001	-0.003
	(0.043)	(0.043)	(0.043)
Violent Death Adult (1 if yes)	0.068	0.036	-0.019
	(0.148)	(0.137)	(0.140)
Forced Labor	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
Household Member(s) Mistreated	-0.003**	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)
Member Joined Rebellion (1 if yes)	0.366**	0.373**	0.347**
	(0.150)	(0.147)	(0.163)

Migration (baseline: no migration)			
Left Looking for Work	-0.019	-0.025	-0.023
	(0.086)	(0.086)	(0.087)
Fled Violence	-0.138	-0.132	-0.184*
	(0.108)	(0.108	(0.105)
Fled Famine in Village	0.543***	-0.545***	-0.509***
	(0.183)	(0.184)	(0.161)
Village Characteristics			
Δ Access to Health Centre	0.009	0.006	0.005
	(0.013)	(0.013)	(0.013)
Δ Access to Electricity	-0.001	-0.001	0.000
	(0.011)	(0.011)	(0.011)
Δ Access to Paved Road	-0.029***	-0.029***	-0.027***
	(0.010)	(0.010)	(0.010)
Violence Robustness Check			
Δ Violence (1 category less violent)			0.039
			(0.052)
Δ Violence (2 categories less violent)			0.111*
			(0.061)
Δ Violence (3 categories less violent)			0.095
			(0.073)
R² Within	0.15	0.15	0.15
N	872	872	872

Notes: The dependent variable is the difference between logged household consumption per adult equivalent in 2007 and logged household consumption per adult equivalent in 1998. Δ means the difference in the value of the variable between 2007 and 1998. Baseline for the violence variable is 'no change in village violence levels between 1998 and 2007'. ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998).
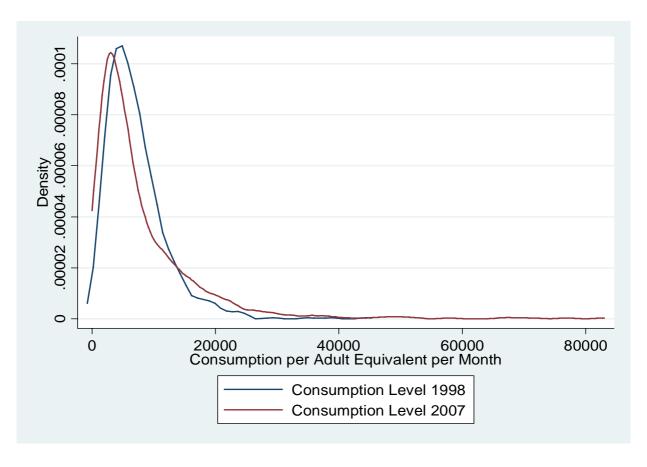
	(3)	(4)	(5)
Δ Proportion of Literate Members	0.629***	0.698***	0.700***
	(0.089)	(0.089)	(0.090)
Δ Value of Livestock (BIF 1998)	0.082***	0.083***	0.082***
	(0.018)	(0.017)	(0.018)
Δ Proportion of Children	-0.050	-0.048	-0.051
	(0.199)	(0.199)	(0.199)
Δ Proportion of Adults	-0.187	-0.194	-0.183
	(0.218)	(0.219)	(0.219)
Δ Proportion of Elderly	0.176	0.167	0.175
	(0.238)	(0.238)	(0.239)
Δ Household Size	-0.064***	-0.064***	-0.062***
	(0.010)	(0.010)	(0.011)
Number of Split-off Households	0.097***	0.099***	0.092***
	(0.028)	(0.029)	(0.028)
Climate and Agriculture Shocks			
Crop Pests, Diseases (First Period)	-0.028	-0.077	-0.016
	(0.042)	(0.059)	(0.037)
Crop Pests, Diseases (Second Period)	-0.009	0.015	0.075
	(0.034)	(0.043)	(0.067)
Crop Pests, Diseases (Third Period)		-0.013	-0.149*
		(0.034)	(0.077)
Harvest Failures (First Period)	-0.003	0.054	-0.044
	(0.046)	(0.058)	(0.038)
Harvest Failures (Second Period)	-0.083**	-0.078	-0.154**
	(0.035)	(0.053)	(0.065)
Harvest Failures (Third Period)		-0.083**	0.036
		(0.036)	(0.066)
Very Good Harvests (First Period)	0.107***	0.089**	0.120***
	(0.034)	(0.039)	(0.033)
Very Good Harvests (Second Period)	0.181***	0.147***	0.092
	(0.046)	(0.050)	(0.132)
Very Good Harvests (Third Period)		0.164***	0.206**
		(0.056)	(0.095)
Destruction of Rugo (First Period)	-0.017	-0.151	0.032
	(0.090)	(0.135)	(0.063)
Destruction of Rugo (Second Period)	-0.001	0.176	-0.028
	(0.056)	(0.107)	(0.097)
Destruction of Rugo (Third Period)		0.225*	-0.032
		(0.131)	(0.120)
Labour Supply Shocks			
Household Members very Ill	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Became Handicapped 98-07	0.063	0.051	0.065
	(0.067)	(0.064)	(0.069)
Household Member(s) in Prison	0.028	0.018	0.029
	(0.067)	(0.054)	(0.055)

Conflict Shocks

Deaths and Wounded (1999-2007)	-0.005**	-0.005**	-0.005**
	(0.003)	(0.003)	(0.003)
Destruction/Theft Assets (First Period)	0.006	-0.011	0.028
	(0.057)	(0.067)	(0.052)
Destruction/Theft Assets (Second Period)	0.024	0.054	-0.011
	(0.064)	(0.083)	(0.151)
Destruction/Theft Assets (Third Period)		-0.017	-0.105
		(0.086)	(0.140)
Violent Death Adult (1 if yes)	0.069	0.075	0.084
	(0.159)	(0.150)	(0.140)
Forced Labor	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
Household Member(s) Mistreated	-0.003**	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)
Member Joined Rebellion (1 if yes)	0.398***	0.369**	0.361**
	(0.153)	(0.155)	(0.155)

Migration (baseline: no migration)

Left Looking for Work	-0.031	-0.034	-0.030
	(0.087)	(0.087)	(0.086)
Fled Violence	-0.169	-0.174*	-0.163
	(0.107)	(0.105)	(0.110)
Fled Famine in Village	-0.560***	-0.569***	-0.523***
	(0.182)	(0.176)	(0.188)

Village Characteristics

Δ Access to Health Centre	0.009	0.010	0.007
	(0.013)	(0.013)	(0.013)
Δ Access to Electricity	-0.001	-0.003	-0.000
	(0.011)	(0.011)	(0.011)
Δ Access to Paved Road	-0.030***	-0.030***	-0.028***
	(0.010)	(0.010)	(0.010)
R² Within	0.15	0.16	0.15
N	862	862	862

Notes: Household fixed effects regression. The dependent variable is the difference between logged household consumption per adult equivalent in 2007 and logged household consumption per adult equivalent in 1998. Δ means the difference in the value of the variable between 2007 and 1998. ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998).

Figure 1: Kernel Density Estimation of Consumption Levels per Adult Equivalent, 1998 and 2007

Notes: Kernel density estimation using Epanechnikov kernel. Data source: ISTEEBU (2007) and Republic of Burundi and World Bank (1998).

Table A1: Testing for selective attrition among original households (+)

Household characteristics in first round	Sampled in both rounds	Sampled in first round only	Difference in means with t-test	Interviewed in both rounds	Drop out in second round	Difference in means with t-test
Household size	4.90	4.94	0.039	5.09	3.57	-1.52***
Adult equivalents	3.88	3.89	0.19	4.03	2.85	-1.18***
Age of the head	44.09	43.18	-0.9*	43.05	51.12	8.06***
% head educated	0.32	0.31	-0.0	0.34	0.19	-0.15***
% female head	0.25	0.25	0.0	0.22	0.44	0.22***
Total income	42673	40012	-2260	44248	31941	-12307**
Consumption per ae	7115	6689	-425**	7089	7295	206
Number of cattle	0.46	0.38	-0.08*	0.5	0.19	-0.3**
% poor	0.69	0.71	0.03*	0.69	0.70	0.02
village level						
time to market	2.67	2.69	0.02	2.65	2.8	0.16*
Intensity of violence				4.07	3.62	-0.45
N	1000	2908		872	128	

Table A2: Probit models testing for selective attrition, using FGM method (+)

Household characteristics in first round	Sampled in both rounds (1)	Sampled in both rounds (2)	Interviewed in both rounds (3)	Interviewed in both rounds (4)
Household size	-0.01	-0.013	0.129***	0.126***
Age of the head	0.002	0.002*	-0.01***	-0.01***
head educated	0.016	0.007	0.167	0.177
female head	-0.001	-0.008	-0.287**	-0.346**
Log total income	0.036	0.054*	0.036	0.069
Number of cattle	0.018	0.025	0.09	0.08*
Village level				
time to market	-0.012	-0.011	-0.054	-0.054
Intensity of violence			0.001	-0.001
constant	-1.05***	-6.59	0.56	0.68
Province FE	No	Yes	No	Yes
N	3908	3908	1000	1000

(+) Source : Burundi Priority Household Survey 1998 and 2007. The consumption data of two tracked households were found to be unusable. Probit specifications where the selection variable is 1 for selection into the sample or the interview and 0 otherwise. All models are clustered around survey cites to obtain robust standard errors; Fitzgerald, Gottschalk and Moffitt (1998).