Who benefited from Burundi's Demobilization Program?[☆]

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Abstract

This paper assesses the impact of the demobilization cash transfers program which took place from 2004 onwards in post-war Burundi. In the short run, we find that the cash payments had a positive impact on beneficiaries' consumption, non-food spending and investments. Importantly, it also generated positive spillovers on civilians in their home villages. However, both the direct impact and the spillovers on consumption and non-food spending seem to vanish in the long run. Stocks of productive assets remain stable. Ex-combatants spent a large part of their allowance on consumption goods, clothing and housing, thereby generating a short-run economic boom in their villages. Their investments in assets were not productive enough to sustain their consumption pattern in the long run, as they ultimately ran out of demobilization money. This interpretation is consistent with qualitative evidence, with change in prices and with our analysis of the heterogeneous impact according to occupation.

Keywords: Civil Conflict, Burundi, Disarmament, Demobilization and Reintegration Program, Cash Transfer, Spillovers

JEL Classification: D74, O12, I32, I38, N47

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1. Introduction

> *"For instance, there was one day I was talking with a representative of the World Bank and I told him, all this money you are going to give these ex-combatants, they will just use it to buy beers and drink if you don't give them other support. And his reaction was: that doesn't matter, because if they use it for beers, it goes into the local economy and that helps too."*
>
> Willems et al. (2010)

Disarmament, demobilization and reintegration (DDR) programs are nowadays an essential component of most peace building programs. Their primary goal is to secure short-run stability in post-conflict countries, clearing the way for more structural reforms (Pugel, 2009). Over the last two decades, these programs have been implemented in more than 30 countries. Muggah (2009) estimated their aggregated cost at more than $US 600 million annually. About 350,000 ex-combatants have benefited from the regional Multi-Country Demobilization and Reintegration Program (MDRP) conducted in Central Africa[1]. Since 1989, more than 2.5 million benefited from some form of demobilization worldwide (Muggah, 2009).

Even though these programs have been continuously implemented since the end of the 20^{th} century, there is still no agreement on their effectiveness nor how to evaluate their success (Muggah, 2009). The complexity of evaluating DDR programs has indeed been emphasized (Humphreys and Weinstein, 2007; Muggah, 2009; Gilligan et al., 2013).

DDR involves several phases, from the collection of weapons to cash and in-kind transfers. It may involve different rebel groups at different moments in time and it generally takes place in a very volatile and dangerous political context. These constraints can make a randomized controlled trial (RCT) virtually impossible. Randomly excluding groups (even temporarily) from certain program benefits could increase violence on the spot, exactly because the exclusion of the benefits of state power and inequality in access to resources in general lay at the basis of many civil wars (see Justino (2009) and Blattman and Miguel (2010) for reviews). Hence, researchers are often not in a position to organize an RCT, and governments are wary of accepting them (Baele, 2013). Nonetheless, in such tense periods as transitions from war to peace, there is a great need for impact evaluations. Understanding how to support ex-combatants' social and economic reintegration is central to post-conflict reconstruction, as their past in the militias makes them the most prone to re-enrollment (Muggah, 2009; Colombo et al., 2014).

[1] Beneficiary countries were Angola, Burundi, CAR, Congo, DRC, Rwanda, Uganda

There are few quantitative studies that have used non-experimental methods to evaluate the impact of DDR-type policies. First, using a panel dataset of civilian and ex-combatants, Verwimp and Bundervoet (2009) found that Burundian households with at least one member in the rebel force increased their consumption during the period 1999-2007 more than households with none. Second, also in the case of Burundi, Gilligan et al. (2013) studied the impact of the reintegration phase (in-kind allocation) of the DDR in a quasi-experimental framework, and also found an improvement in income and livelihoods among ex-combatants. Third, looking at measures of social reintegration in Sierra Leone, Humphreys and Weinstein (2007) did not find any difference in reintegration success between soldiers who voluntarily benefited from the DDR program and those who did not. They additionally looked at whether spillovers from the treated to the treated and from the treated to the non-treated ex-combatants could explain their findings.

Both Gilligan et al. (2013) and Humphreys and Weinstein (2007) focus on a relatively short-term horizon and only interview ex-combatants. We depart from their analysis by having a panel of households including both ex-combatant and civilian households. Although collecting a panel data has reduced the number of combatants that we could have sampled otherwise, we believe that the panel dimension of the data allowed us to shed light on important impacts of the demobilization cash transfers which would have been impossible to capture in other ways. In particular, none of the previously mentioned studies account for possible spillovers on civilians at the community level. It is important to study such spillovers as they may favor the acceptance of ex-combatants within communities (Humphreys and Weinstein, 2007). Accounting for spillovers on civilians is also important for the donor community as mere focus on the ex-combatants themselves may underestimate the benefits of the program (Miguel and Kremer, 2004).

This paper aims to explicitly capture spillovers and evaluate the long-run impacts of cash transferred to ex-combatants in post-conflict Burundi. The most recent phase of the conflict ended in 2009, with the voluntary demobilization of the last Hutu rebel group, Palipehutu-FNL (Palipehutu - Forces Nationales de Libération). From 2005, another major Hutu rebel group, the CNDD-FDD (Conseil National pour la Défense de la Démocratie - Forces de Défense de la Démocratie), benefited from the same DDR program. Adult combatants assigned to this program have been granted two allowances of at least US$ 515, distributed over two years, the first in cash and the second in-kind[2].

We address three questions related to the objectives of the program. First, we look at whether these payments had an impact on ex-combatants' household livelihoods. In particular, we distin-

[2]Each allocation was equivalent to 150% the yearly GDP per capita in 2005 as calculated in PPP, i.e. US$ 356 (World Development Indicators, 2014).

guish between consumption, non-food spending and investments made by ex-combatants. Second, we specifically explore if there were any general equilibrium effects following the return of the demobilized ex-combatants to their home communities. We therefore directly address "the ethical dilemmas associated with 'rewarding' bad behaviours" by showing that the program is more than "a way of securing the peace" (Muggah, 2009). Third, relying on the timing of the demobilization program, we are able to distinguish between short- and long-term impacts. Our identification strategy makes the most of the fact that (i) the demobilization program took place before and in between two waves of a household panel survey and (ii) that some communities in the panel did not have ex-combatants among its population whereas other communities did.

Our empirical analysis shows that demobilization grants significantly increased economic outcomes of beneficiaries in the short run. Importantly, we also identify the presence of positive spillovers to non-beneficiary households in the short run. This result is encouraging as it shows that the reinsertion grants may increase local acceptance and reduce the vulnerability of ex-rebel households. However, our analysis identifies a negative evolution of spending indicators for CNDD-FDD ex-combatants in the long run. Similarly, we find that the positive spillovers on non-beneficiaries have vanished in the long run. Most of the reinsertion and reintegration successes therefore seem to be temporary.

We interpret these results as follows. When they returned home, demobilized ex-combatants spent a large part of their allowances on consumption goods, clothing and housing. This increased demand generated a short-run economic boom in their home village, increasing prices and increasing farmer revenues in the local market. Households having members working in the construction sector also benefited from the program, as ex-combatants needed to build houses. While ex-combatants reported investing part of their demobilization grants in working assets, these investments do not seem to have been productive enough to maintain their high level of consumption beyond the exhaustion of their demobilization money. This interpretation is consistent with qualitative evidence, with the evolution of prices and with our analysis of heterogeneous impact according to different sectors of activities.

The paper is organized as follows. Section 2 provides details on how the demobilization and reintegration program was set up in 2004 for CNDD-FDD ex-combatants and in 2009 for Palipehutu-FNL ex-combatants. In the third section, we describe the data and introduce the identification strategy. Results are presented in Section 4 and interpreted in Section 5. The last section concludes.

2. Background of the DDR program in Burundi

The 1993-2009 conflict in Burundi has been exacerbated by years of ethnic discrimination, whose origins date back to German and Belgian colonization (Vandeginste, 2009). A few year after independence in July 1962, the Tutsi elite established a military dictatorship. Tensions between the Hutu majority and the Tutsi authoritarian government regularly triggered violent conflicts. In 1988, Tutsi President Pierre Buyoya launched a process of political liberalization by establishing a government of national unity and by organizing elections in 1993. In October 1993, four months after his election, the newly-elected Hutu President Ndadaye was assassinated. A few months later, his successor, Lucien Ntaryamira (Hutu), was also assassinated in an airplane crash, together with the Rwandan president Juvenal Habyarimana. This triggered both the Rwandan genocide, and a 6-year ethnic conflict between Hutu rebel groups and the Burundian army led by the Tutsi.

In 2000, the Arusha Peace Agreement laid down the foundations for a peace process and a new constitution based on power-sharing and a short transition towards de-ethnicized political competition. Despite this promising peace treaty, two Hutus rebel groups, the CNDD-FDD and the Palipehutu-FNL, refused to sign. The ethnic conflict turned into a civil war opposing the transitional government and the two Hutu rebel groups. In 2003, a first rebel group, the CNDD-FDD accepted to lay down its weapons. As part of the peace agreement, the CNDD-FDD leaders were given positions in the government, in the national assembly and in the administration[3]. Combatants from the national army (FAB) and from the CNDD-FDD were selected to join the national police and the new national army (The Forces de Défense de la Nation - FDN). Selection criteria were based on stated preferences, age, health status and experience. Those who were not selected, about 23,000 combatants from both sides, were assigned to the disarmament, demobilization and reinsertion (DDR) program. The DDR program was officially launched in December 2004.

In 2009, the Palipehutu-FNL rebels in turn gave up their arms and the FNL became a political party, with 33 minor posts given to the FNL leadership. Of the 20,000 Palipehutu-FNL members[4], 3,500 were reintegrated in the Burundian army, and 6,500 benefited from the DDR program.

The program was coordinated by the National Commission for Demobilization, Reinsertion and Reintegration[5], under the supervision of the World Bank. The demobilization phase started

[3] In 2005, two years after becoming a political party, the CNDD party of Pierre Nkurunziza won the national elections outright.

[4] This number was inflated by the FNL leadership. Knowing that the CNDD-FDD had received the DDR and expecting to benefit from such a program, a lot of people did join the rebel group right before the agreement was signed.

[5] *Commission Nationale de Démobilisation, Réinsertion and Réintégration* (CNDRR)

with disarmament, followed by the transfer of ex-combatants to a demobilization center. The ex-combatant, if admitted[6], spent eight days in the center. During that week, he attended training on economic strategies and opportunities, HIV/AIDS, civic responsibility, as well as peace and reconciliation. A medical examination was conducted on each soldier, and they could choose to be tested for HIV. They were informed of the opportunities offered by the reinsertion and reintegration program.

On the last day, they were reimbursed transportation costs (FBU 20,000, or US$ 18[7]) and they received their first reinsertion payment equivalent to a nine-month salary in the army. Three months later, they received the first of three other payments. The total amount of this 18-month salary allowance was differentiated by rank, with a minimum of FBU 566,000 (US$ 515). Called the Transitional Subsistence Allowance (TSA) by the World Bank, this compensation was dedicated to *"enable the ex-combatants to return to their community and to sustain themselves and their families for a limited period following demobilization"* (The World Bank Group, 2004). Simple back-of-the-envelope calculations allow us to translate these amounts in terms of purchases per adult equivalent for a civilian household. In 2010, such household consumed on average about FBU 190,000 (US$ 173) per adult equivalent per year, which is equivalent to one third of the minimum cash allocation to FNL rebels.

The next phase, dedicated to reintegration, included a unique in-kind payment of FBU 600,000 (US$ 545). The ex-combatants could choose between a range of options including education, support for agro-pastoral activity, start-up material for a small business, or a construction project. This phase was launched in September 2005 for the first rebel group, but some contracts did not start before March 2008 in the central provinces[8] (Gilligan et al., 2013). This delay has been a source of conflict between ex-combatants and the DDR administration.Of the 23,000 beneficiaries from the 2004 wave of the reinsertion program, 85% had received the reintegration support by December 2008. This phase was just starting for the FNL ex-combatants at the time of our 2010 survey.

The DDR program also included the disarmament and the dismantling of militias. These were formed by people helping the factions, notably in terms of logistics, but who were not enrolled nor paid by rebel groups. These people were called "Gardiens de la Paix" (GdP) if they belonged to the FAB, "Militants Combatants" (MC) if they were part of the CNDD-FDD and "Adultes Associés"

[6]In order to identify opportunists who were never combatants, a list of criteria was established in order to assess the military aptitudes of the candidate, defining whether he was accepted or not to the DDR program.

[7]All US$ equivalents are expressed in 2010 US$. US$ 1 was worth 1,100 Burundian francs in 2010.

[8]The provinces included in this analysis were not affected by this disruption.

(AA) if they supported the FNL. 20,000 GdP, 10,000 MC and 11,000 AA benefited from the program. They received FBU 100,000 (US$ 91) as compensation.

Figure 1 shows how ex-combatants from our sample reported to have spent their grant[9]. More than 50% of ex-combatants reported investing part of the reinsertion allowances in a plot of land. A large proportion of ex-combatants used a share of the money to buy consumption goods: 48% reported purchasing food and drinks, and 26% reported buying clothes. Ex-combatants also invested in productive assets: 23% of them invested in a small shop, 19% in working equipment, and one ex-combatant reported buying a cow.

3. Empirical analysis

3.1. The Data

The empirical analysis draws on different types of data. The first dataset consists of a panel of households. The second dataset is a community questionnaire. The third dataset consists of administrative data from the National Commission for Demobilization, Reinsertion and Reintegration.

a. The panel dataset

The first dataset constitutes a two-round household survey undertaken in Burundi. The first round is a QUIBB survey[10] collected in February 2006. The second round, undertaken by the authors in April 2010, only retained 3 provinces of the QUIBB sample: Bubanza, Bujumbura Rural and Cibitoke, located in the North-West of the country. The choice of these provinces is justified by the concentration of ex-combatants in these three provinces interlinked with high level of violence in the region over the last years, as well as by budgetary constraints.

The QUIBB sample is characterized by two-stage cluster sampling. In the first stage, 88 hills[11] were sampled and in the second stage, 15 households were sampled in each primary unit[12]. This resulted in 1284 household interviews. For the 2010 survey, these households were traced. Of the

[9]This figure summarizes the self-reported information provided by 22 demobilized ex-combatants and 9 GdP/MC/AA who were interviewed in 2010. Respondents could give a maximum of three answers. In most households, they did not remember exactly how much they had spent for each category of expenses so Figure 1 only shows the proportion of respondents that declared having spent part of their allowance in each category.

[10]*"Questionnaire des Indicateurs de Base du Bien-être". The survey was requested by the Ministry of Planning and designed by the World Bank. Data collection was coordinated by the University of Burundi.*

[11]There are four administrative levels in Burundi: the province, the municipality (translated *"commune"*), the hill (translated *"colline"*) and the sub-hills (translated *"sous colline"*). In one hill, there are on average five villages, or sub-hills.

[12]The QUIBB survey used the same sampling strategy as the Multiple Indicator Cluster Survey (MICS), collected in September 2005 by UNICEF. This survey mostly collected socio-demographic data and is therefore not used in this paper. It resulted in 1320 households in our three provinces.

total, 1064 (or 83%) households were interviewed in 85 hills[13]. We examine the problems due to attrition more closely in section 3.2.

b. Community data

During the 2010 survey, enumerators also undertook a community survey in each hill. This survey included data on past violence, public services and community initiatives. The data on violent events will be used as a control variable in our econometric model. We will also use population data, based on the 2008 census, in order to scale the number of ex-combatants in each hill.

c. Official demobilization registers

At the time of the 2010 survey, we worked with the National Commission for Demobilization, Reinsertion and Reintegration in Burundi. The Commission provided us with registers of ex-combatants by hill and faction, along with their sex, age, military rank, hill of origin and of return, as well as the date of their demobilization. The registers provided precise information about each demobilized ex-combatant as well as the exact number of demobilized soldiers in each hill. The large variation in the number of demobilized ex-combatants per hill allow us to identify the spillovers of the DDR program in Burundi. We will distinguish between the FNL ex-combatants, demobilized from April 2009, and the CNDD+[14] ex-combatants, demobilized from March 2004.

3.2. Identification strategy

Our identification strategy is based on a difference-in-difference model with province fixed effects. This model assumes that economic outcomes in the absence of the demobilization program would have evolved similarly for households affected and not affected by the program, as well as in hills with more or less ex-combatant returns. We introduce the lagged dependent variable in the regression to control for potential convergence or divergence.

According to this, we propose to estimate the following equation:

$$\begin{aligned}\log \Delta Y_{i,t} =& \beta_0 + \beta_1 R_{i,t}^{FNL} + \beta_2 D_{i,t}^{FNL} + \beta_3 S_{i,t}^{FNL} \\ &+ \eta_1 R_{i,t-1}^{CNDD+} + \eta_2 D_{i,t-1}^{CNDD+} + \eta_3 S_{i,t-1}^{CNDD+} + \delta \log Y_{i,t-1} + \mathbf{X}_{i,t}' \boldsymbol{\gamma_i} + Z_k + \epsilon_{i,t}, \end{aligned} \tag{1}$$

[13]There were three hills in which we could not trace households, all located in Bujumbura Rural. In two hills, the villagers reported not to know the households, either because they had migrated or were invented by 2005 interviewers. The remaining hill was not secure enough to conduct the survey.

[14]While the CNDD was the most important rebel group demobilized in 2004, there were also other small groups which benefited from this wave of the DDR program. As these are included in our analysis, we denote CNDD+ the recipients of the first wave of the DDR.

We consider five dependent variables. The first three economic outcomes are consumption aggregates that are constructed following the guidelines of Deaton and Zaidi (2002) (see Appendix B.1 for details). The first indicator measures the total consumption per adult equivalent of 47 consumption goods. About two thirds of this aggregate is related to the consumption of cereals, fruits and vegetables. The other important food categories are beers and sodas (7.7%), fish, meat and eggs (7%), condiments (3.3%) and milk (3.3%). The second dependent variable is the part of total consumption which was purchased over the 15 days preceding the survey. This variable is labeled consumption expenditures per adult equivalent. Similarly, the third dependent variable is the share of the total consumption aggregate which was taken from stocks. It is also expressed per adult equivalent. The fourth dependent variable is an indicator of non-food spending per adult equivalent which includes spending in terms of clothing, housing, leisure, transport and transfers during the last year. The fifth dependent variable is the tropical livestock units (TLU), which summarizes in one indicator the possession of a wide range of livestock, weighted according to their type and size[15]. Descriptive statistics are presented in Table 1.

The dummies $R_{i,t}^{FNL}$ and $R_{i,t-1}^{CNDD+}$ relate to wether the household declared to have one member having ties with the factions. This could go from an informal link to being a demobilized soldier. This category therefore includes households with registered ex-combatants, households associated with the factions, known as "gardien de la paix", "adultes associés" or "militant combatant", and people without any status but that declared themselves as members of a rebel faction.

The dummies $D_{i,t}^{FNL}$ and $D_{i,t-1}^{CNDD+}$ refer to wether a household benefited from the reinsertion grants. We constructed these according to three definitions. In the first, demobilized ex-combatants are those who declared having ties with a faction and were registered in the official demobilization registers. In order to minimize misreporting, the second definition adds households from which individuals were matched[16] with the official demobilization registers. The third definition is based on self-reported data, and includes anyone who declared to be demobilized (i.e. to have received the cash). The last definition is more likely to contain measurement errors as it includes self-

[15]Conversion factors used are the following: cattle (0.50), sheep and goats (0.10), pigs (0.20), poultry and rabbits (0.01) (Harvest Choice, 2012).

[16]We undertook this matching exercise using generalized Levenshtein edit distance, which is the total number of insertions, deletions and substitutions required to transform one string into another. We matched the names, age, sex and the code of the hill of return of the ex-combatants listed in the official demobilization registers with the household information available in our panel dataset. We use a maximum number of transformation of 2 for string variables (first name, last name, both), a range of [-10,+10] from the age reported, and the match had to be perfect for the hill's code and gender. We did this exercise twice, once matching each entry in the registers to the panel data; and once the other way around. As names are very similar in Burundi, and many people can have the same last name (all twins have the same last names; siblings' last names are different and are chosen according to various contextual factors), we made sure to only consider matches cases where names contain typos. We found eight matches, which supports the fact that we were very restrictive.

reports; its associated coefficient will presumably be biased toward 0 (Hausman, 2001). In addition to numbers, Table 2 provides the definition of dummies in which each type of ex-rebel falls. The three different indicators created will be compared in the empirical analysis[17].

We argue that this is the second definition is the most appropriate for two reasons. First, the matching exercise with official demobilization registers should capture respondents who feared reporting that there is an ex-combatant in their family. Second, cross-checking self-reported demobilization status with official demobilization registers should exclude households who wrongly categorized themselves as having benefited from demobilization allowances. Indeed, there have been a lot of persons who helped the rebels during the war and they may wrongly categorize themselves as demobilized ex-combatants. Similarly, as we were working in cooperation with the National Commission for Demobilization, Reinsertion and Reintegration, some respondents may have claimed to be demobilized in expectation of rewards in exchange for their participation to the survey.

The short-run direct impact of the DDR program is measured by the dummies $R_{i,t}^{FNL}$ and $D_{i,t}^{FNL}$. In particular, the coefficient β_1 measures the impact of the return of an FNL ex-combatant in the household. The coefficient β_2 measures the impact of having benefited from the FNL reinsertion allowance. In this estimation, and the ones that follow, we therefore compare the demobilized ex-combatants which have received the grant to the group of ex-combatants that returned but did not receive any grants.

The variables $R_{i,t-1}^{CNDD+}$ and $D_{i,t-1}^{CNDD+}$ capture the long-run impact of the demobilization program for CNDD+ ex-combatants. To interpret the coefficients associated with these variables, we need to carefully consider the timing of the demobilization of CNDD rebels, FAB and other small factions which started before the first survey at the end of 2004. It implies that by the time of the QUIBB survey, which is used as our baseline, these ex-combatants had already benefited from reinsertion allowances. Then, they benefited from the in-kind reintegration grants between both surveys. Hence, we are not able to measure the long-term impact of the program for the CNDD+ ex-rebels. What we can assess however, is the evolution of their economic outcomes between the two surveys.

Let us explain this argument formally. In an ideal scenario in which we had data before the peace agreement, denote σ the short-run impact of the demobilization program, that is, the one-year impact between the reception of the allowances and the QUIBB survey. Similarly, λ denotes

[17]One should note that the number of registered ex-combatants in our sample is representative of the true ex-combatants' density and that an over-sampling of ex-combatants was not compatible with having a panel.

the measure of the long-run impact of the demobilization program, that is, the five-year impact between the reception of the allowances and the 2010 panel survey. Unfortunately, we are not able to measure σ and λ separately. However, we can capture the difference $\eta = \lambda - \sigma$, which can be thought of as the long-run evolution of the economic outcomes of CNDD+ ex-soldiers.

In Table 3, we show descriptive statistics disaggregated by demobilization status[18] and faction. Looking at socio-demographic characteristics in 2006, returnees and demobilized households' head characteristics are not significantly different. This holds between groups - CNDD+ vs. FNL returnees (resp. demobilized) - and across rebel groups - returnees vs. demobilized within each group. Turning to the dependent variables, a first highlight is the absence of significant differences between returnees and demobilized households within groups in 2006. In 2010, the CNDD+ returnees are better off than their demobilized fellows (differences are significant when it comes to consumption expenditures and non-food spending, which require money). There are no such statistically significant differences for the FNL households in either year. Second, when comparing the FNL and CNDD+ demobilized households, the CNDD+ tend to be better off than the FNL in 2006. The reverse is true in 2010.

We measure the indirect impact of the demobilization program by looking at the proportion per 1,000 people of ex-combatants living in each hill[19]. The variables of interest are denoted $S_{i,t}^{CNDD+}$ for the proportion of ex-combatants demobilized between 2004 and 2006, and $S_{i,t-1}^{FNL}$ for the proportion of ex-combatants demobilized after 2009. On average, there were 3.8 ex-combatants per 1000 inhabitants that came back following the first wave of the program from 2004 onwards. The FNL demobilization process of 2009 led to an average of 3 ex-combatant returns per 1000 inhabitants. There are substantial differences between hills, which are highlighted in Figure 2 for our provinces of interest. These maps present the distribution of ex-combatants in each hill, scaled by population.

The vector $X_{i,t}$ regroups several control variables that may explain changes in economic outcomes between the two rounds of the panel. It includes the sex, age, education, and marital status of the household head, a dummy which accounts for a change of household head between 2006 and 2010, and the main occupation of households. These variables are not first differentiated to avoid the multicollinearity problem. We also control for past violence, using two variables measuring the number of violent events that occurred in the hill before and after the baseline survey. Summary

[18]The statistics related to the demobilized are computed considering the second definition in Table 2.

[19]Note that this indicator is computed at the hill level, which is one administrative level above the villages sampled ("sous-colline"). We therefore consider ex-combatant returns in the village of the household, as well as in neighboring villages. While the villages may be connected to each other, the hills are not. Given the size of hills and the difficulties to move in the country, it is very unlikely that the returns in one hill have affected neighboring hills.

statistics are presented in Table 1. Variables that we expect to have been affected by the demobilization program, such as production, land or other assets, are excluded from the regression (they can be considered as "bad controls" (Angrist and Pischke, 2008)). Standard errors are clustered at the hill level to account for intra-cluster correlation. Sampling weights are accounted for. Outliers are excluded from the regressions (see Appendix B.1 for more details).

Before presenting the results, let us discuss the problem of attrition by following the methods proposed by Becketti et al. (1988) and Fitzgerald et al. (1998) and applied by Alderman et al. (2001, 2006). The analysis of Table 1 suggests that attrited households purchase more, have fewer stocks, are smaller and were more affected by the conflict. Attrition could bias the estimations if it is selective, that is, if the relationship of interest is different for observed and attrited households. To test if selective attrition is likely to bias our results, we first estimated the determinants of our dependent variables in 2006 separately for traced and attrited households (Becketti et al., 1988). Fortunately, we do not reject the null hypothesis that the coefficients of these regressions are the same (Table A.8 in Appendix). Second, we estimated a Probit model to test whether attrition is correlated with dependent variables (Fitzgerald et al., 1998). As shown in appendix (Table A.9), the dependent variables are not significantly correlated with the probability to be sampled both with and without controls. We conclude that differential attrition is unlikely to be a concern in our analysis.

4. Results

Table 4 presents the estimation of the difference-in-difference model in which the dependent variable is the log of the total consumption per adult equivalent. It shows that the return of ex-combatants is not significantly correlated with their household consumption per adult equivalent. However, having benefited from the demobilization program seems to have had a large impact on the consumption of FNL households. The coefficient of the variable $D_{i,t}^{FNL}$, which measures this short-run direct effect, is positive, significant and strikingly high when self-reported information about demobilization status is cross-checked against official demobilization registers (columns (1) to (4)). It suggests that the consumption of demobilized FNL households is between 76% and 144% higher[20] than their consumption levels if they had not been demobilized. Turning to the definition based on self-reported information (columns (5) and (6)), we find that this effect is still positive, but it loses its significance. This reduced precision can be explained by the presence of noise due to misreporting (Hausman, 2001).

[20] As the dependent variables of the regressions are expressed in log, the interpretation of the coefficients in terms of percentage should be corrected according to the formula: $e^{\text{coef.}} - 1$.

The long-run evolution of total consumption turns out to be negative for ex-combatants who benefited from the first wave of the DDR program from 2004. The coefficient of the variable $D_{i,t-1}^{CNDD+}$ is significant, large but negative. These estimates suggest that the consumption of households who benefited from the first wave of the program is between 38% and 47% lower in 2010 than the total consumption of non-beneficiary households who had the same consumption level in 2006. This observation holds for all three definitions.

Table 4 also highlights the presence of spillovers. The coefficient associated with the proportion of ex-FNLs in hills $S_{i,t}^{FNL}$ is positive and significant. This suggests that households living in hills with a large number of demobilized ex-combatants benefited from positive spillovers. By contrast, the coefficient of the variable $S_{i,t-1}^{CNDD+}$ is negative and significant, showing that in the long run, households living in areas with numerous CNDD+ ex-combatants consume on average less in 2010 than households who had a similar standard of living in 2006 and who live in areas with fewer CNDD+ ex-combatants. The coefficients associated with the variables $S_{i,t}^{FNL}$ and $S_{i,t-1}^{CNDD+}$ are of similar size, but of opposite sign (F-test p-value ~0.8).

Finally, the coefficient associated with the lagged dependent variable is negative. This shows that consumption growth was higher for households who were worse off in 2006. This can be explained by a catch-up effect, which is in line with the convergence literature. Turning to control variables, coefficients associated with the past violence variables are not significant, which may reflect the fact that the conflict was less violent from 2005 onwards. With respect to socio-demographic characteristics, we find that male, younger, single and more educated headed households consumed on average more in 2010. Finally, construction workers seem better off than farmers.

Table 5 displays the estimates of the difference-in-difference model for the four other economic outcomes we measured. This table relies on the second definition of demobilized ex-combatants, that is, the one using self-reported information cross-checked with the official demobilization registers supplemented with matches[21].

Consumption expenditures, consumption from stocks, non-food spending and livestock owning significantly increased in households who benefited from the FNL demobilization program. Consumption expenditures of ex-FNL households are on average 70% higher than if they had not been demobilized. Similarly, consumption from stocks is 133% higher, non-food purchases are 63% higher and the total livestock units are 10% higher.

[21] $D_{i,t-1}^{CNDD+2}$ and $D_{i,t}^{FNL2}$ in Table 2. The use of other definitions leads to similar results. When self-reported information is used, the results are weakened by the presence of noise.

The coefficient associated with the long-run impact of demobilization variable for CNDD+ ex-combatants exhibits interesting patterns. When the dependent variables involves spending money, as for consumption or non-food purchases, the coefficients of the variable $D_{i,t-1}^{CNDD+2}$ are negative and significant. For these economic outcomes, the coefficient associated with the CNDD+ demobilization are of opposite signs to those associated with FNL demobilization, but of similar size. On the contrary, for variables associated with asset holdings such as consumption from stocks - which includes consumption from one's own agricultural production - and livestock, coefficients are close to zero and not significant.

The results we find for the spillovers of the DDR program are consistent with this picture. The spillovers of the FNL demobilization on non-beneficiaries are positive - around 2% - and significant for consumption expenditures and non-food purchases. For these two dependent variables, the spillovers of the CNDD+ demobilization are of similar size but of opposite sign. The spillovers on livestock follow a similar pattern, positive and significant for FNL demobilization, and negative and significant for CNDD+ demobilization. However, estimated coefficients are close to zero. There is no significant sign of spillovers on consumption from stocks.

5. Discussion

In this section, we discuss and interpret the empirical results in the light of economic theory and we put them in perspective with existing literature. We first focus on the direct impact on ex-combatants and then turn to the analysis of spillovers.

5.1. Direct effect of the DDR on ex-combatants' households

Our first finding is the large positive impact of demobilization on the economic conditions of households hosting a demobilized FNL. In the short run, these households have consumed more, have spent more in non-food items and have a larger stock of livestock. This finding is not surprising since, at the time of the interviews, the demobilized ex-FNLs were in the process of receiving the equivalent of 18-months' salary in four cash installments. Our 2010 data reveals the absence of formal finance institutions in 84% of the hills surveyed. Informal institutions are also scarce, with 87.5% of the hills without such associations. In a context where savings institutions were poorly functioning, none of the FNL households reported saving part of their allowance. Instead, a large proportion of ex-FNLs reported buying consumption goods (46%), paying off debts (15%) or buying clothes (15%). This observation is consistent with previous qualitative evidence from Burundi. Uvin (2007) showed that some ex-combatants, depending on the region they returned to, had to face immediate needs such as building houses, paying medical bills, and buying food for their family. The civil war had affected preferences in a way that is consistent with

these behaviors: Voors et al. (2012) find that individuals who have been more affected by violence "display more altruistic behavior, are more risk-seeking, and act less patiently." In Mozambique, Kingma (1997) also documents that some ex-rebels spent a large share of their cash allocation on gifts. These arguments certainly explain the substantial increase in consumption of ex-FNLs as they "fell into a lot of money" (Uvin, 2007). A few ex-combatants reported investing part of their allowance in cattle, which may explain the small but positive impact of the program on livestock.

Our second finding is the negative evolution of spending indicators for demobilized ex-CNDD+ between 2006 and 2010. We claim that the ex-CNDD+ households also experienced some sort of consumption boom, after "falling into money" in 2004. Given the scarcity of savings institutions, they are likely to have spent it all, most of it in consumption goods or in investments that were not productive enough to sustain their consumption in the long run. This may explain why we observe a decrease in their consumption between 2006 and 2010. There are alternative interpretations for this downward evolution, but these are less likely. Our regressions may have captured that CNDD+ ex-combatants were already on a declining consumption path in 2006. This trend would not be due to the grants, but would rather be explained by unobservable characteristics correlated with having received the grants. If we believe this, what we measure is the continuation of a decreasing trend.

There is evidence supporting the first interpretation and discrediting the second. First, Verwimp and Bundervoet (2009) have shown that consumption of CNDD+ ex-combatants' households increased by 34% between 1998 and 2007. Their second wave of data was collected right after the program had started and the ex-CNDD+ received the money[22]. This suggests that CNDD+ ex-rebels were not on a decreasing trend before 2007, which dismisses the second interpretation. Second, qualitative evidence suggests that ex-combatants spent a large share of their allowance in non-productive ways: food, drinks or clothes. They are therefore likely to have experienced a consumption boom similar to ex-FNLs in around 2005 and 2006. From our survey, we find that 50% of CNDD+ ex-combatants spent part of their allowance in consumption goods, 33.3% in clothing and only 5.6% reported having saved some money. Similarly, Uvin (2007) shows that many ex-combatants spent the demobilization grants in food, drinks, building houses or paying bills. Based on focus groups, Ndayiziga et al. (2008) also reports that "many demobilized ex-combatants were more used to firearms handling than in the management of development activities." They underline the tendency of ex-combatants to "overspend the demobilization indemnities in an unorganized way, quickly putting them back into hardship." Also based on focus groups and qualitative interviews, Willems et al. (2010) conclude that "although the total sum of the benefits given to ex-combatants was rather large, many of them found it difficult to effectively use it for

[22]By 2007, most of the ex-combatants had received their cash transfers (Gilligan et al., 2013).

their reintegration because they did not have the capacity to handle money." The following quote from a government representative is striking: "They have no idea where their food comes from; they have never been to the market. And in the army all they ever had to use their money for was buying beer, so that is all they buy from their money now. It is a bad habit, but it is a sad reality." (Willems et al., 2010). Third, our results are also consistent with the fact the indicators related to the stocks of productive assets exhibit a constant trend. According to our data, a substantial fraction of ex-combatants invested in a plot of land (39%), in a small shop (28%), in working material (22%) or in livestock (11%). These investments in productive activities made in 2006 are expected to be more durable and hence still partly observable in 2010. On the contrary, the spike in food and non-food spending following the demobilization should be short-lived and vanish when ex-combatants run out of demobilization money. This is exactly what we show in our analysis. The decreasing pattern between 2006 and 2010 is only observed for consumption purchases and non-food spending. There is no significant difference in terms of consumption from stock and in terms of livestock. Finally, our interpretation is consistent with the evolution of total consumption percentile ranks of the demobilized households we observe. Between 2006 and 2010, the average consumption of FNL households increased from the 42^{th} percentile to the 76^{th} percentile. The evolution is almost the opposite for CNDD+ households: it decreased from the 69^{th} to the 48^{th}.

These four arguments, coupled with the observation of a short-run positive impact on ex-FNL demobilized households, encourage us to conclude that the DDR program generated a short-run consumption boom among ex-combatants, both in 2006 and 2010. However, those who received demobilization grants from 2004 have not been able to sustain high levels of consumption in the long run. Altogether, we cannot say if the total effect of the DDR on them is positive or not. In particular, we are unable to test whether their consumption level before the onset of the DDR program in 2004 is higher or lower than their consumption level in 2010. In 2010, the average consumption of CNDD+ households was close to the median level in the population. The fact that they did not experience a decline in livestock units and in consumption from stock is somehow reassuring: these households do not seem to have sold their productive assets to maintain their high consumption level. However, the absence of a strong positive impact on these stock variables may seem surprising given the fact that CNDD+ households benefited from reintegration allowances (in-kind) between the two waves of the panel. The long-run effect of the reintegration phase of the program on assets seems to have been marginal for the CNDD+ ex-combatants, at least when compared to the large effect of reinsertion allowances on consumption. This contrasts with Gilligan et al. (2013), who find that reintegration grants have had a positive impact on self-reported income and decreased poverty incidence. They, however, reckon that they are "evaluating program effects

within a very short time frame" (Gilligan et al., 2013). The difference in indicators[23] and in the time frame, as well as the lower statistical power associated with our demobilization variables, could explain why we reach different conclusions.

5.2. Spillovers on civilians

The large amounts of demobilization money spent in consumption goods are likely to have generated broader equilibrium effects within villages. In Section 4, we presented evidence of positive externalities for the FNL ex-rebels on four out of five indicators. When looking at consumption purchases and non-food spending, one additional ex-combatant per 1000 inhabitants generated, on average, a 2% increase in consumption purchases and non-food spending. The effect is smaller but still significant on livestock. The coefficient associated with consumption from stocks is also positive, but not significant.

As for the direct effect, the spillovers are negative, significant and of the same size when they relate to the demobilization of CNDD+ ex-combatants. This suggests that the positive spillovers of the DDR program vanished in the long run as the ex-combatants ran out of money and the economy returned to its steady state. There is no significant impact of the number of CNDD+ per hill on the consumption from stocks.

Our preferred interpretation is that the DDR program generated a short-run economic boom in villages hosting numerous ex-combatants both in 2006 and in 2010. The large inflows of money and the induced increase in demand are indeed likely to have led to a price increase in hills hosting numerous demobilized ex-combatants. Farmers selling part of their production in the local market should have benefited from this increase in revenue. The construction sector is also likely to have gained from ex-combatants' investments in rebuilding houses. However, after the 2004 demobilization wave, this positive economic environment has become sluggish over time, as the surplus of money brought by demobilized ex-combatants gradually moved outside the local economy as ex-combatants purchased goods produced outside the village. The negative spillovers we measure for the CNDD+ demobilization would capture this return to the steady-state.

An alternative explanation for our findings could be that hills hosting FNLs and CNDD+ ex-combatants were on different trends: a positive trend for FNL hills and a negative trend for CNDD+ hills. This is unlikely for four reasons. First, there is no evidence of strategic relocation of ex-combatants. The registers include data on village of origin and return. Comparing these for each

[23] We only managed to collect precise income data for a minority of households, so we are not able to assess the impact of the program on income.

of the ex-combatants, we find that around 88% have come back to their hill of origin, and 92% to their home municipality.

Second, when the proportion of CNDD+ demobilized soldiers is included in the analysis of Verwimp and Bundervoet (2009), the coefficient associated with these spillovers is positive and equal to 0.01 (p-value = 0.04) without province fixed effects and 0.006 (p-value = 0.13) with fixed effects (available upon request). Its size is hard to compare with our estimates as their sample is very different. In 2007, they did not go to two of our three provinces (Bubanza and Bujumura Mairie) because the situation was still deemed too volatile. We do not use the exact same specification and indicators either. Still, this suggests that hills hosting numerous CNDD+ ex-combatants were on a positive trend between 1998 and 2007.

Third, our interpretation is consistent with the price variations observed in the hills. Economic theory predicts that a sudden increase in cash will push demand upwards, therefore provoking an increase in the price of locally-produced goods. This phenomenon should have been stronger in hills with numerous ex-combatants, as more money was coming in. The impact of the program on the prices of imported goods is unknown as it ultimately depends on the cost structure and the competition faced by wholesalers. In the long run, when ex-combatants exhaust their demobilization money, prices should converge to initial levels.

Table 6 documents how median prices in the local markets have evolved given the intensity of returns in the villages. The estimates are therefore reported at the hill level. The estimation in column (1) includes all products; it relies on a difference-in-difference model with product fixed effects. Columns (3) to (10) present the estimates of the difference-in-difference model for the most consumed items.

The results presented in column (1) of Table 6 suggest that prices were significantly higher in the hills with more demobilized FNL ex-combatants. In contrast, prices were lower in hills with more CNDD+ ex-combatants. Let us turn to an analysis by product, and distinguish goods that are produced locally (columns (2) to (9)) from those that are imported from the capital, Bujumbura (column (10)). For locally-produced goods, our estimates interestingly suggest that the price of traditional drinks drives the positive effect of the proportion of FNL ex-combatants in hills on prices. For hills of similar price levels in 2006, one additional FNL ex-combatant per 1000 population translates into a 2.9% higher price for traditional drinks. This suggests that traditional drinks were bought by ex-combatants following the sudden increase in cash on hand. The price of meat also seems to be higher in hills with a high proportion of FNL ex-combatants, although this relationship is not significant (p-value = 0.2). Turning to CNDD+ demobilization, in columns (3) to (6), we observe that prices are lower in hills where CNDD+ were demobilized. The prices of

fish, meat and rice were particularly lower in hills where CNDD+ ex-rebels live. The impact of the DDR program on the prices of imported goods seems to be of opposite sign. Beer is the only good which is not produced locally for which we have a decent number of observations.

The last column shows that the price of beer is on average lower, although not significant (p-value = 0.2), in hills with a high proportion of demobilized FNLs. The low number of observations may explain the low significance of this coefficient. In contrast, in hills with a high proportion of ex-CNDD+ ex-combatants, the price of beer is on average significantly higher. This opposite effect on the price of beer may be due to an increased competition between resellers. First, resellers may have cut their prices to grab the increased demand for imported goods following the DDR program. Second, some demobilized ex-combatants reported having invested their DDR allowance in a small shop, which may also have increased competition and thereby reduced prices. Again, prices of imported goods returned to their steady state as the money of the DDR program runs low.

Finally, our story is also consistent with the differential impact according to professions. In order to study the differential impact of the DDR according to households' main occupation, Table 7 adds interaction terms between the main occupation of households and the proportion of ex-combatants living in hills. As argued before, FNL ex-combatants spent a large part of their money on food and traditional drinks. These are produced by farmers, which should therefore have indirectly benefited from the program. Ex-combatants also built or repaired their houses. We therefore expect a positive impact in the construction sector. For the shopkeepers, the impact will depend on how fierce competition was and became following the return of ex-combatants.

We grouped households into five employment categories: farming, small business, construction, public sector and extractive activity. We define as the main occupation the one which generated the highest income the year before the survey. Constructing this variable was problematic for households which did not report the revenue of their activities. These households are therefore excluded in columns (1) and (2). In columns (3) and (4), households which did not report their revenue but only engaged in one type of activity are included. In columns (5) and (6), we further add the households which did not report their revenue and which engaged in multiple activities by assuming that their main income generating activity is the non-agricultural one. In all columns, the dummy for farming activity - which comprises 79% of households - is omitted.

Table 7 shows that the indirect impact of the DDR on non-beneficiaries depends on their main occupation. First, farmers' households seems to have consumed on average more in villages where FNL returns were higher, and less in hills where more CNDD+ returned. In line with our expectations and with prices regressions, the increased demand in consumption goods from demobilized ex-combatants seems to have boosted their revenue from sales, allowing them to consume more

in the short run. For CNDD+, this economic boom appears to have been short-lived. Second, the DDR program seems to have had no indirect effect on shopkeepers. F-tests cannot reject the null hypothesis of no indirect impact. Shopkeepers may not have been able to grab the benefits from the DDR program because of the enhanced competition between resellers and the lower prices of imported goods. Third, the positive and significant impact of FNL demobilization on construction workers is also consistent with our expectations. When returning home, around 10% of ex-rebels invested part of their allowance in the construction of a dwelling. Some civilian households probably also invested in their housing following the end of the conflict. Again, construction workers living in hills with numerous CNDD+ demobilized ex-combatants seem to experience a slight slowdown comparing 2010 to 2006 (although not significant in some specifications). According to our story, this drop reflects a normal adjustment after the construction boom which is likely to have occurred in 2005 following the CNDD+ demobilization. Finally, the impact on public sector employees is striking and should be emphasized. The relative situation of public employees has sharply improved in hills with a high proportion of CNDD+ returns. On the contrary, public employees living in hills with numerous FNL ex-combatants are relatively worst off. This is not surprising if we remember that the actual president of Burundi, Pierre Nkurunziza, is the former leader of the CNDD-FDD rebel group; public employees working in hills with numerous CNDD+ ex-combatants may have been favored following his election in 2005.

6. Concluding remarks

Following the end of the Cold War, multidimensional peacekeeping operations have been implemented to facilitate the transition from war to peace in Africa. Disarmament, demobilization and reintegration programs have been an essential component of this process. These programs aim at "disarming combatants, removing them from military structures, and socially and economically integrating them into society" (World Bank 2009).

Burundi is recovering from a civil war that lasted more than a decade (1993-2009). The armed conflict ended in 2009 with the voluntary demobilization of the last Hutu rebel group, the Palipehutu-FNL. In exchange for laying down their arms, ex-combatants received reinsertion allowances equivalent to an 18-month salary in the army. Four years before, another Hutu rebel group, the CNDD-FDD, had benefited from the same allocations, and additionally received in-kind payments.

In this paper, we assessed the impact of this disarmament, demobilization and reintegration program by analyzing a panel dataset collected in 2006 and 2010 in three rural provinces heavily affected by the conflict. Our objectives were to assess the short- and long-run impacts of the

demobilization program on ex-combatants economic outcomes, but also to capture the spillovers that may have affected civilian households.

Our empirical analysis highlighted the positive and significant impact of the demobilization program on ex-combatant households in the short run. The large amounts of money which were introduced in the local economy through the demobilization program have generated an economic boom in the short run. Thereby, households who did not participate actively in the conflict also gained, indirectly, from the demobilization program. In the long run, however, the positive impact of the DDR on beneficiaries and the positive externalities on non-beneficiaries seem to have vanished, as the money received by demobilized ex-combatants ran low.

The conclusions of our empirical analysis should be considered by policymakers while implementing DDR processes in other regions. In the short run, the positive direct effect of the DDR program shows that the program indeed provides a safety net to ex-combatants. The positive spillovers further shows that the program does not only benefit beneficiaries, but also communities where ex-combatants returned, increasing the range of impact. This second effect is likely to ease the return of ex-combatants in their villages. Our study supports therefore the reinsertion program implemented in post-conflict countries as a short-run strategy to reduce the risk of relapse into conflict by alleviating poverty of both recipient and non-recipient households. However, our results suggest that the reinsertion phase is not sufficient for creating a virtuous circle towards economic development as the positive impact of cash transfers is short-lived. The return to a precarious situation may encourage ex-rebels to take up arms again and re-engage in violence.

Once more, we would like to insist on the empirical challenges faced when evaluating DDR programs. Having data from 2006 at hand and knowing that the DDR was going to be implemented in 2009, we decided to collect a second wave after payments were fully transferred to the FNL. The panel dimension allows us to control for individual unobservables, but at the cost of restricting the number of demobilized soldiers in our sample. However, as ex-combatants "fell into a lot of money", the effects we find are large and follow the predictions of economic theory. They are additionally backed up by qualitative evidence from Burundi (Uvin, 2007; Willems et al., 2010).

The absence of long-run positive effects regarding the more subtle reintegration benefits could be due to the low predictive power associated with the small number of officially demobilized soldiers. The measure of the spillovers does not suffer from this caveat, and both the panel dimension and completeness of our sample allowed us to quantify spillovers on the whole communities, both in the short and the longer run. In spite of its limitations, we believe that our study shed light on some important effects of the DDR program on both ex-combatants and civilians. We hope that our

study, together with other analyses of the effects of the DDR program, can pave the way towards innovative designs for evaluating the impact of such important programs.

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7. Figures and Tables

Figure 1: DDR grants spending by ex-combatants

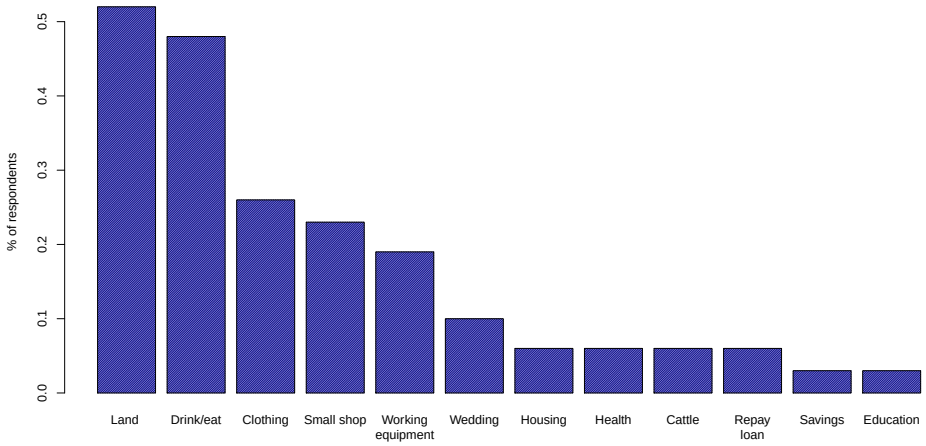
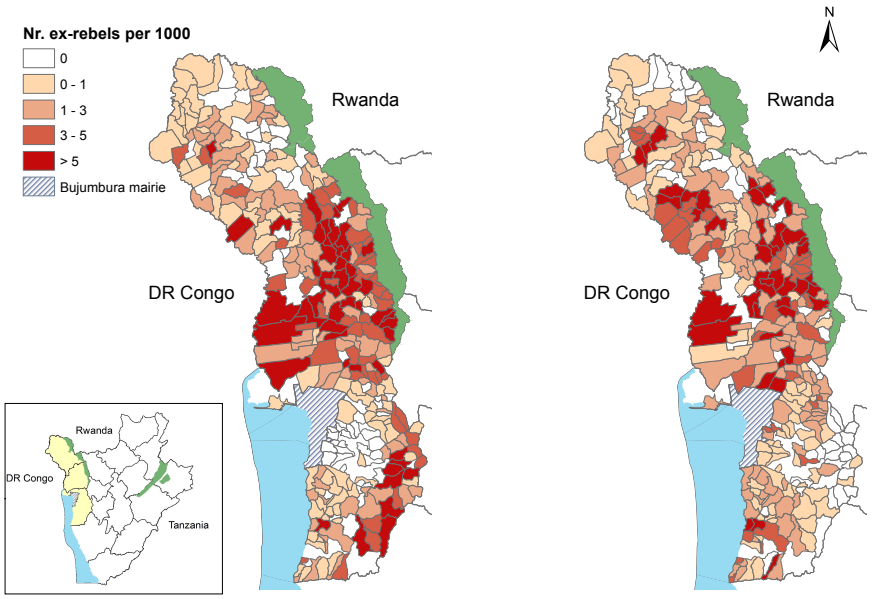


Figure 2: Demobilized ex-combatants per 1000 inhabitants in Bujumbura Rural, Bubanza and Cibitoke provinces



(a) CNDD+ per 1000

(b) FNL per 1000

Table 1: Descriptive statistics

	Sample mean (sd)			T-test p-value	
	2010	2006	Attrition	2010/ 2006	2006/ attrition
Economic outcomes					
Consumption per AE	14387	16101	17706	0.00	0.15
	(11349)	(10996)	(14716)		
Cons. expenditure per AE	7971	8828	11314	0.01	0.00
	(7045)	(7765)	(11155)		
Cons. from stock per AE	6566	7246	6114	0.08	0.09
	(9281)	(8181)	(8679)		
Non-food spending per AE	41312	52646	62956	0.00	0.25
	(65705)	(101080)	(108785)		
Tropical livestock units	0.09	0.16	0.09	0.00	0.03
	(0.16)	(0.19)	(0.19)		
Demographic characteristics					
Adult equivalent (AE)	2.90	2.66	2.48	0.00	0.00
	(0.92)	(0.88)	(0.80)		
HH size	5.89	5.37	4.91	0.00	0.00
	(2.34)	(2.34)	(2.21)		
Sex Head	0.78	0.80	0.81	0.13	0.94
	(0.42)	(0.40)	(0.40)		
Age Head	46	42	41	0.00	0.37
	(14)	(14)	(16)		
Head education					
No school	0.37	0.36	0.34	0.78	0.49
	(0.48)	(0.48)	(0.47)		
Primary school	0.38	0.36	0.41	0.47	0.22
	(0.49)	(0.48)	(0.49)		
Secondary school	0.04	0.03	0.04	0.20	0.43
	(0.20)	(0.18)	(0.20)		
Coranic school	0.21	0.24	0.21	0.08	0.29
	(0.41)	(0.43)	(0.41)		
Head marital status					
Single	0.02	0.03	0.04	0.70	0.20
	(0.15)	(0.16)	(0.20)		
Married	0.76	0.79	0.76	0.07	0.28
	(0.43)	(0.40)	(0.43)		
Divorced	0.02	0.02	0.03	0.25	0.25
	(0.15)	(0.13)	(0.17)		
Widow	0.19	0.16	0.16	0.09	0.97
	(0.39)	(0.37)	(0.37)		
Occupation					
Agriculture	0.79	0.79	0.78	0.97	0.68
	(0.41)	(0.41)	(0.42)		
Small business	0.12	0.08	0.07	0.00	0.51
	(0.32)	(0.27)	(0.25)		
Construction	0.04	0.06	0.09	0.09	0.09
	(0.20)	(0.23)	(0.29)		
Public sector	0.02	0.04	0.02	0.09	0.05
	(0.16)	(0.19)	(0.13)		
Extractive activities	0.03	0.01	0.00	0.00	0.41
	(0.16)	(0.09)	(0.07)		
Colline characteristics (village level)					
Violent events (last 4 years)	0.44	1.14	1.39[a]	0.00	0.00[b]
	(0.86)	(1.63)	(1.71)		
Ex-combatant Return, per 1000	3.76	2.99	3.00[a]	0.31	0.00[b]
	(5.43)	(4.48)	(5.15)		

[a] These statistics were computed at the household level

Table 2: Construction of ex-rebel household variables

	CNDD+	FNL	Total	Variable of interest CNDD+	Variable of interest FNL
Member declared having ties with the factions					
but did not receive anything	8	10	18		
and to be GdP/MC/AA	6	4	10		
Demobilized ex-combatant member					
Member declared to be demobilized	14	9	23	$D_{i,t-1}^{CNDD+3}$	$D_{i,t}^{FNL3}$
And not recorded in official registers	8	5	13		
And recorded in official registers	6	4	10	$D_{i,t-1}^{CNDD+1}$	$D_{i,t}^{FNL1}$
Not declared but matched with registers	1	7	8		
Total matched with registers (declared or not)	7	11	18	$D_{i,t-1}^{CNDD+2}$	$D_{i,t}^{FNL2}$
Totals					
Households belonging to a faction (without matches)	28	21*	49	$R_{i,t-1}^{CNDD+1}$	$R_{i,t}^{FNL1}$
Households belonging to a faction (with matches)	29	28	57	$R_{i,t-1}^{CNDD+2}$	$R_{i,t}^{FNL2}$

* For two households, there were two persons reporting to have ties with the FNL. In one household, both declared to be demobilized in 2009 but none was officially recorded. In another household, there was one recorded ex-combatant, while his brother did not received anything. The related dummies take the value one for each case but the return variable is restricted to one for both cases.

Table 3: Descriptive statistics by demobilization status

	Civilians	CNDD		FNL	
	All	Return	Demob	Return	Demob
Panel A. Dependent variable in 2010					
Total consumption	14419	14927	11153	14037	19046
	(11489)	(9497)	(11504)	(9816)	(8795)
Consumption expenditures	7828	8384	4058	8892	11766
	(7214)	(6285)	(2495)	(7627)	(5660)
Consumption from stocks	6591	6543	7094	5144	7280
	(9145)	(7485)	(10798)	(6163)	(8572)
Non-food spending	7761	8050	4052	9347	10633
	(6763)	(6287)	(2351)	(7495)	(4856)
TLU	0.09	0.08	0.10	0.05	0.11
	(0.16)	(0.18)	(0.24)	(0.08)	(0.19)
Panel B. Dependent variable in 2006					
Total consumption	16127	17051	18608	14906	11780
	(11090)	(8919)	(10685)	(9966)	(7572)
Consumption expenditures	8782	11017	8428	8673	7852
	(7761)	(7911)	(7621)	(7022)	(6695)
Consumption from stocks	7345	6034	10181	6233	3928
	(7993)	(7301)	(6394)	(5464)	(4303)
Non-food spending	4426	5098	3597	5007	3955
	(4039)	(3369)	(2903)	(4737)	(3442)
TLU	0.12	0.11	0.22	0.16	0.15
	(0.19)	(0.17)	(0.19)	(0.23)	(0.21)
Panel C. Socio-demographic characteristics in 2006					
Age	42.28	36.91	41.43	37.71	39.91
	(14.04)	(13.48)	(7.66)	(11.33)	(10.44)
No schooling (%)	0.36	0.27	0.29	0.35	0.45
	(0.48)	(0.46)	(0.49)	(0.49)	(0.52)
Primary schooling (%)	0.39	0.64	0.71	0.47	0.36
	(0.49)	(0.49)	(0.49)	(0.51)	(0.50)
Secondary schooling (%)	0.25	0.09	0.00	0.18	0.18
	(0.43)	(0.29)	(0.00)	(0.39)	(0.40)
Single (%)	0.03	0.00	0.00	0.00	0.09
	(0.16)	(2.00)	(0.00)	(0.00)	(0.30)
Married (%)	0.79	0.91	1.00	0.76	0.82
	(0.41)	(0.29)	(0.00)	(0.44)	(0.40)
Divorced (%)	0.02	0.00	0.00	0.00	0.00
	(0.13)	(2.00)	(0.00)	(0.00)	(0.00)
Widow (%)	0.17	0.09	0.00	0.24	0.09
N[1]	[920,978]	[20,22]	[16,17]	[6,7]	[10,11]

[1] The number of observations may vary as outliers or missing values are not taken into account when computing the means and standard deviations.

Table 4: Difference-in-difference model - Consumption

Dependent variable: Δ Log total consumption per AE in 2010

	(1)	(2)	(3)	(4)	(5)	(6)
Ex-combatant return in HH						
HH member belong to the CNDD faction	0.128	0.042	0.131	0.044	0.280	0.157
	(0.144)	(0.145)	(0.144)	(0.144)	(0.173)	(0.171)
HH member belong to the FNL faction	0.016	-0.017	0.019	-0.017	0.056	0.042
	(0.215)	(0.197)	(0.215)	(0.197)	(0.256)	(0.237)
Demobilized in HH						
Ex-combatant CNDD in household (registers)	-0.610***	-0.628***	-0.510**	-0.530**	-0.546**	-0.480**
	(0.226)	(0.205)	(0.223)	(0.203)	(0.226)	(0.229)
Ex-combatant FNL in household (registers)	0.890**	0.852**	0.586**	0.568**	0.322	0.255
	(0.367)	(0.388)	(0.240)	(0.245)	(0.367)	(0.360)
# of demobilized in the hill (per 1000 inhab.)						
CNDD+ factions ($S_{i,t-1}^{CNDD+}$)	-0.013*	-0.014**	-0.013*	-0.014**	-0.012*	-0.014*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
FNL factions ($S_{i,t}^{FNL}$)	0.012**	0.012***	0.012**	0.012***	0.012**	0.012***
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Log consumption per AE in 2006	-0.819***	-0.854***	-0.813***	-0.848***	-0.821***	-0.855***
	(0.037)	(0.040)	(0.038)	(0.040)	(0.037)	(0.039)
Constant	7.574***	7.831***	7.511***	7.750***	7.585***	7.830***
	(0.360)	(0.451)	(0.366)	(0.441)	(0.352)	(0.445)
Controls	No	Yes	No	Yes	No	Yes
Province FE	No	Yes	No	Yes	No	Yes
Observations	969	958	969	958	969	958
R^2	0.046	0.092	0.047	0.094	0.043	0.089

Clustered-robust standard errors in parentheses

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

Table 5: Difference-in-difference model - Disaggregated consumption, non-food spending and Tropical livestock Units (TLU)

	Δ Log cons. expenditures per AE		Δ Log cons. from stocks per AE		Δ Log non-food spending per AE		Δ Log Tropical Livestock	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ex-combatant return in HH								
CNDD+ factions ($R^{CNDD+}_{i,t-1}$)	0.306	0.088	-0.056	-0.041	0.145	-0.101	0.016	0.019
	(0.204)	(0.165)	(0.276)	(0.277)	(0.231)	(0.184)	(0.042)	(0.044)
FNL factions ($R^{FNL}_{i,t}$)	0.141	0.168	-0.335	-0.409	0.136	0.153	-0.062***	-0.068***
	(0.215)	(0.210)	(0.461)	(0.422)	(0.219)	(0.215)	(0.015)	(0.019)
Demobilized in HH								
CNDD+ factions ($D^{CNDD+}_{i,t-1}$)	-0.869***	-0.774***	0.015	-0.042	-0.610*	-0.498*	0.016	-0.006
	(0.312)	(0.259)	(0.480)	(0.498)	(0.340)	(0.280)	(0.047)	(0.044)
FNL factions ($D^{FNL}_{i,t}$)	0.611***	0.531**	0.766	0.846*	0.550**	0.488**	0.077*	0.097**
	(0.227)	(0.242)	(0.522)	(0.481)	(0.230)	(0.243)	(0.046)	(0.045)
# of demobilized in the hill (per 1000 inhab.)								
CNDD+ factions ($S^{CNDD+}_{i,t-1}$)	-0.022***	-0.020**	-0.002	-0.015	-0.028***	-0.025***	-0.003**	-0.001*
	(0.008)	(0.009)	(0.017)	(0.013)	(0.008)	(0.008)	(0.001)	(0.001)
FNL factions ($S^{FNL}_{i,t}$)	0.020***	0.019***	0.015	0.012	0.019***	0.019***	0.002***	0.002***
	(0.004)	(0.004)	(0.015)	(0.010)	(0.004)	(0.004)	(0.001)	(0.001)
Lag								
Lagged dep. var.v	-0.789***	-0.830***	-0.858***	-0.889***	-0.782***	-0.830***	-0.858***	-0.875***
	(0.038)	(0.041)	(0.042)	(0.040)	(0.035)	(0.039)	(0.056)	(0.051)
Constant	6.785***	7.341***	7.119***	7.292***	6.873***	7.421***	0.069***	0.001
	(0.333)	(0.363)	(0.379)	(0.506)	(0.289)	(0.330)	(0.007)	(0.028)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Province FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	985	974	796	786	986	975	968	952
R^2	0.080	0.171	0.029	0.081	0.085	0.174	0.038	0.084

Clustered-robust standard errors in parentheses

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

Table 6: Channels - Spillovers and prices (Price paid per kg)

Dependent variable: Δ Log price paid per kg in 2010

	(1) All products	(2) Traditional drinks	(3) Manioc	(4) Rice	(5) Beans	(6) Tomatos	(7) Sweet potatoes	(8) Fish	(9) Meat	(10) Beers
# of demobilized in the hill (per 1000 inhab.)										
CNDD+ factions ($S_{i,t-1}^{CNDD+}$)	-0.005**	0.006	-0.001	-0.019***	-0.006*	-0.014	-0.004	-0.024**	-0.018**	0.044**
	(0.002)	(0.008)	(0.004)	(0.004)	(0.003)	(0.010)	(0.008)	(0.010)	(0.007)	(0.021)
FNL factions ($S_{i,t}^{FNL}$)	0.003**	0.029***	0.002	0.002	-0.001	-0.003	0.002	0.006	0.007	-0.021
	(0.002)	(0.010)	(0.003)	(0.003)	(0.003)	(0.008)	(0.007)	(0.008)	(0.005)	(0.016)
Controls										
Log price paid per kg in 2006	-0.940***	-0.943***	-1.001***	-0.715***	-0.896***	-0.950***	-0.965***	-0.962***	-0.966***	-0.926***
	(0.018)	(0.097)	(0.069)	(0.098)	(0.093)	(0.064)	(0.069)	(0.089)	(0.077)	(0.097)
Violent events 2002-2005	-0.004	-0.036*	0.007	-0.014	-0.005	-0.029	0.013	0.010	-0.055**	-0.065
	(0.006)	(0.021)	(0.014)	(0.012)	(0.010)	(0.031)	(0.025)	(0.029)	(0.021)	(0.056)
Violent events 2006-2009	0.041***	0.036	0.013	0.032	0.036*	-0.043	0.081	0.052	0.086**	0.173**
	(0.012)	(0.049)	(0.025)	(0.024)	(0.020)	(0.061)	(0.050)	(0.059)	(0.041)	(0.081)
Constant	6.394***	5.361***	6.351***	5.042***	6.142***	6.272***	5.552***	8.355***	7.950***	6.498***
	(0.120)	(0.544)	(0.390)	(0.636)	(0.573)	(0.367)	(0.354)	(0.635)	(0.553)	(0.615)
Product FE	Yes	No	No	No	No	No	No	No	No	No
Observations	2080	78	80	77	84	80	78	83	81	50
R^2	0.852	0.219	0.017	0.331	0.130	0.075	0.080	0.114	0.187	0.164

These regressions are performed at the hill level, using the median of the log price paid per kg by households in each hill. Note that for some products, there were no purchases in certain hills, which implies less observations. Clustered-robust standard errors are in parentheses.

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

Table 7: Channels - Spillovers and sector of activity

Dependent variable: Δ Log total consumption per AE in 2010

	(1)	(2)	(3)	(4)	(5)	(6)
Ex-combatant return in HH						
CNDD+ factions ($R_{i,t-1}^{CNDD+}$)	0.233	0.137	0.213	0.114	0.143	0.047
	(0.160)	(0.161)	(0.157)	(0.158)	(0.149)	(0.146)
FNL factions ($R_{i,t}^{FNL}$)	-0.045	-0.075	-0.032	-0.072	-0.001	-0.040
	(0.257)	(0.237)	(0.251)	(0.234)	(0.219)	(0.204)
Demobilized in HH						
CNDD+ factions ($D_{i,t-1}^{CNDD+}$)	-0.611*	-0.569	-0.524*	-0.512*	-0.687***	-0.678***
	(0.349)	(0.345)	(0.304)	(0.295)	(0.238)	(0.230)
FNL factions ($D_{i,t}^{FNL}$)	0.488*	0.494**	0.496**	0.511**	0.587**	0.597**
	(0.252)	(0.243)	(0.245)	(0.242)	(0.243)	(0.242)
# of demobilized in the hill (per 1000 inhab.)						
CNDD+ factions ($S_{i,t-1}^{CNDD+}$)	-0.020***	-0.023***	-0.017**	-0.019***	-0.017**	-0.020***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
FNL factions ($S_{i,t}^{FNL}$)	0.018***	0.015***	0.018***	0.016***	0.018***	0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Channel						
$S_{i,t-1}^{CNDD+}$ × Small business	0.066**	0.064**	0.048*	0.051**	0.014	0.016
	(0.029)	(0.028)	(0.025)	(0.023)	(0.026)	(0.025)
$S_{i,t-1}^{CNDD+}$ × Construction	-0.104	-0.096*	-0.108	-0.094	-0.092	-0.083
	(0.068)	(0.058)	(0.067)	(0.058)	(0.083)	(0.080)
$S_{i,t-1}^{CNDD+}$ × Public	0.066***	0.061***	0.078***	0.069***	0.071***	0.060***
	(0.016)	(0.014)	(0.016)	(0.016)	(0.015)	(0.016)
$S_{i,t-1}^{CNDD+}$ × Extractive activities	0.046	0.047	0.042	0.042	0.014	0.016
	(0.042)	(0.041)	(0.042)	(0.041)	(0.026)	(0.025)
$S_{i,t}^{FNL}$ × Small business	-0.022**	-0.015	-0.018**	-0.013	-0.009	-0.004
	(0.011)	(0.011)	(0.008)	(0.009)	(0.008)	(0.008)
$S_{i,t}^{FNL}$ × Construction	0.283***	0.281***	0.292***	0.281***	0.134	0.125
	(0.079)	(0.073)	(0.082)	(0.078)	(0.110)	(0.109)
$S_{i,t}^{FNL}$ × Public	-0.041***	-0.032***	-0.042***	-0.034***	-0.026***	-0.015***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
$S_{i,t}^{FNL}$ × Extractive activities	-0.021*	-0.008	-0.021*	-0.009	-0.021***	-0.013*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.008)	(0.008)
Lag						
Log consumption per AE in 2006	-0.796***	-0.822***	-0.816***	-0.840***	-0.821***	-0.847***
	(0.054)	(0.055)	(0.052)	(0.053)	(0.044)	(0.045)
Constant	7.339***	7.963***	7.506***	8.034***	7.552***	8.119***
	(0.519)	(0.578)	(0.504)	(0.566)	(0.430)	(0.516)
Controls	No	Yes	No	Yes	No	Yes
Province FE	No	Yes	No	Yes	No	Yes
Observations	858	853	909	904	963	958
R^2	0.097	0.133	0.088	0.121	0.070	0.102

This table reports OLS estimates for the second definition of demobilization ($D_{i,t-1}^{CNDD+2}$ and $D_{i,t}^{FNL2}$). In column (1) and (2), the main activity of the HH is assumed to be the non-agricultural one if it engages in different activities whose revenues cannot be classified. In column (3) and (4), HH whose most lucrative activity cannot be distinguished or whose did not report the revenue of their activities are excluded. In column (5) and (6), HH whose most lucrative activity cannot be distinguished are excluded. Clustered-robust standard errors are in parentheses.

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

Appendix A. Attrition

Table A.8: Selective Attrition - Becketti et al. (1988) method

	Total cons. (1)	Cons. expend. (2)	Cons. stocks (3)	Non-food spending (4)	Tropical Livestock (5)
Traced HH	0.508	0.151	0.122	-0.156	0.070
	(0.521)	(0.805)	(1.142)	(0.797)	(0.079)
CNDD+ factions ($S_{i,t-1}^{CNDD+}$)	-0.016	0.003	-0.044**	-0.000	-0.004***
	(0.010)	(0.012)	(0.019)	(0.012)	(0.001)
CNDD+ factions ($S_{i,t-1}^{CNDD+}$) × Traced	0.006	-0.005	0.026	-0.011	0.003
	(0.010)	(0.013)	(0.018)	(0.009)	(0.002)
FNL factions ($S_{i,t}^{FNL}$)	0.004	0.015	0.004	0.029***	0.005**
	(0.012)	(0.009)	(0.031)	(0.010)	(0.002)
FNL factions ($S_{i,t}^{FNL}$) × Traced	0.005	0.007	-0.004	-0.008	-0.004
	(0.009)	(0.009)	(0.026)	(0.008)	(0.003)
Violence	-0.004	0.031	-0.081	0.036	0.005
	(0.034)	(0.045)	(0.080)	(0.048)	(0.006)
Violence × Traced	-0.007	-0.045	0.072	-0.045	-0.006
	(0.037)	(0.049)	(0.078)	(0.047)	(0.008)
Sex Head	0.525*	0.125	0.631	-0.093	-0.010
	(0.270)	(0.394)	(0.611)	(0.403)	(0.032)
Sex Head × Traced	-0.551*	-0.128	-0.408	0.125	-0.005
	(0.318)	(0.469)	(0.655)	(0.466)	(0.041)
Age Head	-0.006	-0.016**	0.004	-0.011	0.000
	(0.005)	(0.007)	(0.010)	(0.007)	(0.000)
Age Head × Traced	0.006	0.016**	-0.004	0.016**	0.000
	(0.005)	(0.008)	(0.010)	(0.007)	(0.001)
Married	-0.335	-0.122	-0.318	0.261	0.043
	(0.389)	(0.325)	(0.714)	(0.337)	(0.029)
Married × Traced	0.326	-0.088	0.576	-0.283	-0.029
	(0.402)	(0.354)	(0.723)	(0.391)	(0.048)
Divorced	-0.191	0.404	0.155	-0.185	-0.009
	(0.446)	(0.437)	(0.767)	(0.660)	(0.058)
Divorced × Traced	0.261	-0.344	-0.234	-0.175	-0.073
	(0.418)	(0.651)	(0.981)	(0.797)	(0.067)
Widow	0.169	0.427	-0.235	0.256	-0.009
	(0.417)	(0.447)	(0.790)	(0.438)	(0.041)
Widow × Traced	-0.184	-0.756	0.785	-0.606	-0.029
	(0.427)	(0.510)	(0.811)	(0.493)	(0.056)
Primary School	0.361**	0.923***	0.097	0.807***	0.026
	(0.161)	(0.303)	(0.346)	(0.288)	(0.023)

Continued on next page

Table A.8 – continued from previous page

	(1)	(2)	(3)	(4)	(5)
Primary School × Traced	-0.141	-0.689**	0.232	-0.576*	-0.011
	(0.176)	(0.313)	(0.340)	(0.291)	(0.027)
Secondary School	0.132	0.506*	-0.233	0.478*	0.021
	(0.147)	(0.286)	(0.330)	(0.271)	(0.023)
Secondary School × Traced	0.066	-0.399	0.616	-0.375	0.001
	(0.208)	(0.260)	(0.409)	(0.234)	(0.039)
Shop keeper	0.029	0.051	0.055	0.173	0.047
	(0.206)	(0.248)	(0.389)	(0.270)	(0.067)
Shop keeper × Traced	0.048	0.010	0.004	-0.051	-0.039
	(0.217)	(0.257)	(0.439)	(0.298)	(0.071)
Construction worker	0.012	0.131	0.354	0.121	-0.017
	(0.275)	(0.371)	(0.330)	(0.345)	(0.029)
Construction worker × Traced	0.181	0.062	-0.468	0.153	0.027
	(0.295)	(0.396)	(0.362)	(0.371)	(0.032)
Civil servant	0.159	0.016	0.564	-0.036	0.002
	(0.460)	(0.515)	(0.486)	(0.615)	(0.069)
Civil servant × Traced	0.073	0.349	-0.822	0.748	0.058
	(0.442)	(0.513)	(0.527)	(0.590)	(0.074)
Constant	8.875***	8.603***	7.467***	8.735***	0.008
	(0.478)	(0.687)	(1.078)	(0.652)	(0.063)
Observations	1178	1191	1105	1195	1195
R^2	0.050	0.085	0.049	0.106	0.040
F-test Traced HH	0.95	0.04	0.01	0.04	0.79
p-value F-test	0.33	0.85	0.92	0.85	0.38
F-test interactions variables	0.98	0.92	1.20	1.34	0.87
p-value F-test	0.48	0.54	0.29	0.21	0.58
F-test Traced HH + interactions variables	0.91	1.15	1.60	1.59	1.75
p-value F-test	0.55	0.33	0.1*	0.1*	0.06 *

Selective attrition has been tested for the log of dependent variables in 2006. Consumption and spendings are per adult equivalent. We did not trace only one household which had a member working in the extractive sector so it is omitted.Clustered-robust standard errors are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.9: Selective Attrition - Fitzgerald et al. (1998) method

Dependent variable: Probability to be traced in 2010

	(1)	(2)	(3)	(4)	(5)	(6)
Log consumption per AE in 2006	0.005					-0.275
	(0.059)					(0.267)
Log cons. expenditures per AE in 2006		-0.033				0.010
		(0.057)				(0.228)
Log cons. from stocks per AE in 2006			0.069			0.154
			(0.044)			(0.111)
Log non-food spending per AE in 2006				-0.003		0.147
				(0.048)		(0.136)
Log tropical livestock in 2006					0.500	0.289
					(0.319)	(0.314)
CNDD+ factions ($S_{i,t-1}^{CNDD+}$)						-0.018**
						(0.008)
FNL factions ($S_{i,t}^{FNL}$)						0.009
						(0.010)
Violent events 2002-2005						-0.033
						(0.041)
Sex Head						-0.305
						(0.197)
Age Head						0.003
						(0.004)
Married						0.379
						(0.301)
Divorced						-0.130
						(0.497)
Widow						0.018
						(0.360)
Primary School						-0.051
						(0.125)
Secondary School						0.087
						(0.180)
Shop keeper						0.171
						(0.199)
Construction worker						0.094
						(0.230)
Extractive activity						0.290
						(0.517)
Civil servant						0.219
						(0.308)
Constant	0.934*	1.276***	0.457	1.012**	0.935***	0.859
	(0.560)	(0.485)	(0.380)	(0.414)	(0.061)	(0.736)
Province FE	No	No	No	No	No	Yes
Observations	1227	1227	1123	1232	1232	1113
R^2						

Clustered-robust standard errors in parentheses

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

Appendix B. Online appendix - The construction of variables of interest

Appendix B.1. The construction of consumption aggregates

In this appendix, we describe how we cleaned the data and constructed the relevant consumption aggregates for our analysis. First, we introduce the construction of the reference price vector and the local price vectors associated with each household. Second, we explain in detail how we corrected typing mistakes, how we treated missing and vague information, and how we dealt with outliers. Finally, we describe the construction of our main consumption measure which is a consumption aggregate per adult equivalent calculated using constant prices.

a. Prices

Prices faced by households are crucial in each stage of our analysis. First, in the data cleaning process, prices are an important to fill missing information as well as to detect and correct outliers. Second, in the construction of consumption aggregates, prices are used to make consumption data comparable across space and time. Following Deaton and Zaidi (2002), the harmonization of consumption data is done by scaling consumption values by a Paasche index of prices. Finally, finding a price increase in primary units where demobilized ex-combatants are numerous would corroborate the hypothesis that positive spillovers of the DDR program are due to a local economy effect.

We distinguish two sets of prices. On the one hand, the reference price matrix, denoted p^0, is a 47×1 vector such that each line is a reference price for one of our 47 consumption products. This matrix is common for all households and both periods of time. We used the 2010 panel survey as the reference year. For each one of the 47 products, the reference price was computed as follows. First, the most widely used unit of measurement was selected by considering the entire sample. In this process, we excluded vague[24] and wrong[25] units of measurement whose conversion into kilos is ambiguous. Second, the median price per unit was computed for this most used unit, and converted into kilos.

On the other hand, hill prices faced by each household are denoted p^h. These 47×1 vectors are different for each one of the 85 hills and for each periods of time. These local prices were computed as follows. Our survey distinguishes four levels of administrative subdivision: the whole survey area is divided into three provinces, 22 municipalities and 85 hills. For each hill and for each one of the 47 consumption products, the most used measurement unit was selected (still by excluding vague and wrong units of measurement). If this unit was used 10 times or more at the hill level, we

[24] For example a basket, a pile or a pan.
[25] For example, a stere of meat or a liter of batteries.

computed the median price per unit, further converted into a median price per kilo. Conversely, if the most used unit was reported less than 10 times at the hill level, we followed the same procedure but at the municipality level. Again, if the most used unit at the municipality level was reported less than 10 times, the procedure was adapted at the province level. If less than 10 households reported a similar unit at the province level, then the procedure was done for the whole sample, even if no unit was used more than 10 times.

b. Correction of errors and outliers

In the correction process, we distinguished three types of manipulations: the correction of mistakes, the completion of missing data, and the treatment of outliers. First, we reviewed the data manually in order to find and correct recurrent typing mistakes such as the double entry of a number or the inversion between the code of the unit and the quantity. For few ambiguous cases, we replaced the suspicious information with a missing value.

Second, missing information was extrapolated in two cases. On the one side, if the amount spent for one consumption good was available and if the quantity or the unit (or both) were missing, the quantity consumed per kilo was calculated by dividing the amount spent by the local price per kilo p^h. If both the quantity and the measurement unit were reported but the amount paid was missing, this amount was imputed by multiplying the quantity consumed by the local price p^h expressed in the same unit. All other cases were considered to be zero.

Finally, we looked for outliers. In order to identify the outlying observations, we computed the price paid per kilo for each household and each product by dividing the amount paid by the quantity consumed previously converted into kilos. By denoting Q1, Q2 and Q3 the first quartile, the median and the third quartile respectively, we define an outlier as an observation whose price paid per kilo lies outside the following fences (Hubert and Vandervieren, 2008):

$$[Q_1 - k_1(Q_2 - Q_1); Q_3 + (Q_3 - Q_2)] \text{ with } k_1 = k_2 = 3. \tag{B.1}$$

For such observations, we then identified whether the amount paid or the quantity consumed was responsible for this extreme deviation from the median. On the one hand, if the amount paid was identified as extreme, it was replaced by multiplying the quantity consumed by the local price. On the other hand, if the quantity consumed was identified as the outlier, then the quantity consumed was replaced by the amount paid divided by the local price per kilo.

c. Construction of consumption aggregates

In order to construct consumption aggregates and to render these comparable between households in the two surveys, we constructed for each household what Deaton and Zaidi (2002) call

a money metric utility. This consumption measure, denoted u^h, corresponds to the minimum cost for reaching a certain level of utility. Following Deaton and Zaidi (2002), the money metric utility u^h can be approximated by the inner product of reference prices p^0 and the quantity consumed q^h, or equivalently, by adding up all the household's expenditures and dividing by a Paasche index of prices P_P^h:

$$u_m^h \approx p^0 \cdot q^h = \frac{x^h}{P_P^h} \text{ with } P_P^h = \frac{p^h \cdot q^h}{p^0 \cdot q^h}. \tag{B.2}$$

In order to construct this consumption indicator, we proceeded in three steps. First, we computed household's total expenditures by adding up food expenses to the value of self-consumption and gifts. For each good, our questionnaire asked the quantity consumed and the quantity received as a gift, but not an estimate of their value. Hence, the value of consumption and gifts were calculated by multiplying the quantity converted into kilos by its local price.

In the second step, we built the Paasche index P_P^h whose goal is to deflate household expenditures through the use of reference prices, therefore allowing comparisons across space and time. In order to construct the Paasche index, we used the following approximation (Deaton and Zaidi, 2002):

$$\ln P_P^h \approx \sum w_k^h ln(\frac{p_k^h}{p_k^0}), \tag{B.3}$$

where w_k^h is the share of household h's budget devoted to good k.

In the third step, the money metric utility at the household level is calculated by dividing household's total expenditures by the Paasche index. In order to obtain a measure of individual purchases, the household money metric utility has to be adjusted by taking into account household size. If each household member would consume an equal share of the household total expenditures, we could think about dividing consumption by household size. There are however differences between adults and children consumption. We should also correct for economies of scale inside households, arising from the distinction between private consumption (such as food consumption), and public good enjoyment (such as housing expenditures). Still following Deaton and Zaidi (2002), we computed different equivalence scales, which will be confronted against each other for robustness checks.

Adult equivalents are calculated according to the following formula:

$$AE = [(1 + \beta(A - 1)) + \alpha K]^\theta, \tag{B.4}$$

where A is the number of adults and K the number of children in the household. The parameter α is the cost of a child relative to that of an adult. It is assumed to be low in developing countries because expenditures are mainly associated with food consumption. The parameters β and θ both account for economies of scale in household expenditures. On the one side, the parameter β assigns a weight to all adults but one, which is weighted as 1. On the other side, θ measures the elasticity of adult equivalents with respect to effective household size. As suggested in Deaton and Zaidi (2002), we use the following benchmark values for the parameters: $\alpha = 0.3$, $\beta = 1$ and $\theta = 0.9$. The final money metric utility per adult equivalent used in our main empirical analysis is simply equal to the household money metric utility divided by the number of adult equivalents.