Agricultural Production amidst Conflict: The Effects of Shocks, Uncertainty and Governance of Non-State Armed Actors[*]

María Alejandra Arias
Universidad de Los Andes

Ana María Ibáñez
Universidad de Los Andes

This version: August 8, 2012

Abstract

This paper examines the effect of conflict on agricultural production of small-farmers. We use a unique household survey applied to 4.800 households in four micro-regions of Colombia. The survey collects detailed information on households' economic conditions, incidence of violent shocks, and presence of non-state armed actors. We separate the effects of conflict on direct impacts, measured through conflict-induced shocks, and indirect impacts, measured through years of presence of non-state armed actors. The results show the association between lower agricultural production and conflict transmits through different channels. In regions with an intense conflict, yearly agricultural revenues per hectare and investments are lower, and households concentrate production on seasonal crops and pasture. Presence of non-state armed actors is associated with an immediate increase in production costs, lower access to formal financial institutions, and lower investments. The results suggest that households are affected by indirect and direct impacts that may induce sub-optimal agricultural decisions. Although traditional reconstruction efforts are crucial, post-conflict policies should also aim to reduce uncertainty and improve the rule of law to foster increases in production.

Key Words: Conflict, agricultural production, small-farmers, developing economies

JEL Codes: D13, D74, Q1

[*] The authors are research assistant and associate professor at Universidad de Los Andes in Colombia, respectively. We gratefully acknowledge funding from UKaid from the Department for International Development- DFID/ESRC. Adriana Camacho and Andrés Moya provided valuable comments in the improvement of this paper. Any remaining mistakes in the paper are our own.

1. Introduction

Conflicts impose costs on economic production through two broad channels. First, conflict-induced shocks cause devastation and limit market transactions. Armed combats, terrorist attacks, looting or overall devastation generate the destruction of public and private capital, and assets; thereby decreasing the productive capacity of firms and households (Blattman and Miguel 2010; Ibáñez and Moya 2010; Justino 2011). Aggressions against the civil population destroy or deteriorate human capital through abductions, killings and maiming (De Walque 2006; Camacho 2008; Walque and Verwimp 2009; Verwimp, Bundervoet et al. 2010). Direct impacts of conflict also reduce market efficiency. Contraction in the supply of goods, and higher transactions costs cause prices increases, and reductions in the size of networks (Deininger 2003; Justino 2011). All these effects produce a drop in households' in income and consumption, and countries experience a fall in the aggregate production (Abadie and Gardeazabal 2003; Brück 2004; Justino and Verwimp 2006).

Second, presence of non-state actors pushes households to modify behavior in spite of not facing violent shocks. When non-state actors control a region and are hegemonic, attacks against the civil population and armed confrontations are infrequent (Kalyvas 2006). In addition, non-state actors assume many times the role of the state and impose their own rules of governance. Households adapt their behavior to prevent being the victim of attacks, or to respond to the new governance structures imposed by armed groups. Adaptation strategies amidst conflict may induce inefficiencies in production and increments in costs (Justino 2011; Rockmore 2011).

Studies on the economic literature concentrate mostly on the direct impact of conflict shocks. However, identifying the strategies households adopt to confront conflict, despite not facing direct violent shocks, is important for three reasons. First, the bulk of the population is not directly affected by violent shocks, but a large proportion modifies their behavior in response to the violent context in which they live. This is particularly relevant for countries facing conflict of low or medium intensity that has lasted for many years. Second, households learn to live amidst conflict and change their behavior in subtle ways. These costs are largely unaccounted for in current studies and might be large. Third, once the conflict ends, households may remain entrenched in the low risk strategies adopted

during the conflict, preventing them from reaping the benefits of peace. Thus, income may not necessarily rebound in a post-conflict period for many households.

Understanding these adjustments in behavior is important. Current studies underestimate the economic consequences of conflict. Furthermore, policies in post-conflict periods concentrate on reconstruction efforts, and largely ignore other negative consequences. In order to ensure a long-term recovery and sustainable post-conflict, policies should incentive households to separate from sub-optimal decisions adopted during conflict.

The purpose of this paper is to identify how conflict affects household behavior through these two channels: direct and indirect impacts. We measure direct impacts through conflict-induced shocks and indirect impacts through years of presence of non-state armed actors. Our paper intends to understand whether conflict has an effect on household behavior beyond the impact of conflict-induced shocks. We concentrate the analysis on households' decisions related to agricultural production such as yearly agricultural revenues, land use, investments, and access to financial markets.

Our analysis uses a unique data set for Colombia, a country that has experienced a long-standing conflict for fifty years. We designed a household survey to identify the impact of conflict-induced shocks and presence of non-state armed actors on household behavior. The survey collects detailed information on agricultural production, the occurrence of violent shocks, historic presence of armed groups, and the governance structure they impose upon the population. This unique data set allows us to examine to separate the impact of conflict t through shocks and presence of non-state actors.

Estimating a causal relation between violent shocks and armed group presence, on the one hand, and agricultural decisions, on the other, is difficult. Presence of armed groups is not randomly allocated across the territory. Non-state actors establish presence on regions with particular geographical and institutional characteristics that favor their war objectives. Incidence of covariate shocks is not random either. Non-state actors attack certain groups of the population to illegally seize assets, strengthen territorial control, or prevent future civil resistance (Azam and Hoeffler 2002; Engel and Ibáñez 2007). An instrumental variable that correlates with presence of non-state armed actors and covariate shocks, but does not affect

agricultural production is difficult to find. Our empirical strategy compares communities within states with a large variation in the extent of presence of non-state actors and incidence of violent shocks. We control for past history of violence in the community, and a rich set of household, community and geographical controls. In spite of not establishing causality, we are able to minimize the bias arising from omitted variables. Our results provide associations between conflict-induced shocks or presence of non-state actors, and agricultural production of households. We are also able to identify some of the channels through which this association occurs.

Results of this paper show that conflict leads to contractions in agricultural production through different channels. In regions with intense conflict, yearly agricultural revenues per hectare are lower. Changes in land use from perennial to seasonal crops, and reductions in agricultural investments seem to be driving this association. Costs of conflict are present beyond those imposed by violent shocks. After controlling for violent shocks, households in regions with presence of non-state armed actors face higher costs per hectare, have a lower access to formal financial institutions, and invest less. However, households appear to habituate somehow to presence of non-state armed actors. Households adjust decisions such to re-optimize costs and investment decisions. Besides reconstruction efforts, post-conflict policies should aim to restitute assets, foster credits, and create favorable conditions to reduce uncertainty.

The structure of the paper is as follows. Next section briefly discusses the impact of conflict on households' welfare and production. Section three provides a brief summary of the Colombian conflict. In section four, we describe the data and the empirical strategy, and discuss the results. Section five concludes.

2. Conflict and Violent Shocks: Economic Consequences

The economic costs of conflicts emerge due to direct impacts, such as destruction of factors of production and market impacts, or indirect impacts caused mainly by changes in behavior of economic agents. Most of the economic literature concentrates on measuring the direct impacts of conflict-induced shocks on factors of production (Blattman and Miguel 2010). These studies associate measures of economic activities with incidence of violent events at the aggregate or individual level. Findings show that conflict negatively

affects economic performance, but countries and households may quickly recover from devastation if a threshold of destruction is not surpassed (Murdoch and Sandler 2002; Abadie and Gardeazabal 2003; Justino and Verwimp 2006; Nillesen and Verwimp 2010; Akresh, Verwimp et al. 2011).

However, conflict imposes costs beyond destruction. Violence increases uncertainty and risks (Rockmore 2011). In addition, non-state actors may impose governance structures in the regions they control by enforcing rules of conduct, taxing households and production, obliging households to grow certain crops (i.e. illegal crops), and favoring some groups over others (Kalyvas 2006; Justino 2011). In spite of not facing violent shocks, households adjust their behavior in anticipation of a conflict induced-shock, to avoid being targeted, or to minimize potential losses after an attack or to abide rules imposed by non-state armed actors. These adjustments seek to minimize conflict risks, and not to maximize profits (Verpoorten 2009).

Recent research provides examples on how households modify productive decisions to reduce conflict risks. First, small agricultural producers change their cattle portfolio (Verpoorten 2009). Cattle are difficult to conceal, and signal household wealth to non-state actors, which increases the likelihood of being targeted. Conversely, cattle can be easily sold, providing financial resources to households in times of need. Verpoorten (2009) finds the second effect dominates in Rwanda: cattle sales increase in war time to smooth household consumption. Sales are particularly responsive to covariate violent shocks vis-à-vis idiosyncratic ones.

Second, households shift income sources to protect consumption. In Mozambique, farmers relied more on subsistence activities, and reduced participation in markets activities. By shunning out of markets, households protected food consumption and their income. Weak labor markets intensified these effects because opportunities on off-farm work were scarce (Bozzoli and Brück 2009). Households also recur to income activities that are less sensible to conflict. Deininger (2003) finds that war increased start-ups in non-agricultural activities in Uganda.

Third, conflict induce adjustments in investment decisions though several channels. Households may save more as future income becomes increasingly uncertain (Verpoorten 2009). Expected returns on assets change. Risk of attacks, and subsequent forced migration, imply that mobile assets are more valuable in conflict regions (Grun 2008). Because assets signal household wealth and some are difficult to conceal, assets may become liabilities (Engel and Ibáñez 2007; Rockmore 2011). Empirical findings show that conflict induces households to reduce the share of fixed assets and to increase the share of mobile assets, and reduces investment overall (Deininger 2003; Grun 2008).

Since these adjustments in behavior seek to minimize conflict risk, households adopt sub-optimal production decisions. Households living in conflict regions may produce less, earn lower profits, and face higher costs, despite not being direct victims of conflict induced-shocks. In addition, sub-optimal strategies may persist after the conflict ends. In Mozambique, three years after the cease fire, households were still practicing many of the their war time coping strategies (Bozzoli and Brück 2009).

The lack of detailed data on conflict dynamics limits the contributions of the papers discussed above. These papers explore potential adjustments in behavior in response to conflict, yet conflict is measured as incidence of violent shocks. These papers assume the coefficient for incidence of idiosyncratic or covariate shocks would capture losses from direct and indirect impacts, if these are correlated. However, conflict dynamics are complex. Kalyvas (2006) shows that, in regions in which non-state armed actors exercise a strong regional control, violence against civilians is lower or practically non-existent. Thus, the coefficient for conflict-induced shocks only captures a fraction of the economic losses from conflict. These costs, such as destruction and devastation of private assets and public infrastructure, are more easily recovered once conflict ends (Blattman and Miguel 2010).

A noteworthy exception is Rockmore (2011) who separates the impact of subjective and objective risk. His estimates show subjective risk has a higher impact than objective risk on household consumption. In fact, half of welfare losses caused by conflict are related to risk and not to direct exposure to violence. Given data constraints, the paper separates risk into objective and subjective, and assumes the latter is influenced by household characteristics and not the dynamics of the conflict. Yet conflict dynamics play a large role on responses

of households. For example, the effect of the presence of non-state actors might be highly non-linear. At initial periods, households may react abruptly to presence of non-state actors, and incidence of shocks. Once non-state actors stay for a long period, households may habituate to their presence, and reactions are less abrupt or may converge to a low-income equilibrium, but with low risk of being victimized. In addition, Rockmore (2011) measures the effect on consumption, and not the impact on production decisions. This coefficient captures not only adjustments in productive behavior, but also the ability of household to rely on formal and informal insurance mechanisms.

Our paper contributes to understand the association between conflict dynamics and households productive decisions. First, we have detailed information on incidence of shocks, and conflict dynamics. These allow us to separate tangible and intangible impacts of conflict. Second, we can capture the non-linear effects of conflict on households' decisions. Lastly, we estimate the effect of conflict dynamics and conflict-induced shocks on agricultural production, and explore the potential channels through which this occurs.

3. Conflict in Colombia

During the twentieth century, Colombia faced two conflicts. The first conflict started in 1948 after the assassination of Jorge Eliécer Gaitán, the presidential candidate from the *Liberal* party. During this period, named *La Violencia*, violent disputes between the two traditional political parties (*Liberal* and *Conservador*) originated the conflict. Near 200,000 people died in the period ranging from 1948 and 1953 (Guzmán, Fals-Borda et al. 1963; Sánchez and Meertens 2001). In 1953, a military dictatorship, headed by General Rojas Pinilla, overthrew the democratic government and provided an amnesty to the liberal guerrillas. The dictatorship lasted five years. Democracy returned after the two traditional parties brokered a power sharing agreement that lasted from 1958 till 1974.

Although the power sharing agreement eased violence, the underlying factors leading to conflict in the first place remained. Income inequality, weak institutions, lack of state presence and pervasive land disputes remained dormant in many regions of the country. In addition, this agreement excluded participation in the electoral arena for other political groups. Left-wing guerrilla groups, namely ELN and FARC, emerged during the 1960s aiming to overthrow the government. These guerrilla groups operated in isolated regions of

the country and launched sporadic attacks. By the end of the seventies, guerrilla groups intensified kidnappings, cattle theft and extortions against landowners and drug dealers in many regions of the country.

Right-wing paramilitary groups were created during the 1980s. Several factors contributed to the emergence of these groups. First, the appearance of illegal drugs provided financial resources to strengthen left-wing guerrilla groups and to foster the creation of vigilante groups. Drug-dealers created vigilante groups as a response to kidnappings, cattle theft, and extortions (Verdad Abierta, 2011)[1]. Second, failed peace negotiations with guerrilla groups in 1982 and 1986 led to the appearance of these groups to protect the civil population against aggressions from guerrilla groups (Romero 2002). Third, land owners in several regions of the country created vigilante groups of less than 1.000 men to protect their properties and agricultural production (Duncan 2005; Duncan 2006). Initially, these groups were organized to defend land barons and drug dealers, yet in 1997 vigilante groups merged under the *Autodefensas Unidas de Colombia* (AUC) to contest the territories dominated by the guerrillas and to launch attacks in strategic regions to further their war objectives.

The rise of paramilitary groups and the resources provided by coca cultivation fueled the conflict and contributed to its geographical expansion. Attacks against the civil population from guerrillas and paramilitaries heightened, leading to massacres, selective homicides, death threats and massive forced displacement. Today, 3.9 million people, equivalent to 8.4 percent of the population have been forced to migrate[2].

Non-state armed actors consolidated significantly during this period. While in 1978, the FARC had seven fronts and 850 combatants, in 2000 these figures increased to 66 fronts and 16.000 combatants. The ELN increased to 4.500 combatants in 2000 from 350 in 1984 (Sánchez, Díaz et al. 2003). In 1993, the AUC had 1.200 combatants, which increased to 10.000 in 2002 (Echandía 2006). Graph 1 illustrates this sharp increase for the three groups, which reached its maximum number in 2002.

[Graph 1 goes about here]

[1] www.verdadabierta.com retrieved on the 7th of July, 2012
[2] www.accionsocial.gov.co retrieved on the 15th of July, 2012.

From 2002 onwards, the conflict eased. Massive financial resources provided to the State Armed Forces, and a peace process with paramilitary groups contributed to reduce violence. The demobilization process with the AUC started in 2003 and ended in 2006. This lead to 38 collective demobilizations, equivalent 31.767 combatants (Valencia 2007). However, the demobilization was incomplete. Some groups did not demobilize and others preserved their warring structures. The groups mutated to drug-dealer bands, named BACRIM (Criminal Bands, for its Spanish Acronym), scattered around the country. In 2009, 82 criminal groups with an estimated of 5.000 combatants were exercising presence in 273 municipalities (Fundación Nuevo Arco Iris, 2009[3]). On the other hand, guerrilla groups are still operating in several regions of the country.

4. Empirical strategy

The purpose of the empirical strategy is threefold. First, we estimate regressions to establish the association between yearly agricultural revenue per hectare, on the one hand, and covariate violent shocks and presence of non-state actors, on the other. By separating conflict-induced shocks and conflict dynamics, we provide evidence on how the complexities of conflict affect household behavior. Second, we explore the possible channels through which shocks and presence of non-state actors affect agricultural production: input prices, land use, investments and access to credits. We expect a heterogeneous response for the different outcomes. Third, we examine the non-linearity of the years of presence of non-state actors and the number of conflict induced shocks. This will provide evidence on how households learn to live amidst conflict.

We assume households maximize consumption subject to a budget constraint. Sources of income are agricultural production in their own land plot, wage labor, and non-wage income. Households allocate time in on-farm work, off-farm work and leisure. Since access to financial markets is limited, production and consumption decisions are non-separable.

Conflict affects households' agricultural production through different channels. Agricultural production may decline due to direct attacks against the population such as

[3] http://www.verdadabierta.com/component/content/article/50-rearmados/1520-narcotrafico-extorsion-sicariato-y-robo-de-tierras-tendrian-afectados-a-25-departamentos-el-tiempo retrieved on the 7th of July, 2012.

destruction of yields, theft of productive assets, or land plundering, among others. Declines in agricultural production may also respond to mere presence of non-state actors. In Colombia, non-state armed actors target certain groups of the community to instill fear, prevent civil resistance movements, or illegally seize assets (Engel and Ibáñez 2007). Thus, households may cut back agricultural production to reduce visibility in the community and prevent attacks. Reductions in production may increase prices of agricultural goods.

Supply of inputs contracts in conflict regions. Destruction of infrastructure creates obstacles for transporting goods, reduces the supply of electricity and water, and forces financial institutions to close. Killings and maiming decreases labor supply. Risks of supplying inputs in conflict regions, and taxes imposed by non-state actors reduce profits for input producers; thereby supply contracts. As a result, prices of inputs and interest rates increase, causing higher short-run costs.

Households adjust land use to protect consumption, reap the profits of agricultural production in the short-run, and to prevent investment losses. In order to protect household consumption, households retreat to subsistence farming. The fear of an extreme shortage of food, or the impossibility to smooth consumption due to the breakdown of informal risk-sharing mechanisms prompts households to substitute from cash to food crops. This effect might be lower in countries in which markets still operate, such as Colombia (Rockmore 2011). The risk of forced displacement or property loss may induce households to shift from perennial to seasonal crops, even if the former yield higher returns, because seasonal crops provide yields and returns in a shorter time period. However, if households expect to stay in their communities, they may prefer to cultivate perennial crops that can be left without close attention for longer periods of time, allowing households to be absent for long periods of time. Farmers may also expand cattle production, which can be easily sold if conflict intensifies. In extreme violence, farmers may increase the percentage of unused land

Risk of abandoning or losing the land discourages investment in permanent structures or sunk costs that are difficult to recoup. In addition, visible assets signal wealth, increasing the risks of deliberate attacks from non-state armed actors. Both effects cause a reduction in productive assets and other investments directed to increase productivity. A contraction on

the supply of financial credits, due to a lower presence of financial institutions, deepens the investment shortage. In countries with markets still operating, this contraction might be smaller. Because other households in the community are facing similar conditions, households may not be able to rely on informal credits from friends and family.

4.1.The Data

We use four different sources of data. The first source of data is the Colombian Longitudinal Survey of Universidad de los Andes (ELCA for its Spanish acronym). The Department of Economics designed ELCA to understand the impact of internal conflict on household welfare, labor markets, and agricultural production, among others. The first wave of the survey was administered during the first semester of 2010 to 10.800 households, 6.000 households in urban areas and 4.800 in rural regions. The survey is representative of urban households from income stratum one to four, and four rural micro-regions (Middle Atlantic, Central East, Cundi-Boyacense, and Coffee regions). We selected the micro-rural regions to maximize variation in conflict intensity. Two regions had a high intensity of conflict (Middle-Atlantic and Central East) and two a low intensity (Cundi-Boyacense and Coffee region). Within each municipality, rural districts were chosen randomly. In this paper, we use the rural sample as conflict in Colombia occurs mainly in rural areas. In the sample, there are 17 municipalities and 222 rural districts in total. We only use households that report complete information on agricultural production, land use, and production costs, that are 1.801 households.

The survey collects standard information about employment, income, consumption, education, health, family formation and social capital. For rural households, we collect detailed information on land tenure and property rights, agricultural production, and asset ownership. In addition, we designed a special module about shock incidence, which elicits information on conflict shocks. The questions were carefully designed to protect households, and reduce apprehension to answer accurately these questions. All households were geo-coded.

We also designed a rural district questionnaire applied to leaders of the community. The purpose of this questionnaire is to gather information on social and public infrastructure, incidences of shocks, including conflict, and access to markets. The questionnaire elicits

detailed information on the history of conflict in the community during the last 10 years such as presence of non-state armed actors, imposition of rules and governance structures, and victimization of the civil population.

Despite carefully designing the rural questionnaire to reduce underreporting of presence of non-state actors and conflict-induced shocks, some underreporting may persist and it might be systematic. Some rural districts have a strong presence of non-state armed actors and underreporting might be larger in these areas. Respondents may face fear or misapprehension to provide detailed information related to conflict. With the purpose of correcting this potential underreporting, we complemented the rural questionnaire with information for the National Government. In particular, we use information on presence of non-state armed actors at the rural district level during the last 10 years.

In order to complement the household and the rural district questionnaire, we use geographical data, and a panel data of municipal characteristics. We matched geographical data from IDEAM and IGAC[4] to each household, which allowed us to construct a rich set of geographical controls. Municipal characteristics are from the CEDE data panel which covers the period from 1990 till 2010.

4.2. Estimation strategy

In order to understand the effect of conflict on agricultural decisions, we estimate the correlation between conflict variables and yearly revenue per hectare. In order to calculate yearly revenue, we use the reported revenue per product per yield and multiply it by the number of yields obtained each year. We aggregate the yearly revenue per product and divide it by the land plot size. Then, we estimate regressions to explore which are the potential channels driving this association. We use the following reduced form for household *i* located in rural district *j* municipality *k* and state *l*

$$y_{ijkl} = \propto_0 + \alpha_l + X_{ijkl}\beta + W_{jkl}\gamma + \delta Z_{kl} + \sum_{m=1}^{10} \theta_m P_{mjkl} + \sum_{n=1}^{5} \lambda_n S_{njkl} + \varepsilon_{ijkl}$$

[4] Government institutions responsible for collecting climatic information and geographic information, respectively.

where y_{ijkl} are outcomes related to agricultural production such as yearly agricultural revenue per hectare, costs per hectare, percentage of land used on perennial crops, seasonal crops or pasture, whether the households invested in the land plot during the last three years, whether the household had a credit from a financial institution, and whether the household had a credit from family and friends. X_{ijkl} is a vector of household controls, W_{jkl} is a vector of rural district controls, Z_{kl} represents controls for municipality *k* from state *l*, α_l are fixed effects at the state level, and ε_{ijkl} is a random term.

We capture conflict dynamics with the term $\sum_{m=1}^{10} \theta_m P_{mjkl} + \sum_{n=1}^{5} \lambda_n S_{njkl}$. P_{mjkl} is a dummy variable equal to one if non-state actors have been present in rural district *jk* for *m* years (*m*=1,2,…,10). These set of dummies capture how household adjust decisions to presence of non-state armed actors, after controlling for conflict-induced shocks, and θ_m are the parameters of interest. S_{njkl} is a dummy variable equal to one if rural district *jk* face *n* types of conflict-induced shocks (*n*=1,2,…,5). Although the household questionnaire collects information on covariate and idiosyncratic violent shocks, we believe that underreporting is high and we prefer to use the information collected on the rural district questionnaire for covariate shocks. Conflict-induced shocks reported in the rural district questionnaire are murder, cattle theft, land seizure, threats by non-state armed actors, and kidnappings. These set of dummies capture the direct impact of conflict through destruction, devastation, and market impacts. λ_n are the parameters traditionally estimated in other studies. By using dummy variables for years of presence and type of shocks, we are capturing the non-linear effects of both variables. We expect that the effect of presence of non-state armed actors is higher during the first years of presence and declines once households learn to live amidst conflict. On the other hand, an increasing number of types of shocks signal an intensification of the conflict. Thus, we expect the effect to be larger as the number of type of shocks increases.

Presence of non-state armed actors and conflict induced-shocks is not random. Non-state armed actors intend to control regions that serve their war objectives, such as extracting economic rents or illegally seizing valuable assets, or with lower costs to establish presence, such as difficult geographic conditions or alienation of the civil population against the state. In addition, aggressions against the civil population are deliberate and not

a by-product of conflict. Non-state actors attack households with better-economic conditions to seize assets, or leaders of the community to weaken support to the opponent (Azam and Hoeffler 2002; Engel and Ibáñez 2007). We include a rich set of geographic, household, land plot, rural district and municipality controls to reduce potential bias due to omitted variables.

We include household controls to account for preferences, and the life cycle such as gender and age of the household head. To control for wealth and potential targeting from non-state armed actors, we use years of education, and a wealth index constructed using principal components of household assets. We include variables for family composition (number of members less 14 years of age, between 14-60 years old, and more than 60 years of age). Lastly, we have a dummy variable equal to one if the household is a beneficiary of *Familias en Acción*, a conditional cash transfer program.

We have a vector of land plot characteristic to control for variables that influence agricultural productivity. These variables also account for the value of land, thereby signaling the likelihood of being a victim of non-state armed actors. The controls include a dummy variable equal to one if the land plot has access to water sources, a set of dummy variables that show the fertility of their land plot, a dummy variable indicating whether the household has a formal legal title over the land plot, the rental value of the land[5], the size of the land plot and altitude above the sea level. We control for the distance in kilometers from the land plot to the state capital, primary roads, other roads, nearest seashore, and the nearest illicit crop cultivation. In order to capture other economic shocks that might be correlated to conflict shocks, we include three variables that account for climate shocks: number of months during the previous years in which rain was below the historic mean, number of months during the previous years in which rain was above the historic mean, and the rainfall historic mean (Miguel, Satyanath et al. 2004).

[5] Based on Colombian tax code and the appraisal values by municipality from IGAC, we calculate the rent for each household. The Colombian tax code states that the commercial value of a property must be maximum two times its appraisal, and that the rent should be maximum 1% of the commercial value. We calculate the rent for each household according to farm size.

Since the data is geo-coded, we construct a rich set of geographical controls at the rural district level that influence agricultural productivity and the attractiveness of the rural district for non-state armed actors. The controls are distance in kilometers to the nearest river, and distance to the nearest water routes (sea or river). We complement these variables with information collected in the rural district questionnaire and include a dummy variable equal to one if the rural district has no access to credits, daily agricultural wage, and a price index of agricultural goods produced in the rural district[6].

Given that conflict in Colombia has a long history and intensified during the last two decades, we include the average municipal homicide rates for the period ranging from 1993 and 2000. This variable controls for the historic effect of conflict. For the estimations on access to financial credits, we control for the number of banks in the municipality to account for general equilibrium effects. We use clustered standard errors at the rural district level.

4.3.Descriptive statistics

Presence of non-state armed actors, years of presence and incidence of covariate shock have a large variation across and within regions. Table 1 presents the distribution of years of presence for rural districts. More than three quarters of rural districts did not have presence of non-state armed actors between 2001 and 2010. The average years of presence of non-state armed actors are 0,64, with a higher concentration on one or four years. In three rural districts, non-state armed actors have been present six years. These districts are located in the Central-Eastern region, a region in which non-state armed actors have exerted a strong influence for many years.

[Table 1 goes about here]

Presence of non-state armed actors and incidence of covariate shocks do not necessary overlap. Table 2 reports incidence of covariate shocks by regions. We divide incidence for

[6] We use the price per kilogram for each product by State for the period ranging from for 2006 and 2010, and calculate the average price for each community. Based on ELCA, we calculate the average production in kilograms by rural district. This data is used to compute the Paasche Index

.

rural districts with and without at least one year of presence of non-state armed actors. Incidence of covariate conflict-induced shocks affects from 5 to 52 percent of the rural districts. In the Middle-Atlantic, the incidence of shocks is much lower for districts with presence than without presence of non-state armed actors, and in the Coffee region the percentages are slightly lower. Map 1 depicts overlapping between incidence of conflict shocks and presence of non-state armed actors for one of the four regions. The map clearly shows that violent shocks and presence of non-state armed actors do not necessarily coincide. Conflict-induced shocks occur frequently in rural district in which non-state armed actors are not present. Near 27 percent of rural districts with no presence of armed groups face a conflict shock, while this figure is 10.1 percent for rural districts with presence.

Two reasons may explain this lower incidence. As discussed by Kalyvas (2006), violence against the civil population might be lower in regions with strong control from an hegemonic non-state armed actors. Another potential explanation is that the likelihood of underreporting incidence of violence is larger in regions with a stronger presence of non-state armed actors. Although we are able to correct for measurement error in years of presence, we do not have alternative sources of information for correcting incidence of covariate shocks. However, in the estimation we control for past history of homicide rates in the municipality, which is potentially correlated with incidence today.

When we divide incidence by type of shock, we find some interesting patterns. First, frequency of homicides is lower in rural districts with presence of non-state armed actors. With the exception of the Cundi-Boyacense region, a region near the capital of Colombia and relatively peaceful, all the other regions exhibit this pattern. Second, cattle theft exhibits the larger incidence for all types of shocks, in particular in districts with presence of non-state armed actors. This may signal a breakdown of the rule of law that creates ideal conditions for criminal groups to operate. Cattle theft implies asset depletion and a direct impact on agricultural production. Third, threats from armed groups are higher in the Middle Atlantic, the region with lower incidence of conflict-induced shocks. In these regions, non-state armed actors may exert a strong control, leading to higher threats, but

lower incidence of other violent shocks. These patterns provide additional supports to Kalyvas (2006) hypothesis.

[Table 2 goes about here]

Table 3 presents descriptive statistics for all the outcome variables. We divide the results for rural districts without and with at least one year of presence from non-state armed actors, and with and without incidence of covariate conflict-induced shocks. In regions with a least one year of presence, households dedicate more percentage of land to perennial crops and pasture. By requiring less attention from farmers, both productive activities might be better suited for regions with armed conflict. In addition, cattle provide daily cash and can be easily sold if households are forced to migrate. Access to credit from formal financial institutions is higher for households located in regions with at least one year of presence. Higher access to formal institutions may result from targeting of non-state armed actors to wealthier households, and their decision to establish presence in wealthier rural districts with a larger supply of formal credits.

Agricultural outcomes for households living in rural districts with covariate violent shocks are also different. These households dedicate less land to perennial crops, and more land to seasonal crops and pasture. In addition, these households had a higher access to formal credits, which may result from targeting to wealthier households in the community.

[Table 3 goes about here]

Rural districts with at least one year of presence of non-state armed actors are systematically different from those without presence (Tables 4a, 4b and 5). The former have a younger population, and with lower educational levels. For other household characteristics, the differences are not statistically significant. In rural districts with presence of non-state armed actors, land erosion is more prevalent and water sources are scarcer. These rural districts seem to be more isolated, yet closer to river and water routes, which facilitate the actions of non-state armed actors. Lastly, input prices and prices of agricultural goods are higher.

Tables 4a, 4b and 5 show differences for households with and without incidence of conflict-induced shocks are more systematic than for presence/non-presence of armed groups. Rural districts with conflict-induced shocks report a lager informality of property rights and an apparently lower soil quality. These districts are isolated and far away from the state's capital, roads, and sea- shores, but these households are closer to regions with illicit crop production. Despite this isolation, the number of banks in the municipality is larger, and homicide rates during 1993 and 2000 were lower.

[Table 4a goes about here]

[Table 4b goes about here]

[Table 5 goes about here]

4.4. Estimation results

This paper examines the impact of conflict on agricultural production of small farmers. We explore two channels through which conflict affects agricultural production: presence of non-state armed actors, and incidence of violent shocks. We concentrate on yearly agricultural revenues and costs, land use, credits and investments. For each outcome, we report three columns. The first column uses continuous variables for years of presence from non-state armed actors and the number types of conflict shocks. The second column includes dummy variables for each year and each type of shock in order to capture non-linear effects. Since conflict may also induce general equilibrium effects, we control for daily agricultural wages, if rural district has problems to access credit and agricultural prices at the rural district level in the third column.

Table 6 reports the estimation results for yearly agricultural revenue per hectare. When we include conflict variables as linear, we do not find a statistically significant association between years of presence or conflict-induced shocks, on the one hand, and yearly agricultural revenues, on the other. Column 2 shows the non-linear effects of conflict variables. Incidence of conflict shock is negatively associated with yearly agricultural revenues per hectare only for households living in rural districts confronting the largest

number of shocks. This effect is accentuated after controlling for potential general equilibrium effects, which may signal the association is transmitted through a lower productivity, and not lower prices. The yearly revenue per hectare of households living in rural districts with three types of conflict shocks is 57.6 percent lower, which is equivalent to a reduction of 1.13 pesos/hectare on average yearly revenues.

Presence of non-state armed actors show a highly non-linear association. In rural districts with only one year of presence, the yearly agricultural revenue per hectare is higher, yet for districts under six years of presence, revenues are lower. The latter association disappears once the estimation controls for potential general equilibrium effects. The positive correlation during the first year of presence may result from non-state armed actors targeting richer regions. Although we control for several households and regional characteristics to account for this potential targeting, we are not able to fully control for this. The negative association for six years of presence seems to be driven by general equilibrium effects, and not a contraction of agricultural productivity. Rural districts with a longer presence of non-state armed actors may have weaker markets, and lower prices for final goods, which might explain the lower agricultural revenues per hectare.

[Table 6 goes about here]

In contrast to agricultural revenues, costs per hectare are less sensitive to presence of non-state armed actors or conflict-induced shocks as results in Table 7 show. In fact, the coefficient estimate for conflict-induced shocks is not statistically significant in the three different estimations. The first year of presence of non-state armed actors is associated with costs 49.4 percent higher. The effect in costs persists after controlling for general equilibrium effects. Thus, higher costs are not the result of a sharp increase in daily wages. Since yields in the current period are determined by decisions in the previous period, households have few alternatives for short-term adjustments. Thus, the effects may easily transmit during the first year of presence, while the following years households are able to react and may adopt optimal decisions to minimize costs given the presence of non-state armed actors.

[Table 7 goes about here]

Direct effects of conflict, through destruction, and indirect impacts due to changes in behavior influence differently revenues and costs per hectare. Intense attacks against the civil population appear to be related to a lower productivity per hectare. These attacks may directly reduce agricultural yield due to destruction and cattle theft. However, costs are apparently not affected by these attacks. Given the structure of agricultural production, households may have presumably incurred in many of the production costs when attacks intensify. On the other hand, presence of non-state armed actors is positively associated with costs. Uncertainty, risks and governance structures imposed by armed groups may increase costs initially, yet households are able to adjust in subsequent years.

Land allocation among different agricultural products may explain changes in agricultural revenues per year. Table 8 presents the results for percentage of land allocated to perennial crops, seasonal crops, and pasture. Land use is strongly associated with conflict-induced shocks in regions with a high intensity of conflict. In rural districts with incidence of three types of shocks, households dedicate less land to perennial crops, and more to seasonal crops: 21.6 percentage points less land is dedicated to perennial crops and 18.1 percentage points more land to seasonal crops. Land allocated to pasture for cattle raising shows an intuitive result. Households living in districts with incidence of two types of conflict-induced shocks allocate less land to pasture. Nonetheless, higher incidence of shock is correlated to more land allocated to pasture, which presumably is capturing targeting of non-state armed actors to wealthier households.

Presence of non-state armed actors, after controlling for incidence of shocks, is not strongly correlated to land allocation. Households living in regions with one or three years of presence allocate more land to perennial crops. Three potential explanations may drive this result. First, perennial crops require large up-front investments, while profits are recouped after several years. Households may prefer to wait to profit from several yields before changing land allocation. Since we are covering a short period of time, we might not be able to capture changes in land allocation. This applies particularly to the first year of presence. Second, perennial crops, by requiring less attention from farmers, provide more flexibility to households. Farmers may be absent for several months to avoid being victimized without necessarily losing the yield. Third, non-state armed actors may be

targeting regions with a larger presence of perennial crops. These regions may be attractive to non-state armed actors due to characteristics that also are important for cultivation of perennial crops. In fact, the rural districts with three years of presence are all located in the coffee region. Coffee is perennial crops and has been traditionally cultivated in this region.

[Table 8 goes about here]

Access to credits (formal and informal) and investment decisions are strongly associated with conflict through both channels: direct and indirect impacts. Table 9 reports estimation results for having formal and informal credits in the year previous to the survey, and having done at least one investment since 2007. Households living in regions with a strong incidence of conflict-induced shocks show a higher likelihood of having formal credits, and lower likelihood of having a credit from family friends. Households in rural districts with incidence of three types of shocks are 56.5 percentage points more likely to have a credit from a formal institution and 33.9 percentage points less likely to have credits from family and friends. A higher access to formal financial markets may signal non-state armed actors targeting wealthier households or rural districts. Once we control for number of banks in the municipality (column 3), the positive coefficient for access to formal credits persist. Thus, this partially rules out the potential targeting of wealthier districts. Households may recur to formal credits to mitigate the impacts of conflict-induced shocks. The negative coefficient on informal credits shows a potential substitution between formal and informal credits. Because all households are presumably affected by the covariate violent shock, albeit in a different intensity, support from families and friends may dwindle and households need to seek support from formal institutions.

Presence of non-state armed actors is also associated with access to formal and informal credits. During the first years of presence, households are less likely to have access to credits from formal financial institutions. The coefficient estimate continues to be statistically significant after controlling for general equilibrium effects. The risk and uncertainty of living amidst conflict may prevent households from acquiring debts that are difficult to honor if the conflict worsens. However, households seem to habituate after some years. Credits from formal financial institutions are more likely for households living in regions with five years of presence.

The story for informal credits is the opposite. During the first year of presence, credits from family and friends are 12.4 percentage points more likely and appear to substitute for formal credits. As time passes, credits from family and friends are lower such that for households living in regions with four or five years of presence the coefficient is negative and statistically significant. A decrease in trust among community members and the difficult conditions shared by households in the rural district may explain this lower access to informal credits.

Investment decisions are strongly associated with incidence of shocks and presence of non-state armed actors. Aggressions against the population are associated with much lower investment from farmers. Households living in regions with incidence of two or three shocks have a probability of investment 12.3 and 21.5 percentage points lower, respectively. Therefore, changes in investment decisions not only respond to risk and uncertainty, but also to the direct impacts of conflict.

Years of presence from non-state armed actors have a non-linear effect. As we discussed, presence of armed groups increases risk and uncertainty inducing households to adjust investment decisions. The third year of presence is associated with a likelihood of investment 11.0 percentage points lower. Interestingly, after controlling for general equilibrium effects, the effect is less strong, showing some of the reductions in investment are due to changes in prices and interest rates. After five years of presence, investment is much higher. Farmers residing in these regions have a probability of investment 36.4 percentage points higher. Farmers may learn to live amidst conflict and may update the investments they have postponed for several years.

[Table 9 goes about here]

Short-term production decisions appear to be more influenced by conflict. Adjustments in land use respond sharply to violent shocks, when conflict intensity is high. Nonetheless, presence of non-state armed actors is not strongly associated with differences in land use. Because modifications in land use have long-term consequences, households may allocate land use differently under extreme violence. If households learn to live amidst conflict, households may prefer to adjust variables that can be easily modified, such as credits and

investments. Access to credits, formal and informal, and investments respond strongly to shocks and presence of armed groups. Households seem to substitute between formal and informal credits to cover their production needs. Investments are strongly associated with violent shocks and presence of non-state armed actors. However, households apparently habituate to their presence and, after years of presence, investment recovers.

5. Conclusions

This paper studies how conflict influences households' agricultural decisions, and examines the potential channels of this association. We explore whether households respond differently to direct impacts of conflict, such as destruction and devastation, and to indirect impacts, such as uncertainty, risk and the governance structures imposed by non-state armed actors. Households may react strongly to violent shocks and presence of non-state armed actors if conflict is recent. However, households may learn to live amidst conflict, and adapt their behavior to prevent aggressions from non-state armed actors, and mitigate the economic consequences of violence.

We apply a household survey representative of four Colombian micro-regions. Colombia has faced a civil war for more than half a century; thus, it is the ideal context to investigate how households adjust their decisions in conflict-ridden regions. Our empirical strategy compares rural districts within states with a wide variation in the intensity and history of the conflict. Since finding an instrumental variable strongly correlated with violence and not agricultural production is difficult, we include a rich set of controls at the household, land plot, rural district, and municipality level. These controls reduce the potential omitted variable bias, yet we are not claiming causality of our results.

The results of the paper show that households' responses to violent shocks and presence of non-state armed actors differ. Violent shocks are associated with lower yearly agricultural revenues per hectare, while costs are not affected by shocks. High intensity of shocks induce changes in land use such that households in rural districts with a larger number of violent shocks use less land on perennial crops, and more on seasonal crops and pasture. In addition, investments in these districts are much lower. Households appear to resort to formal credits to mitigate the violent shocks. However, higher likelihood of formal credits may also result from targeting of wealthier households. On the other hand, the likelihood of

having an informal credit is lower for these households. As all households are facing difficult conditions, reliance on informal support is less likely.

Presence of non-state armed actors is associated with different responses from households. We find that, similarly to Kalyvas (2006), presence of armed groups does not necessarily coincide with violent aggressions against the civil population. In fact, incidence of violent shocks is lower in rural districts with presence of non-state armed actors. This implies households may adjust behavior to prevent future aggressions, become less visible to armed groups, or to reduce other indirect costs of conflict. Results show that the association between yearly agricultural revenues per hectare and presence of non-state armed actors is highly non-linear, with a positive association in the first year of presence and a negative one for six years of presence. Costs are higher during the first year of presence and thereafter households seem to adjust and re-optimize decisions to mitigate this increase. Presence of non-state armed actors induces households to adopt short-term responses, such as contraction of investments and credits. Similarly to costs, contractions in investments occur during the first years, yet investments rebound after longer years of presence. Decisions with medium or long-term consequences, such as land use, are less responsive to presence of non-state armed actors. It is important to note that Colombia has not faced a complete breakdown of markets as a consequence of conflict, reducing the need of households to retrieve from markets and recur to food crops.

This paper finds households' agricultural decisions are associated with violent shocks and presence of non-state armed actors. Households living in regions with a high conflict intensity seem to borne the larger costs of conflict through lower yearly agricultural revenues, and changes in productions decisions. In regions with presence of non-state armed actors, households appear to learn to live amidst conflict, yet in a lower-income equilibrium. Traditional post-conflict policies concentrate on reconstruction efforts, which are necessary to increase production in a short period of time as this paper shows. However, policies should also aim to restitute assets, foster credits, and create favorable conditions to reduce uncertainty. Improving the rule of law and reducing uncertainty induce households to expand investment and avoid sub-optimal decisions.

References

Abadie, A. and J. Gardeazabal (2003). "The Economic Costs of Conflict: A Case Study of the Basque Country." American Economic Review 93(1): 113-132.

Akresh, R., P. Verwimp, et al. (2011). "Civil War, Crop Failure and Stunting in Rwanda." Forthcoming *Economic Development and Cultural Change*.

Azam, J. P. and A. Hoeffler (2002). "Violence against Civilians in Civil Wars: Looting or Terror?" Journal of Peace Research 39(4): 461-485.

Blattman, C. and E. Miguel (2010). "Civil War." Journal of Economic Literature 48(1): 3-57.

Bozzoli, C. and T. Brück (2009). "Agriculture, Poverty, and Postwar Reconstruction: Micro-Level Evidence from Northern Mozambique." Journal of Peace Research 46(3): 377-397.

Brück, T. (2004). The Welfare Effects of Farm Household Activity Choices in Post-War Mozambique. DIW Berlin Discussion Papers No. 413.

Camacho, A. (2008). "Stress and Birth Weight: Evidence from Terrorist Attacks." American Economic Review 98(2): 511-515.

Deininger, K. (2003). "Causes and Consequences of Civil Strife: Micro-Level Evidence from Uganda." Oxford Economic Papers 55(4): 579-606.

Duncan, G. (2005). "Del campo a la ciudad en Colombia. La infiltración urbana de los señores de la guerra." Documento CEDE 2005-2.

Duncan, G. (2006). Los señores de la guerra. Bogotá, Planeta.

Echandía, C. (2006). El conflicto armado y las manifestaciones de violencia en las regiones colombianas. Bogotá, Presidencia de la República.

Engel, S. and A. M. Ibáñez (2007). "Displacement Due to Violence in Colombia: A Household Level Analysis." Economic Development and Cultural Change 55(2): 335-365.

Grun, R. E. (2008). Household Investment under Violence—The Colombian Case, World Bank. Policy Research Working Paper 4713.

Guzmán, G., O. Fals-Borda, et al. (1963). La Violencia en Colombia, Estudio de un Proceso Social. Bogotá, Ediciones Tercer Mundo.

Ibáñez, A. M. and A. Moya (2010). Do Conflicts Create Poverty Traps? Asset Losses and Recovery for Displaced Households in Colombia. The Economics of Crime. R. D. Tella, S. Edwards and E. Schargrodsky. Chicago, University of Chicago - NBER. Forthcoming.

Justino, P. (2011). War and Poverty Oxford Handbook of the Economics of Peace and Security. M. R. Garfinkel and S. Skarpedas. Oxford, Oxford University Press.

Justino, P. and P. Verwimp (2006). Poverty Dynamics, Violent Conflict and Convergence in Rwanda. HiCN Working Paper No. 16.

Kalyvas, S. N. (2006). The Logic of Violence in Civil War. New York, Cambridge University Press.

Miguel, E., S. Satyanath, et al. (2004). "Economic Shocks and Civil Conflict: An Instrumental Variables Approach." Journal of Political Economy 112(4): 725-753.

Murdoch, J. C. and T. Sandler (2002). "Economic Growth, Civil Wars and Spatial Spillovers." Journal of Conflict Resolution 46(1): 91-110.

Nillesen, E. and P. Verwimp (2010). A Phoenix in Flames? Portfolio Choices and Violence in Civil War in Rural Burundi. Microcon Working Papers No. 25.

Rockmore, M. (2011). The Cost of Fear: The Welfare Effects of the Risk of Violence in Northern Uganda.

Romero, M. (2002). Paramilitares y autodefensas: 1982-2003. Bogotá, Iepri-Planeta.

Sánchez, F., A. M. Díaz, et al. (2003). "Conflicto, violencia y actividad criminal en Colombia: Un análisis espacial." Documento CEDE 2003-05.

Sánchez, G. and D. Meertens (2001). Bandits, Peasants and Politics: The Case of "La Violencia" in Colombia. Austin, University of Texas Press, Institute of Latin American Studies.

Valencia, G. D. (2007). "Reconstrucción analítica del proceso de desarme, desmovilización y reinserción con las Autodefensas Unidas de Colombia 2002-2007." Perfil de Coyuntura Económica, Universidad de Antioquia 10: 147-191.

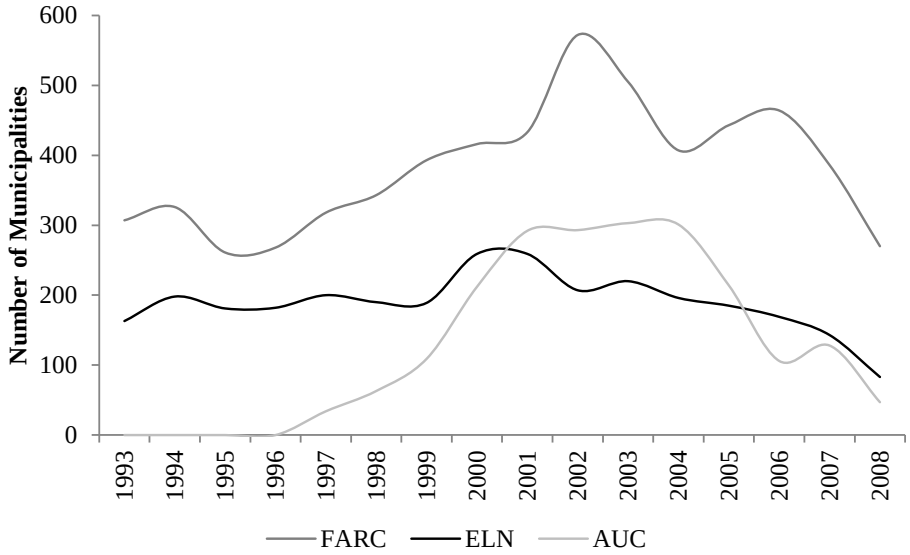
Verpoorten, M. (2009). "Household Coping in War- and Peacetime: Cattle Sales in Rwanda, 1991-2001." Journal of Development Economics 88(1): 67-86.

Verwimp, P., T. Bundervoet, et al. (2010). The Impact of Violent Conflict on Child Health: What are the Channels. Microcon Policy Briefing No. 6.

Walque, D. d. (2006). "The Socio-Demographic Legacy of the Khmer Rouge Period in Cambodia." Population Studies 60(2): 223-231.

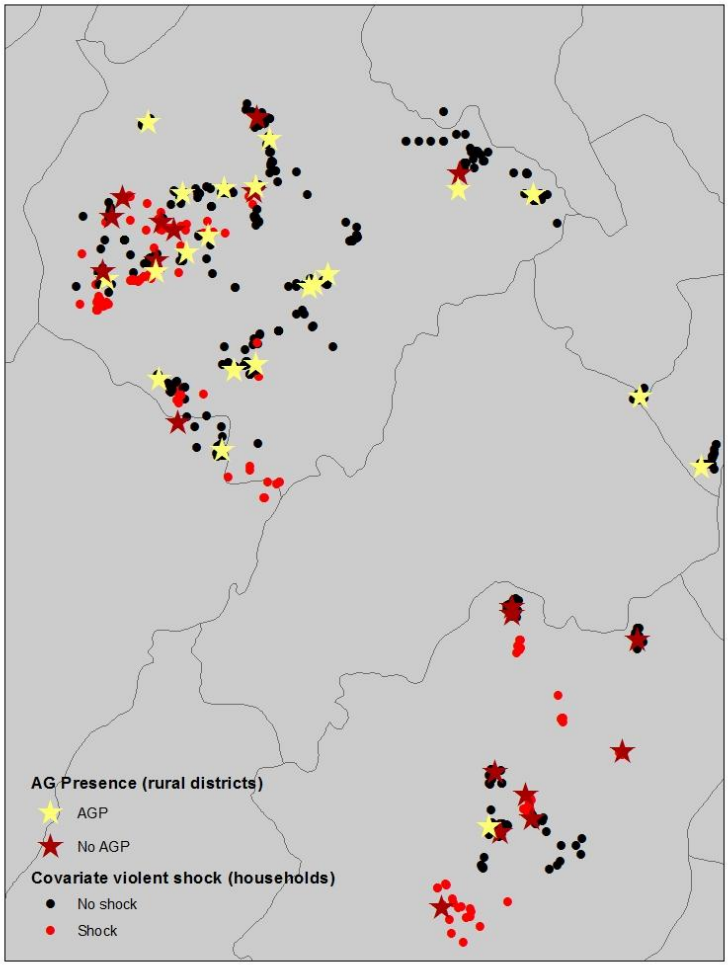
Walque, D. d. and P. Verwimp (2009). "The Demographic and Socio-Economic Distribution of Excess Mortality during the 1994 Genocide in Rwanda." Journal of African Economies 19(2): 141-162.

Graph 1. Number of municipalities with presence of armed groups



Source: Authors' calculation based on CEDE Municipal Panel

Map 1. Presence of non-state armed actors and incidence of conflict-induced shocks



Source: Authors' calculations based on ELCA (Wave I) and National Government

Table 1. Years of presence of non-state armed actors (% rural districts)

Years of presence	Rural districts	Percentage
0	171	76.3%
1	23	10.3%
2	3	1.3%
3	2	0.9%
4	19	8.5%
5	3	1.3%
6	3	1.3%
Mean (Standard deviation)	0,64 (1,4)	

Source: Authors' calculations based on ELCA (Wave I) and National Government

Table 2. Incidence of conflict-induced shocks by regions: with and without presence of non-state armed actors (% rural districts)

Micro-Region	Rural district	
	No presence	Presence
Middle-Atlantic	21%	5%
Cattle Theft	6%	0%
Homicides	6%	0%
Land seizure	0%	0%
Kidnaps	0%	0%
Threats from armed groups	8%	14%
Cundi-Boyacense	34%	52%
Cattle Theft	59%	69%
Homicides	13%	19%
Land seizure	0%	0%
Kidnaps	0%	0%
Threats from armed groups	0%	0%
Coffee region	29%	14%
Cattle Theft	17%	17%
Homicides	13%	8%
Land seizure	4%	0%
Kidnaps	0%	0%
Threats from armed groups	4%	0%
Central East	16%	29%
Cattle Theft	5%	33%
Homicides	15%	0%
Land seizure	0%	0%
Kidnaps	7%	0%
Threats from armed groups	5%	0%

Source: Authors' calculations based on ELCA (Wave I) and National Government

Table 3. Descriptive statistics: outcome variables

	=1 at least one year of presence			=1 at least one conflict-induced shock		
	No	**Yes**		**No**	**Yes**	
Annual agricultural income/hectares	2.44	0.08	-	3.17	0.11	-
	(87.2)	(0.50)		(100.0)	(0.47)	
Costs/hectares	1.58	0.09	-	2.05	0.09	-
	(56.99)	(0.82)		(65.42)	(0.70)	
% of land used in perennial crops	23.4%	27.4%	**	27.4%	19.2%	***
	(0.34)	(0.37)		(0.36)	(0.31)	
% of land used in seasonal crops	16.7%	15.3%	-	15.3%	18.2%	***
	(0.29)	(0.27)		(0.29)	(0.29)	
% of land used in pasture	6.6%	10.0%	***	6.1%	9.2%	***
	(0.18)	(0.21)		(0.17)	(0.20)	
=1 if invested in land plot since 2007	19.1%	23.2%	**	19.3%	20.8%	-
	(0.39)	(0.42)		(0.40)	(0.41)	
Observations	1,439	362		1,092	709	
=1 if hh had a credit with banks on survey day	62.6%	68.7%	**	58.9%	70.8%	***
	(0.48)	(0.46)		(0.49)	(0.45)	
=1 if hh had credit with family and friends on survey day	29.2%	30.0%	-	29.7%	29.0%	-
	(0.45)	(0.46)		(0.46)	(0.45)	
Observations	933	300		698	535	

Source: Authors' calculations based on ELCA (Wave I) and National Government * p<0.10, ** p<0.05, ***p<0.01

Table 4a. Descriptive statistics: control variables (household characteristics)

	=1 at least one year of presence			=1 at least one conflict-induced shock		
	No	**Yes**		**No**	**Yes**	
Number of members	4.71	4.62	-	4.64	4.75	-
	(2.02)	(1.94)		(1.99)	(2.00)	
=1 if household head is man	85.4%	85.3%	-	84.7%	86.4%	-
	(0.35)	(0.35)		(0.36)	(0.34)	
Household head's age	46.6	45.1	**	46.2	46.3	-
	(12.6)	(11.8)		(12.5)	(12.4)	
Household's head years of education	4.88	4.51	**	4.87	4.68	-
	(3.58)	(3.38)		(3.47)	(3.62)	
Members between 14-60 years old	2.93	2.87	-	2.94	2.89	-
	(1.41)	(1.37)		(1.40)	(1.40)	
Members less than 14 years	1.36	1.35	-	1.29	1.43	**
	(1.34)	(1.30)		(1.31)	(1.36)	
Members more than 60 years	0.42	0.40	-	0.41	0.42	-
	(0.68)	(0.66)		(0.67)	(0.70)	
=1 if is beneficiary of Familias en Acción	37.2%	40.0%	-	38.0%	37.8%	-
	(0.48)	(0.49)		(0.49)	(0.49)	
Wealth index	0.05	-0.10	-	0.09	-0.09	*
	(2.27)	(2.03)		(2.36)	(1.99)	
Observations	933	300		698	535	

Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.

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

Table 4b. Descriptive statistics: control variables (land plot and geographic characteristics)

	=1 at least one year of presence			=1 at least one conflict-induced shock		
	No	**Yes**		**No**	**Yes**	
Land plot size (hectares)	1.56	2.82	-	3.5	3.2	-
	(4.78)	(4.88)		(5.03)	(4.48)	
=1 if land tenure is formal	25.9%	26.0%	-	28.7%	22.4%	***
	(0.44)	(0.44)		(0.45)	(0.42)	
Rental value of land	564,870	536,983	-	526,645	599,104	-
	(1'179,092)	(741,126)		(1'113,876)	(1'054,468)	
=1 if has access to water sources	65.1%	54.7%	***	61.2%	64.3%	-
	(0.48)	(0.50)		(0.49)	(0.48)	
=1 if fertility is high	1.5%	1.7%	-	1.6%	1.5%	-
	(0.12)	(0.13)		(0.12)	(0.12)	
=1 if fertility is from high to moderate	2.1%	0.0%	***	1.7%	1.5%	-
	(0.14)	(0.00)		(0.13)	(0.12)	
=1 if fertility is moderate	9.1%	6.3%	**	11.0%	5.0%	***
	(0.29)	(0.24)		(0.31)	(0.22)	
=1 if fertility is from moderate to high	20.6%	7.7%	***	24.6%	8.0%	***
	(0.40)	(0.27)		(0.43)	(0.27)	
=1 if fertility is from moderate to low	0.9%	1.3%	-	0.9%	1.1%	-
	(0.09)	(0.11)		(0.09)	(0.11)	
=1 if fertility is low	10.6%	18.7%	***	6.3%	20.7%	***
	(0.31)	(0.39)		(0.24)	(0.41)	
=1 if fertility is from low to moderate	22.0%	39.0%	***	23.4%	29.7%	***
	(0.41)	(0.49)		(0.42)	(0.46)	
=1 if fertility is very low	7.8%	6.7%	-	7.4%	7.7%	-
	(0.27)	(0.25)		(0.26)	(0.27)	
=1 if fertility is from very low to low	24.7%	18.0%	***	21.9%	24.5%	-
	(0.43)	(0.38)		(0.41)	(0.43)	
Months of drought	1.6	1.5	**	1.3	1.9	***
	(1.11)	(0.96)		(1.10)	(0.93)	
Months of wetness	0.69	0.80	**	0.97	0.39	***
	(0.88)	(0.93)		(0.95)	(0.69)	
Average historic rainfall	147.8	130.5	***	148.3	137.4	***
	(28.6)	(36.3)		(29.1)	(33.4)	
Height above sea level	1,466	1,705	***	1,197	1,951	***
	(1,020)	(1,050)		(958)	(970)	
Distance to the state's capital (km)	66.2	73.9	***	61.6	76.6	***
	(44.7)	(42.3)		(36.5)	(51.4)	
Distance to primary roads (km)	7.4	7.8	-	7.8	7.0	**
	(9.15)	(7.28)		(9.00)	(8.37)	
Distance to other roads (km)	3.8	3.2	***	3.5	3.9	**
	(2.37)	(2.29)		(2.4)	(2.3)	
Distance to the sea (km)	188.5	214.2	***	162.3	237.1	***
	(125.2)	(104.3)		(113.1)	(117.8)	
Distance to coca crops (km)	81.0	81.6	-	88.3	71.8	***
	(33.6)	(36.6)		(33.7)	(32.8)	
Observations	933	300		698	535	

Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.
* p<0.10, ** p<0.05, ***p<0.01

Table 5. Descriptive statistics: control variables (rural district and municipality characteristics)

	=1 at least one year of presence			=1 at least one conflict-induced shock		
	No	**Yes**		**No**	**Yes**	
Distance to nearest river (km)	13.1	11.2	***	14.5	10.1	***
	(11.8)	(10.5)		(12.4)	(9.7)	
Distance to sea and river routes (km)	84.1	79.2	***	75.6	92.5	***
	(20.0)	(35.9)		(23.4)	(23.5)	
Price index of the community	1.14	1.22	***	1.17	1.15	-
	(0.33)	(0.33)		(0.27)	(0.40)	
=1 if community has problems to get credit	41.8%	44.0%	-	41.8%	43.0%	-
	(0.49)	(0.50)		(0.49)	(0.50)	
Number of banks on municipality	1.8	1.5	***	1.96	1.44	***
	(0.03)	(0.06)		(0.88)	(0.95)	
Daily agricultural wage	11,788	12,760	***	11,725	12,414	***
	(2,974)	(1,871)		(3,157)	(2,126)	
Municipal homicide rate 1993-2000	61.1	62.3	-	65.8	55.7	***
	(45.4)	(44.4)		(51.6)	(34.2)	
Observations	933	300		698	535	

Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.

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

Table 6. OLS estimation – yearly agricultural revenues per hectare

	(1)	(2)	(3)
Shock intensity	0.0727		
	[0.0803]		
Years of armed group presence	0.00810		
	[0.0544]		
Intensity 1		0.132	0.145
		[0.128]	[0.129]
Intensity 2		0.179	0.152
		[0.219]	[0.226]
Intensity 3		-0.498*	-0.579*
		[0.295]	[0.307]
One year of presence		0.248*	0.269*
		[0.135]	[0.138]
Two years of presence		0.260	0.218
		[0.191]	[0.192]
Three years of presence		0.263	0.304
		[0.689]	[0.673]
Four years of presence		-0.205	-0.242
		[0.364]	[0.357]
Five years of presence		0.298	0.365
		[0.365]	[0.354]
Six years of presence		-0.882*	-0.783
		[0.513]	[0.519]
Observations	1801	1801	1801
R-squared	0.161	0.165	0.166
Household and land plot characteristics	Yes	Yes	Yes
Rural district and municipality controls	Yes	Yes	Yes
General equilibrium variables	No	No	Yes
Fixed effects by department	Yes	Yes	Yes
Clustered by rural district	Yes	Yes	Yes

Robust standard errors in brackets. * p<0.10, ** p<0.05, ***p<0.01
Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.

Table 7. OLS estimation – yearly agricultural costs per hectare

	(1)	(2)	(3)
Shock intensity	0.112		
	[0.0878]		
Years of armed group presence	0.0909		
	[0.0706]		
Intensity 1		0.166	0.190
		[0.135]	[0.134]
Intensity 2		0.117	0.0472
		[0.254]	[0.256]
Intensity 3		0.373	0.225
		[0.280]	[0.317]
One year of presence		0.452***	0.494***
		[0.157]	[0.164]
Two years of presence		0.330	0.215
		[0.357]	[0.356]
Three years of presence		0.646	0.773
		[1.036]	[0.961]
Four years of presence		-0.0804	-0.163
		[0.380]	[0.383]
Five years of presence		0.433	0.625
		[0.518]	[0.484]
Six years of presence		-0.0600	0.188
		[0.459]	[0.473]
Observations	1801	1801	1801
R-squared	0.208	0.212	0.218
Household and land plot characteristics	Yes	Yes	Yes
Rural district and municipality controls	Yes	Yes	Yes
General equilibrium variables	No	No	Yes
Fixed effects by department	Yes	Yes	Yes
Clustered by rural district	Yes	Yes	Yes

Robust standard errors in brackets. * p<0.10, ** p<0.05, ***p<0.01
Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.

Table 8. OLS estimation – land allocation: perennial crops, seasonal crops, and pasture (Percentage of total land plot)

	Perennial Crops			Seasonal Crops			Pastures		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shock intensity	-0.0124			0.0195*			0.00518		
	[0.0159]			[0.0118]			[0.0120]		
Years of armed group presence	0.00465			0.00106			0.00298		
	[0.00943]			[0.00781]			[0.00541]		
Intensity 1		-0.0340	-0.0303		0.0163	0.0160		0.0178	0.0180
		[0.0210]	[0.0206]		[0.0185]	[0.0182]		[0.0123]	[0.0117]
Intensity 2		0.0390	0.0337		0.0232	0.0268		-0.0401***	-0.0428***
		[0.0354]	[0.0370]		[0.0250]	[0.0263]		[0.0150]	[0.0146]
Intensity 3		-0.192***	-0.216***		0.182***	0.181***		0.210***	0.214***
		[0.0471]	[0.0425]		[0.0366]	[0.0365]		[0.0222]	[0.0213]
One year of presence		0.0829**	0.0880***		-0.0112	-0.0105		0.00448	0.00167
		[0.0323]	[0.0330]		[0.0228]	[0.0234]		[0.0143]	[0.0144]
Two years of presence		-0.00527	-0.0119		0.0798	0.0838		-0.0227	-0.0216
		[0.0369]	[0.0392]		[0.0798]	[0.0799]		[0.0138]	[0.0131]
Three years of presence		0.100**	0.105**		0.00698	-0.00245		-0.0161	-0.00864
		[0.0503]	[0.0528]		[0.0283]	[0.0305]		[0.0113]	[0.0124]
Four years of presence		-0.0199	-0.0277		0.0568	0.0569		0.0697	0.0740
		[0.0632]	[0.0646]		[0.0598]	[0.0627]		[0.0479]	[0.0452]
Five years of presence		-0.00344	0.00541		-0.0335	-0.0424		-0.0149	-0.0136
		[0.0839]	[0.0905]		[0.0478]	[0.0485]		[0.0387]	[0.0398]
Six years of presence		-0.120	-0.101		-0.0832	-0.0927		0.0230	0.0256
		[0.0842]	[0.0817]		[0.0600]	[0.0638]		[0.0562]	[0.0562]
Observations	1801	1801	1801	1801	1801	1801	1801	1801	1801
R-squared	0.199	0.208	0.211	0.220	0.224	0.226	0.135	0.149	0.154
Household and land plot characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rural district and municipality controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
General equilibrium variables	No	No	Yes	No	No	Yes	No	No	Yes
Fixed effects by department	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered by rural district	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in brackets. * p<0.10, ** p<0.05, ***p<0.01

Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.

Table 9. Probit estimation – access to formal and informal credits, and investment decisions during 2009

	=1 if credit with banks			=1 if credit with family and friends			=1 if at least one investment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shock intensity	0.0462			-0.0229			-0.0428**		
	[0.0285]			[0.0247]			[0.0172]		
Years of armed group presence	0.00321			-0.0142			0.0163		
	[0.0159]			[0.0151]			[0.0195]		
Intensity 1		-0.0296	-0.0519		0.0300	0.0273		-0.0238	-0.0227
		[0.0368]	[0.0365]		[0.0340]	[0.0345]		[0.0263]	[0.0268]
Intensity 2		0.0819	0.0698		-0.0344	-0.0323		-0.116**	-0.123***
		[0.0502]	[0.0503]		[0.0412]	[0.0405]		[0.0448]	[0.0461]
Intensity 3		0.530***	0.565***		-0.367***	-0.339***		-0.209***	-0.215***
		[0.0822]	[0.0812]		[0.0909]	[0.0916]		[0.0456]	[0.0427]
One year of presence		-0.0976*	-0.107**		0.120**	0.124**		0.0112	0.0141
		[0.0500]	[0.0477]		[0.0524]	[0.0508]		[0.0330]	[0.0329]
Two years of presence		0.106	0.147		-0.0352	-0.0544		0.0603	0.0467
		[0.0806]	[0.0940]		[0.0973]	[0.0978]		[0.0504]	[0.0541]
Three years of presence		-0.0777	-0.0573		0.106	0.115		-0.110***	-0.0932***
		[0.111]	[0.117]		[0.165]	[0.144]		[0.0343]	[0.0322]
Four years of presence		0.0212	0.116		-0.227***	-0.253***		0.0972	0.0898
		[0.102]	[0.108]		[0.0856]	[0.0935]		[0.0864]	[0.0854]
Five years of presence		0.140	0.222**		-0.227***	-0.229***		0.340***	0.364***
		[0.0871]	[0.0864]		[0.0750]	[0.0873]		[0.0921]	[0.0972]
Six years of presence		-0.0921	0.0249		0.0281	0.0306		-0.127	-0.101
		[0.155]	[0.155]		[0.155]	[0.160]		[0.143]	[0.147]
Observations	1233	1233	1233	1233	1233	1233	1801	1801	1801
R-squared	0.210	0.222	0.231	0.086	0.101	0.105	0.130	0.138	0.141
Household and land plot characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rural district and municipality controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
General equilibrium variables	No	No	Yes	No	No	Yes	No	No	Yes
Fixed effects by department	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered by rural district	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in brackets. * p<0.10, ** p<0.05, ***p<0.01

Source: Authors' calculations based on ELCA (Wave I), National Government, IDEAM, IGAC and CEDE Municipal Panel.