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Agricultural Production Amid Conflict: Separating the Effects of Conflict into Shocks and Uncertainty[1]

María Alejandra Arias, Ana María Ibáñez and Andrés Zambrano

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Abstract:
This paper examines the effect of conflict on agricultural production of small farmers. First, an inter-temporal model of agricultural production is developed in which the impact of conflict is transmitted through violent shocks and uncertainty brought about by conflict. We test the model using a unique household survey applied to 4,800 households in four micro-regions of Colombia. Our findings suggest households learn to live amid conflict, albeit at a lower income trajectory. When presence of non-state armed actors prolongs, farmers shift to activities with short-term yields and lower profitability from activities that require high investments. If violence intensifies in regions with presence of non-state armed actors, farmers concentrate on subsistence activities.

Keywords: conflict, uncertainty, agricultural production, small-farmers, developing economies

JEL Classification: D13, D74, Q1

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1. Introduction

Conflict imposes costs on economic production through two broad channels. First, assaults and attacks during conflicts cause devastation and limit market transactions. Second, the presence of non-state armed actors prompts households to modify behavior regardless of whether they are exposed to violent shocks. Studies in the economic literature focus mostly on the impact of violent shocks during conflict (Blattman and Miguel 2010). However, these two channels are far from being perfectly correlated. Kalyvas (2006) shows that violence and conflict are not interchangeable concepts. In regions in which a contesting group exerts hegemonic control, violence against the population is presumably low. Because the hegemonic group already controls the population, there is little need to resort to violent tactics. Nonetheless, despite the low levels of violence in the hegemonic regions, the population faces uncertainty and fear as the conflict is ongoing and the conditions may rapidly change. Thus, papers focusing on the first channel underestimate the total effect of conflict and ignore an important dimension of armed conflict. The purpose of this paper is to identify and distinguish the effect of violent shocks on household behavior from the uncertainty and fear brought about by conflict (hereinafter, uncertainty).

There is ample evidence of the first channel. Armed combats, terrorist attacks, looting, and 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 2010b; Justino 2011). Aggression against the civilian population destroys or deteriorates human capital through abductions, killings, and maiming (De Walque 2006; Camacho 2008; Walque and Verwimp 2009; Verwimp, Bundervoet et al. 2010). These violent shocks also reduce market efficiency. Contraction in the supply of goods and higher transactions costs cause price increases and reductions in the size of trade networks (Deininger 2003; Justino 2011). All of these effects produce a drop in household income and consumption, and countries experience a decline in aggregate production (Abadie and Gardeazabal 2003; Brück 2004; Justino and Verwimp 2013). The findings also show that conflict adversely 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; Nillesen and Verwimp 2010; Akresh, Verwimp et al. 2011; Justino and Verwimp 2013).

Nevertheless, conflict imposes additional costs besides destruction. Hegemonic 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). Moreover, uncertainty persists in regions with hegemonic control of one armed group. Because the conflict is still ongoing, conditions may change rapidly and the armed power may shift to the contesting group. For example, Wood (2003) discusses how small agricultural producers in El Salvador reported stress and fear during a stalemate between the government forces and the rebels. Regardless of whether they face violent shocks, households adjust their behavior in anticipation of a conflict induced-shock to avoid being targeted, to minimize potential losses after an attack, or to abide by rules imposed by non-state armed actors. These adjustments seek to minimize conflict risk and uncertainty, not to maximize profits (Verpoorten 2009).

Identifying the strategies that 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 long-lasting low- or medium-intensity conflict. Second, households learn to live amid conflict and change their behavior in subtle ways. These costs are largely unaccounted for in current studies and may be high. 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, incomes may not necessarily return to previous levels in a post-conflict period for many households.

To understand how conflict distorts agricultural decisions, we first propose a theoretical model where a farmer living in autarky decides how to use the available land. The farmer decides how to divide land use between a more profitable crop (perennial crops) and less profitable crops (seasonal, mixed groups and livestock production). Each period, the farmer may be hit by a violent shock that decreases (more) the productivity of perennial crops. However, the farmer is uncertain about the distribution of the violent shock and slowly learns about it once a shock is observed.

The model predicts that farmers prefer to invest more in other agricultural activities vis-à-vis perennial crops when violent shocks are more likely. Since these are less profitable, farmers are driven to a low-income equilibrium. On the other hand, when farmers are hit by a violent shock, perennial crops decrease, whereas the impact on other agricultural production is ambiguous. If the farmer is sufficiently certain about the distribution of the shocks then the impact is also negative. However, when the farmer is uncertain, a negative shock will lead the farmer to believe that violent shocks are more likely and thus will increase its production in other agricultural activities. Therefore, after a violent shock, in the first case we would observe an increase in idle land, whereas in the second case we may observe an increase in other agricultural activities different than perennial crops.

We then test the hypothesis derived from the model using a unique dataset for Colombia, a country that has experienced ongoing conflict for over 50 years. We designed a household survey to collect detailed information on the dynamics of conflict, such as the occurrence of violent shocks, the historic presence of armed groups, and the governance structures they impose on the population. This dataset allows us to examine and separate the impact of conflict through violent shocks from uncertainty, measured in terms of years of presence of non-state armed actors, the governance structure they impose and contestation from other non-state armed actors. Our paper attempts to discover whether conflict is associated with household behavior beyond the impact of conflict-induced shocks. We concentrate the analysis on household decisions related to agricultural production, namely land use.

Estimating a causal relationship between violent shocks and the presence of armed groups, on the one hand, and agricultural decisions, on the other, is difficult. Armed groups do not randomly locate themselves across the territory. Non-state actors establish their presence in 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 civilian resistance (Azam and Hoeffler 2002; Engel and Ibáñez 2007). In order to reduce the endogeneity bias, we use a spatial discontinuity strategy similar to Acemoglu et al. (2012), Naidu (2012), and Dube et al. (2010). We create a pair of contiguous districts, one with presence of non-state armed groups and the other without. Unobservables

that jointly determine armed group presence and agricultural decisions vary smoothly across districts and are potential sources of bias. Our empirical strategy controls for these unobservables by including fixed effects for each contiguous pair. We also include a rich set of geographic, household, land plot, rural district, and municipality controls that may jointly determine the presence of non-state armed actors or incidence of violent shocks. We perform several robustness checks and the results tend to be robust to different specifications. Even though we reduce the endogeneity bias by creating pairs of contiguous communities and including a rich set of controls, we cannot claim causality.

Our contribution lies on showing how violence and uncertainty brought by conflict might potentially have different and opposite impacts on agricultural decisions. The results of this study show that conflict affects land use beyond violent shocks. Farmer that live in regions with a longer presence of non-state armed actors or community that faced violence shocks dedicate land to agricultural activities that are less profitable but provide food to the household or can be easily transferable if required to migrate: seasonal, mixed crops and cattle ranching. However, in districts where there are both violent shocks and a strong presence of an armed group there is an increase of a bigger magnitude in the land used for seasonal crops, which provide food for subsistence for the household. Our findings also show that two potential mechanisms are the uncertainty of having more than one NSAA in the territory and the imposition of economic regulations. Therefore, the results suggest that households learn to live amid conflict, yet at a lower income trajectory.

The policy implications from our paper complement those of current studies that underestimate the economic consequences of conflict. We argue that policies in post-conflict periods should focus on more than just reconstruction efforts. In order to ensure a long-term recovery and a sustainable post-conflict economy, policies should incentivize households to alter their sub-optimal decision making adopted during conflict.

Recent research provides examples of how households modify production decisions to reduce conflict risk. First, small agricultural producers change their cattle portfolio by selling it to provide for financial resource and smooth household consumption (Verpoorten 2009). Second, households shift income sources to protect consumption. Farmers may rely more on subsistence activities to protect food consumption and their income, or resort to income activities that are less sensitive to conflict (Deininger 2003; Bozzoli and Brück 2009).

Third, conflict induces adjustments in investment decisions. Households may save more as future income becomes increasingly uncertain, or invest more in mobile assets to minimize the risk forced migration entails (Grun 2008; Verpoorten 2009). Because assets signal household wealth and some are difficult to conceal, assets may become liabilities (Engel and Ibáñez 2007; Rockmore 2011).

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 violent shocks. These sub-optimal strategies may persist after the conflict ends. In Mozambique, three years after the ceasefire, households were still practicing many of their wartime 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 the incidence of violent shocks. These papers assume that the coefficient for the incidence of idiosyncratic or covariate shocks captures losses from violent shocks and uncertainty, if these are correlated. However, conflict dynamics are complex. Kalyvas (2006) shows that, in regions in which non-state armed actors exercise strong regional control, violence against civilians is lower. Thus, the coefficient for conflict-induced shocks only captures a fraction of the economic losses from conflict. These costs, such as the destruction and devastation of private assets and public infrastructure, are more easily recovered once the conflict ends (Blattman and Miguel 2010).

An exception is Rockmore (2011), who separates risk of violence from exposure to violence when analyzing the impact of conflict. The perceived risk of violence is estimated as a predicted value of a regression of perceived insecurity explained by distances to the closest community exposed to violence. The author evaluates the effect of the two measures of conflict on household consumption and found that exposure to violence has a greater impact. However, since all households are subject to the risk of violence (by construction), the author founds that half of the welfare losses caused by conflict are related to risk. The main problem of this approach is that the risk is constructed using exposure, and then both are included to explain consumption. Coefficients are very likely to be biased since exposure is a realization of risk.

We depart from Rockmore's (2011) approach in two ways. First, both measures of risks in his paper only use attacks to capture conflict dynamics, yet uncertainty may arise even when no attack or assault has occurred. Instead, we use objective data on the presence of non-state armed groups and measures of rules imposed by armed groups, and relate them to subjective beliefs through our model. Second, Rockmore uses a reduced form to identify the impact of conflict on welfare without separating the mechanism through which conflict may decrease consumption. We focus on one potential channel: agricultural production decisions.

The structure of the paper is as follows. Section 2 provides a brief summary of the Colombian conflict. Section 3 develops a theoretical model that includes the effect of both violent shocks and uncertainty on decisions taken by a small farmer. In Section 4, we describe the data and the empirical strategy and discuss the results. Section 5 concludes.

2. Conflict in Colombia

During the 20th century, Colombia faced two conflicts. The first one began in 1948, following the assassination of Jorge Eliécer Gaitán, the presidential candidate from the Liberal Party. During this period, known as *La Violencia*, violent disputes between the two traditional political parties (*Liberal* and *Conservador*) fueled the conflict. Nearly 200,000 people were killed between 1948 and 1953 (Guzmán, Fals-Borda et al. 1963; Sánchez and Meertens 2001). The two traditional parties brokered a power-sharing agreement that lasted from 1958 until 1974.

The power-sharing agreement significantly reduced violence, yet the structural causes of *La Violencia* remained unresolved. Income inequality, a weak state unable to establish a presence in many regions of the country, uncertain property rights over land, and an unequal land distribution predominated in many regions of the country. In addition, this agreement excluded participation in the electoral process for other political groups. New left-wing guerrilla groups, namely the National Liberation Army (*Ejercito de Liberacion Nacional*—ELN) and the Revolutionary Armed Forces of Colombia (*Fuerzas Armadas Revolucionarias de Colombia*—FARC), emerged in the 1960s. These groups aimed to overthrow the government. During the first two decades, these guerrilla groups were in small, controlled, isolated regions of the country, from which they launched sporadic attacks. By the end of the

1970s, the guerrilla groups modified their strategy in order to collect monetary resources to fund their war strategies. Kidnappings, cattle thefts, and extortion against landowners and drug dealers intensified in many regions of the country.

Right-wing paramilitary groups were formed in the 1980s. Several factors contributed to the emergence of these groups. First, illegal drugs provided financial resources that strengthened left-wing guerrilla groups but also fostered the formation of vigilante groups, created by drug dealers and local landlords in response to kidnappings, cattle thefts, and extortion (*Verdad Abierta*, 2011).[2] Second, failed peace negotiations with guerrilla groups in 1982 and 1986 led to the appearance of these groups to protect the civilian population against assaults from guerrilla groups (Romero 2002). Third, landowners in several regions of the country created vigilante groups to protect their property and agricultural production (Duncan 2005; Duncan 2006).

The rise of paramilitary groups and the monetary resources amassed from the illegal drug trade contributed significantly to fuel the conflict and expand the conflict geographically. Attacks against the civilian population by guerrillas and paramilitaries increased, leading to massacres, selective homicides, death threats, and massive forced displacement. According to the Official Group of Historical Memory (2013), for the period between 1985 and 2013, more than 166,000 people died due to conflict, 1,982 massacres were perpetrated by non-state armed actors, and 8.3 million hectares were illegally seized. Some 3.9 million people, equivalent to 8.4 percent of the population, were forced to emigrate.[3]

From 2002 onward, the conflict eased. Massive financial resources provided to the Armed Forces and a peace process with paramilitary groups between 2003 and 2006 helped reduce the level of violence. This led to 38 collective demobilizations of a total of 31,767 combatants (Valencia 2007). Still, the scope of the demobilization was limited, as some groups did not demobilize and others preserved their wartime structures. The groups mutated into smaller drug-dealing bands, known as BACRIM (criminal bands), which were scattered around the country. To this day, guerrilla groups still operate in several regions of the country.

[2] www.verdadabierta.com retrieved on July 7, 2012
[3] www.accionsocial.gov.co retrieved on July 15, 2012.

3. The Model

We propose a model that distinguishes the impact of conflict between the impact of violent shocks and the impact of uncertainty. The model features a small farmer who lives in autarky[4] and has to decide every season how much to invest in two types of agricultural activities before a productivity shock is realized. Violent shocks are associated to losses in productivity. For example, homicides, kidnaps or land eviction reduce human capital, labor or productive land. Also decreases in output are associated to a larger appropriation of production by non-state armed actors. Therefore violent shocks can be interpreted as negative productivity shocks. In addition, agricultural activities are distinguished by how complementary they are with productivity shocks; that is, they differ by how their marginal productivity changes with productivity shocks. We associate those that are more complementary to productivity shocks with perennial crops, whereas we identify the least complementary agricultural activities to seasonal and mixed crops, or livestock. This implies conflict reduces more the productivity of perennial crops than that of seasonal and mixed crops, or livestock

We assume farmers are uncertain as to whether the productivity shocks are permanent or transitory. Productivity shocks are assumed to be permanent when the non-state armed actor is hegemonic in the region, whereas they are assumed to be transitory if the government is the hegemonic actor. The distribution of permanent shocks is dominated by the distribution of transitory shocks in the monotone likelihood ratio order. This assumption rationalizes the idea that when non-state armed actors are hegemonic, larger negative shocks are more likely to arise. This can happen because they appropriate a larger portion of the production than a government would do through taxes, because aggressions against civilians is more likely, because there is a higher chance of destruction of inputs, or because it is more likely that the situation changes through contestation of another armed group (i.e. the national army or another non-state armed group). For example, Engel and Ibáñez (2007) find that deliberate attacks against households are less likely when police or military forces are present in the

[4] Farmers in Colombia have a very low access to credit markets. The National Agricultural Census of 2014 shows that only 11% of rural producers in Colombia that live in their farm have a credit. Moreover, in the empirical section we control for such access to concentrate on the impact of conflict on land-use.

territory, while this likelihood increases with presence of paramilitary or guerrilla groups. The uncertainty caused by conflict is included through the farmers' beliefs about the distribution of the shocks. [5]

Consider an infinitely lived farmer who maximizes her discounted inter-temporal utility $\sum_{t=0}^{\infty} \beta^t u(c_t)$, where c_t is the consumption at time t, $\beta \in (0,1)$ is the discount factor, and $u(\cdot)$ is a strictly increasing and concave function. Each period, the farmer decides how much to invest in perennial crops k_p and how much to invest in other agricultural activities k_s, before observing the shock z. After the shock occurs, perennial crops will produce $Y_p(k_p, z)$, whereas other agricultural activities produce $Y_s(k_s, z)$. This general definition of the production function accommodates several cases, for example it allows for depreciation and the fact that a violent shock could increase it. In each period, total production is distributed between consumption c_t and investment in perennial crops and other agricultural activities for next period.

We assume that both production functions are strictly increasing in z and k_i, and concave in k_i for both $i \in \{p, s\}$. We also assume that perennial crops are more complementary to shocks, $\frac{\partial^2 Y_p\ (k,z)}{\partial k_p \partial z} > \frac{\partial^2 Y_s\ (k,s)}{\partial k_s \partial z} \geq 0$. In other words, we assume that violent shocks decrease more the marginal returns of perennial crops. For example, this is the case if violent shocks decrease more the output of perennial crops, if they increase more their depreciation, or if they decrease more inputs that are more complementary to perennial crops. In fact, perennial crops are harder to hide and thus are more subject to violent shocks when compared to cattle, which is easily moved (Verpoorten 2009). Moreover, when perennial crops are destroyed and a farmer cultivate them again, the farmer has to wait much more time to obtain its returns when compared to seasonal crops.

Shocks can arise from two possible distributions. When the non-state armed actor is hegemonic in the region, we will say that shocks are permanent and are distributed according to the c.d.f. $G(z)$ with p.d.f. $g(z)$. When this is not the case, we will say that shocks are

[5] The model does not consider any strategic interaction with non-state armed actors; the unique interaction is through the shocks. Although farmers may make decisions to decrease their vulnerability to non-state armed actors, we abstract from modeling the decisions taken by the non-state armed groups. Our aim is to generate testable predictions of farmers' decisions, and empirically we deal with the endogeneity that arises from the strategic interaction. Similarly, we do not model market interactions that can generate general equilibrium effects, but we control for them in the empirical strategy.

transitory and are distributed with c.d.f. $H(z)$ and p.d.f. $h(z)$. We assume that $H(z)$ dominates $G(z)$ in the monotone likelihood ratio (MLR) order. This implies that the more negative the shock, the more likely it was drawn from the permanent distribution rather than the transitory one. The MLR dominance also generates first-order stochastic dominance (Athey 2002). Hence, the expectation of monotone increasing functions with respect to the shock is greater when shocks are transitory.

We let the farmer be uncertain about the nature of the shocks. The farmer believes with probability q that shocks are permanent and with probability $1-q$ that shocks are transitory. When the farmer faces a shock z, she updates this belief using Bayes' rule:

$$q' = \frac{g(z)q}{g(z)q + h(z)(1-q)}$$

Given our dominance assumption on the distributions, a larger negative shock induces a larger subsequent belief q':

$$\frac{\partial q'}{\partial z} = \frac{q(1-q)\big(g'(z)h(z) - g(z)h'(z)\big)}{[g(z)q + h(z)(1-q)]^2} < 0$$

The derivative is negative by the log supermodularity of the distributions, which is implied by the likelihood ratio ordering. It suggests that a larger negative shock leads the farmer to increasingly believe that she is facing permanent shocks. On the other hand, a greater prior belief q leads also to a greater posterior belief q'. Note that the model includes both risk, through z, and ambiguity, through q. However, although there is risk aversion, we assume for the sake of simplicity that the individual is ambiguity neutral.[6]

The problem can be expressed recursively as:

$$v\big(k_p, k_s, q, z\big) = \max_{c, k_p', k_s'} u(c) + \beta\big[q' \int v\big(k_p', k_s', q', z'\big) dG(z') + (1-q') \int v\big(k_p', k_s', q', z'\big) dH(z')\big]$$

subject to $c + k_p' + k_s' = Y_p\big(k_p, z\big) + Y_s(k_s, z)$ and $q' = \frac{g(z)q}{g(z)q + h(z)(1-q)}$

[6] The results will hold if we assume ambiguity aversion since it will make the self-insurance motive stronger.

Using standard techniques we can show that there exists a unique solution to the recursive problem. The value function is strictly increasing and strictly concave in k_i since the production function is strictly increasing and concave in both variables. It is also strictly increasing in z since it also strictly increases the production function and because $E\left[v\left(k_p', k_s', q', z'\right)\right]$ is increasing in z if $v(\cdot)$ is increasing in z. The latter property arises because the distribution of transitory shocks $H(\cdot)$ dominates the distribution of permanent shocks $G(\cdot)$, and a greater z decreases the weight q' given to $G(\cdot)$. Since a higher q leads to a higher q', this also implies that the value function $v(\cdot)$ is decreasing in q. Therefore, the model implies that farmers in regions where non-state armed actors are hegemonic are worse off.

Our study seeks to understand how farmers change investment in the presence of violent shocks and uncertainty. Therefore, we are interested in computing the derivative of $k_i{}'$ with respect to shock z and belief q. Remember that a violent shock decreases z, and thus its derivative has to be interpreted inversely. Since the problem is concave in k_i', its first order condition is necessary and sufficient and is given by:

$$u'(c) = \beta\left[q'\int \frac{\partial v\left(k_p', k_s', q', z'\right)}{\partial k_i'} dG(z') + (1-q')\int \frac{\partial v\left(k_p', k_s', q', z'\right)}{\partial k_i'} dH(z')\right]$$

where $\frac{\partial v(k_p', k_s', q', z')}{\partial k_i'} = u'(c')\frac{\partial Y_i(k_i', z)}{\partial k_i'}$

The left-hand side of the equation is the opportunity cost of investing more in terms of current consumption. The right-hand side of the equation represents the discounted future marginal benefits of investment: an expected increase in future utility via an increase in future production, weighted by the subsequent belief.

The comparative static with respect beliefs is given by:

$$\frac{\partial k_i'}{\partial q} = -\frac{\beta\frac{\partial q'}{\partial q}\Delta dv_i}{u''(c) + \beta E\left[\frac{\partial^2 v\left(k_p', k_s', q', z'\right)}{\partial k_i'^2}\middle| q'\right]}$$

The term $\Delta dv_i = \int \frac{\partial v(k_p', k_s', q', z')}{\partial k_i'} dG(z') - \int \frac{\partial v(k_p', k_s', p', z')}{\partial k_i'} dH(z')$ denotes the difference in the expected marginal benefit of investment given the type of shock. Its sign will depend on how such marginal benefit depends on z. If the marginal benefit is increasing

in z then the expected marginal benefit will be higher under transitory shocks and thus the difference Δdv_i would be negative.

To find this sign we compute the cross partial derivative of the value function, which is given by:

$$\frac{\partial^2 v(k_p', k_s', q', z')}{\partial k_i' \partial z} = u'(c') \frac{\partial^2 Y_i(k_i', z)}{\partial k_i' \partial z} + u''(c') \frac{\partial Y_i(k_i', z)}{\partial k_i'} \left[\frac{\partial Y_p(k_p', z)}{\partial z} + \frac{\partial Y_s(k_s', z)}{\partial z} \right]$$

We assumed that perennial crops are more complementary to shocks than the other agricultural activities. If such complementarity is sufficiently large then the first term dominates the second one and $\frac{\partial^2 v(k_p', k_s', q', z')}{\partial k_p' \partial z} > 0$, which in turn implies that $\Delta dv_p < 0$. Since the denominator of $\frac{\partial k_i'}{\partial q}$ is negative given the concavity of the problem, the result suggests that farmers will invest less in perennial crops when they increasingly believe they are facing permanent shocks.

On the other hand, if the other agricultural activities have a sufficiently low complementarity with shocks, where independence is the limiting case, then the second term of the derivative will dominate. Therefore the expected marginal return becomes higher when the farmer faces permanent shocks. Hence, farmers will invest more in these activities when its belief that they face permanent shocks increases. The intuition for this result is that when the farmer expects negative shocks to be permanent, she prefers to invest more in crops which marginal return is affected less by the shocks.

We can also obtain the comparative static with respect to the shock:

$$\frac{\partial k_i'}{\partial z} = - \frac{-u''(c) \left[\frac{\partial Y_p(k_p, z)}{\partial z} + \frac{\partial Y_s(k_s, z)}{\partial z} \right] + \beta \frac{\partial q'}{\partial z} \Delta dv_i}{u''(c) + \beta E \left[\frac{\partial^2 v(k_p', k_s', q', z')}{\partial k_i'^2} \middle| q' \right]}$$

The first term of the numerator is positive implying that a violent shock, which reduces productivity z, reduces investment since a negative shock decreases available production. The second term represents the change in investment due to a change in beliefs

after observing the shock. It is positive in the case of perennial crops since a violent shock increases the belief that shocks are permanent and thus the farmer invest less in perennial crops since its marginal return is greatly affected by the shocks. Therefore, both effects are positive for perennial crops, thus implying that a violent shock decreases investment in them.

In the case of other agricultural activities, the first term is also positive for the same reason. However, the second term is negative since the farmer will invest more on other agricultural activities when the belief that shocks are permanent increase. Therefore the effect of a violent shock becomes ambiguous. The overall effect will be negative when there is little uncertainty since the updating process is almost null and the second term vanishes. This is the case when the farmer is almost sure that shocks are permanent (q is close to 1) or transitory (q is close to 0), just note that $\frac{\partial q'}{\partial z}$ approximates to zero as q goes to 0 or 1. However, when there is uncertainty, the reaction of farmers after a violent shock is mitigated or it can even change its sign. The intuition behind this result is that a more negative shock suggests that it is permanent, which leads the farmer to increase investment in other agricultural activities as a self-insurance strategy, as implied by the derivative $\frac{\partial k_s'}{\partial q}$.

In sum, given the complementarity conditions on each type of production function, the model has several predictions that we test empirically. First, it predicts that more pessimistic beliefs (biased towards the permanent distribution) lead farmers to invest more in other agricultural activities rather than in perennial crops. This reaction is part of a self-insurance strategy since they want to smooth consumption and the marginal return of these activities is affected less by the violent shocks. Since beliefs are associated with the presence of non-state armed actors in the region, the greater the number of years the non-state armed actor has been in the region, beliefs should be more pessimistic and we should expect a substitution of perennial crops.

On the other hand, a violent shock has two opposite impacts: it decreases both investments since it decreases available production, but it also tends to increase investment in other agricultural activities since beliefs are now more pessimistic and such strategy will allow farmers to insure their consumption. When the farmer is very uncertain about the distribution of shocks she is facing, the updating process becomes more important and the latter effect could lead to an overall increase in investment in these activities. However, if

the farmer is sufficiently certain that shocks are either permanent or transitory, the first negative effect would dominate and the farmer will decrease investment in both productive activities, thus we should expect an increase of idle land.

4. Empirical Strategy

The purpose of the empirical analysis is to test the hypotheses put forth in the theoretical model. We measure investment in perennial crops and other agricultural activities using the percentage of land dedicated to each activity since the survey does not collect productive investments disaggregated by productive activity. We assume a higher investment in a particular agricultural activity may lead to more land dedicated to that activity. We measure shocks using violent shocks, while we use the number of years NSAA have been present in the community as a proxy for beliefs about whether violent shocks are transitory or permanent. We assume that, as non-state armed actors stay longer in the community, households believe with higher probability that non-state armed actors will become hegemonic in their region; thus, they expect shocks to be permanent. We perform some robustness checks to gauge whether this assumption is valid.

We probe the hypotheses identified in the model. First, we test whether a higher belief of a permanent presence of non-state armed actors is associated with more land dedicated to other agricultural activities. *A priori* the relation between beliefs and the percentage of land dedicated to perennial crops is ambiguous. If complementarity of perennial crops with the violent shock is high (low), the percentage of land dedicated to perennial crops is lower (higher) with higher beliefs. Second, we gauge whether violent shocks are associated with less land dedicated to perennial crops. Third, we test whether an intensification of violent shocks is associated with less (more) land dedicated to other agricultural activities when there is little (high) uncertainty on non-state armed actors being hegemonic. Also, we test whether the interaction between beliefs and violent shocks leads to more idle land. All predictions imply that violent shocks and a prolonged presence of non-state armed actors would push farmers toward less risky, yet less profitable activities. Thus conflict may push households onto a low-income trajectory.

4.1.The Data

We use four different sources of data. The first is the Colombian Longitudinal Survey of the Universidad de los Andes (ELCA). We 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 areas. In this paper, we use the rural sample, as conflict in Colombia occurs mainly in rural areas. The survey is applied in four rural regions (Middle Atlantic, Central East, Cundi-Boyacense, and Coffee region). We selected the rural regions and municipalities within them 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. The sample contains 17 municipalities and 222 rural districts.

The survey collects standard information about employment, income, consumption, education, health, and family formation. We collected also detailed information on land tenure and property rights, agricultural production, and asset ownership. In addition, we designed a special module on shock incidence during the year previous to the survey, which elicits information on the occurrence of violent shocks. Because non-state armed actors are active in some communities of the surveys, the questions were carefully designed to protect households and reduce apprehension about answering the questions truthfully. Therefore, we included the detailed questions on conflict and violence on the rural district questionnaire, while the household questionnaire only includes one general question on whether the household was victim of a violent event during the previous year. Since NSAA or criminal groups may be responsible for violent events, we cannot discern conflict victimization at the household level. All households were geo-coded.

We apply the rural district questionnaire to community leaders. 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 in the previous 10 years, such as presence of NSAA, strategies adopted by NSAA, and victimization of the civilian population. In some districts, the enumerators did not apply the rural district questionnaire, reducing our sample to 204 rural districts.

Despite carefully designing the rural questionnaire to reduce underreporting of the presence of NSAA and violent shocks, some underreporting may persist and it may be systematic. Some rural districts have a strong presence of NSAA, and underreporting may be more prevalent in these areas. Respondents may be fearful or apprehensive about providing detailed information related to conflict. To correct for potential underreporting, we complemented the rural questionnaire with information from the national government. Specifically, we use information on the presence of NSAA at the rural district level in the preceding 10 years. Table A1 in the appendix measures the potential extent of measurement error on the variable of NSAA presence. We create a dummy variable equal to one when the rural district had at least one year of presence for each data set: the rural district questionnaire and the National Government. The results show an overlap for 75.9% of the rural districts. Data from the National Government reports more presence of NSAA (40%) than the rural district questionnaire (34%): for 15.3 percent of the rural districts the community leaders report no presence whereas the National Government reports presence.

To complement the above-described information, and using the coordinates where each household is located, we construct a set of geographic variables that includes altitude above sea level of the household, nine soil fertility dummies and distance to the state capital, the nearest main road, the nearest marine coast, other roads, and coca crops. All distances are Euclidean and were calculated using data from IGAC,[7] the Integrated System of Illicit Crop Monitoring (SIMCI), and the National Roads Institute (INVIAS). Weather conditions affecting the households were obtained from data collected by the Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM) between 1980 and 2009. The IDEAM collects information on daily rainfall at 1,365 monitoring stations in the country. As the stations are geo-referenced, we first calculated monthly rainfall for each station and then, using the Kriging[8] method values, we assigned rainfall values to each household. Municipal characteristics come from the Economic Development Research Center (CEDE) at the Universidad de los Andes and cover the period between 1990 and 2010.

[7] Government institution responsible for collecting geographic information.

[8] Kriging is a spatial interpolation method that estimates surfaces from sampled point values. The estimated values are weighted averages of the observed values within a neighborhood of sampled points. We can be confident about the accuracy of our estimations because we have a large sample of points uniformly distributed over the surface of the country. Given the characteristics of our data, we choose ordinary Kriging for our rainfall interpolation.

We only use households that report complete information on land use and live in a community with data from the rural district questionnaire. Our final sample includes 3,735 households. Table A2 reports the coefficients for the probability of selection into the sample. Unfortunately, we cannot test whether presence of NSAA and violent shocks is systematically different from both samples as these variables come from the rural district questionnaire and the excluded households do not have this information. However, the coefficients for municipal homicidal rates can suggest whether violence and conflict determines selection into the sample. The coefficient estimate for homicides from 2000 to 2008 is not statistically significant, yet historically these municipalities have lower homicides rates. Differences in household and land plot characteristics are not large: households in the sample are larger and with less frequency of legal land titles. Some geographical characteristics determine selection into the sample: distance to primary roads, to the nearest sea shores, and climatic shocks.

4.2. Estimation Strategy

In order to understand the relation between conflict and agricultural decisions, we estimate the coefficient of violent shocks and years of presence of NSAA on agricultural outcomes. We use the percentage of land devoted to perennial crops and other agricultural activities that include seasonal crops, mixed crops, cattle ranching or idle land. Mixed cropping occurs when farmers combine within crops -perennial and seasonal crops – in the same portion of land. Thus, crops are intermingled and not cultivated in separate portions of the land. Mixed cropping reduces economies of scale and productivity, but diversifies risk.

The presence of non-state armed actors and violent shocks is not random. NSAA attempt to control regions that serve their war aims, such as extracting economic rents or illegally seizing valuable assets, or where the costs of establishing a presence are lower, such as difficult geographic conditions or alienation of the civilian population from the state. In addition, aggression against the civilian population is deliberate and not a by-product of conflict. Non-state actors attack households with better economic conditions to seize assets, or community leaders to weaken support of the opponent (Azam and Hoeffler 2002; Engel and Ibáñez 2007). To reduce the endogeneity bias, we use two strategies. First, we create pairs of contiguous rural districts with and without the presence of non-state armed actors. A

pair of contiguous districts need to: (i) share a common geographical border; and (ii) one district has presence of non-state armed actors and the other does not. We create 103 groups of contiguous pairs. It is worth noting one community with presence may belong to more than one group as well as one without presence. By comparing contiguous districts, we control for unobservables that vary smoothly across districts and are potential sources of bias. Market conditions, government programs, land productivity, and economic shocks affect agricultural decisions and are also correlated with the presence of non-state armed actors. These conditions are similar across rural district borders. Thus pair fixed-effects control some of these unobservables. Acemoglu et al. (2012), Naidu (2012) and Dube et al. (2010) use a similar spatial discontinuity strategy.

Table A3 compares community characteristics collected in the rural district questionnaire that influences agricultural production and gauge whether the pair fixed-effects reduce the difference between districts with and without NSAA presence. We first regress each variable on a dummy variable equal to one if the rural district has NSAA presence. Then, we estimate the same regression adding the fixed effects for the contiguous pairs. Before adding the contiguous pair, we find statistically significant differences between rural districts with and without NSAA presence. Once we control for the contiguous pairs, the differences disappears, showing observable characteristics relevant for agricultural production are similar within contiguous pairs.

The second strategy we use is to control for geographic, land and household controls that may jointly determine presence of non-state armed actors and incidence of violence shocks, on the one hand, and agricultural decisions, on the other. Geographic conditions are strongly correlated to the current and past presence of non-state armed actors by partially determining the costs of establishing control or the private or collective benefits for armed actions. Since the Colombian conflict is long-standing, presence of non-state armed actors in 2010 depend on the history of violence in each community. By controlling for geographic conditions besides the contiguous-pair fixed effects, we expect to reduce significantly the endogeneity bias. We also control for initial conditions by controlling for municipal homicide rates between 1993 and 2008. To account for deliberate targeting of non-state armed actors, we include a rich vector of household and land plot controls.

Although both strategies reduce the endogeneity bias, our results are only indicative of a potential causal relation. Spillover effects and unobservable variables jointly determining conflict dynamics and agricultural decisions may persist. We estimate the following model for household *i* located in rural district *j* in pair *p* and

$$y_{ijp} = \propto_0 + \gamma_p + X'_{ijp}\beta + W'_{jp}\gamma + \theta P_{jp} + \lambda S_{jp} + \pi P_{jp} * S_{jp} + \varepsilon_{ijp}$$

where y_{ijp} are outcomes related to agricultural decisions, γ_p denotes a rural district pair fixed effect, X_{ijp} is a vector of household controls, W_{jp} is a vector of rural district controls, and ε_{ijp} is a random term.

We capture conflict dynamics with the term $\theta P_{jp} + \lambda S_{jp} + \pi P_{jp} * S_{jp}$. The variable P_{jp} is the number of years armed groups were present between 2001 and 2010 in rural district *j* from pair *p*. This variable captures the association between the presence of non-state armed actors, which proxies beliefs, and households' agricultural decisions after controlling for violent shocks. By using years of presence as a proxy for beliefs, we are assuming that the longer the years of presence the higher the probability that NSAA are hegemonic. In order to explore if this assumption is valid, we estimate regressions at the rural district level of the probability that NSAA impose social norms or economic regulations in the community and gauge the association of these variables with years of presence. These behaviors are possible if the NSAA have a strong control over the territory. We use the rural district questionnaire to construct these variables. Imposition of social norms is a dummy variable equal to one when community leaders report that NSAA impose these norms and economic regulations is equal to one when leaders report NSAA seized or forcefully demand cattle and/or crops, tax the population or forced households to cultivate illicit crops. We drop communities in which leaders do not report NSAA presence while the government reports presence. Results in Table A4 show that the probability of these groups adopting the two behaviors is higher as the years of presence increase, albeit at a decreasing rate.

The variable S_{jp} is the number of types of conflict-related shocks that occurred during the year previous to the survey in rural district *j* from pair *p*. We include the violent shocks clearly related to conflict such as homicides, illegal land seizure, kidnapping and threats from non-state armed actors. We exclude cattle theft as we cannot discern whether it was performed by criminal groups not necessarily involved in the conflict or NSAA. However, we control for cattle theft in all regressions. We also estimate the regressions with dummy

variables for each type of shock. The parameter θ captures the association between a longer presence of armed groups and decisions on land use without the incidence of violence. The parameter λ measures the relation between incidence of shocks and agricultural decisions through destruction, devastation, and market impacts and is the one traditionally estimated in other studies. The coefficient π shows the effects of shocks in rural districts with presence of NSAA. The model predicts that violent shocks reinforces households' beliefs that the presence of non-state armed actors is hegemonic, pushing them to agricultural activities of lower risk and lower profitability.

Although the household questionnaire collects information on covariate and idiosyncratic violent shocks during the year previous to the survey, we use covariate shocks instead of idiosyncratic shocks. Ideally, we should use idiosyncratic shocks but we proxy direct household victimization with covariate shocks for three reasons. First, the information on covariate shocks is richer as we designed the ELCA questionnaire to collect more detailed information on violence and conflict on the community questionnaire with the purpose of protecting respondents and reducing untruthful responses due to fear. The household questionnaire only includes one question asking whether the household had been a victim of a violent event during the last year. Second, we believe that underreporting is higher for idiosyncratic violent shocks than for covariate shocks. For example, in the Middle Atlantic region, the official registry of the National Government reports that 1.3 percent of the population was a direct victim of violence in 2009 whereas the ELCA respondents reports only 0.2 percent of the population were victims in that same year[9]. Third, and as a direct consequence of the former two, only 0.96 percent of households reports facing an idiosyncratic violent shock during the last year. Given the small sample size, the preciseness of our coefficient estimates is low.

We include household controls to account for preferences, and life cycle controls such as gender, age of the household head and aged squared. To control for wealth and potential targeting from non-state armed actors, we use years of education and a wealth index

[9] We obtain information on: (i) the official registry of victims of violence in Colombia in http://rni.unidadvictimas.gov.co/v-reportes (retrieved on April 25th of 2016); and (ii) population projections in http://www.dane.gov.co/files/investigaciones/poblacion/proyepobla06_20/7Proyecciones_poblacion.pdf (retrieved on April 25th of 2016).

constructed using principal components of household assets. We include variables for family composition (household size, number of members under 14 years of age, between 14-60 years old, and over 60 years of age). Finally, 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 characteristics 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 the size of the land plot, a dummy variable equal to one if the land plot has access to water sources, a dummy variable indicating whether the household has a formal legal title to the land plot, the rental value of the land,[10] and a set of nine dummy variables denoting soil fertility (where one denotes the highest fertility and nine the lowest). Since the data is geo-coded, we control for a rich set of geographic characteristics at the plot level: altitude above sea level, distance in kilometers from the land plot to the state capital, primary roads, other roads, nearest seashore, and nearest illicit crop cultivation. These geographic variables also control for the non-randomness of presence of non-state armed actors. Non-state armed actors seek to establish control in regions in which presence is less costly due to isolation from populated centers or geographical barriers, or provides higher benefits for escaping easily or for economic benefits. Table A5 estimates a rural district regression for the probability of having at least one year of presence. The results show the probability of NSAA presence is strongly correlated to geographical variables. NSAA are located in rural districts with a higher altitude, more distant from the state capital and illicit crops, and closer to secondary roads. These geographical variables explain 17.7 percent on the variation in NSAA presence.

In order to capture other shocks that might be correlated with violent shocks, we include six variables at the rural district level. The first five variables control for climate shocks: number of months (and the number of months squared) during the previous years in which rainfall was one standard deviation below (above) the historic mean, and the rainfall

[10] Based on the 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 of two times its appraised value, and that the rent should be maximum of 1% of the commercial value. We calculate the rent for each household according to farm size.

historic mean (Miguel, Satyanath et al. 2004). Lastly, we also control for a dummy variable equal to one when the rural district faced cattle theft during the year previous to the survey.

We control for a price index of agricultural goods produced in the rural district and a dummy variable indicating whether farmers in the rural districts face problems obtaining credits to account for potential general equilibrium effects caused by conflict.[11]

Given that conflict in Colombia has a long history and it intensified in the last two decades, we include the average municipal homicide rates for the period ranging from 1993 to 2000 and the average municipal homicide rates for the period ranging from 2000 to 2008. These variables control for the historic effect of conflict.

4.3.Descriptive Statistics

The presence of non-state armed actors, years of presence, and incidence of violent shocks vary considerably across rural districts. Table 1 presents the distribution of years of presence for rural districts. Sixty percent did not have a presence of non-state armed actors between 2001 and 2010. The average years of presence of non-state armed actors are 1.17, but the variance is large across rural districts, as the standard deviation is 1.95. Thirty three percent of rural districts with presence are concentrated between one and four years.

[Table 1 goes about here]

The presence of non-state armed actors and the incidence of violent shocks do not necessarily overlap. Communities with strong control of NSAA might not experience high levels of violence, while communities with no continuous presence might experience violence from criminal groups or from NSAA with sporadic presence. Table 2 reports the incidence of covariate shocks by type and by presence of non-state armed actors when the community had at least one year of presence during the last 10 years. The average incidence of type of violent shocks during the last years is 0.18 with a large variance (0.46) and 15.4% of the communities experience at least one type of shock. Homicides are the most frequent shocks (11.6%) followed by threats (3.8%), kidnapping (1.1%) and land seizure (0.9%). While the average

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

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number of type of shocks is lower in communities with NSAA presence, the percentage of communities with at least one shock is higher (18.5% and 13.8%). This difference is mostly driven by threats from armed groups, kidnaps and land seizure. As discussed by Kalyvas (2006), violence against the civilian population might be lower in regions with strong control of hegemonic non-state armed actors.

[Table 2 goes about here]

Table 3 presents descriptive statistics for land use. Households report the portion of their land plot dedicated to crops (perennial, seasonal and mixed crops), cattle ranching, idle land, environmental conservation and other uses. We concentrate our analysis on agricultural activities and idle land. We divide the results for rural districts without and with at least one year of presence of NSAA, and with and without the incidence of covariate violent shocks. Fifty six percent of land is dedicated to crops - mixed (21%), perennial (19.5%) or seasonal crops (15.4%) – while 14.1 percent to cattle ranching and 6.2 percent of the land is idle. The rest of the land is dedicated to other uses (forest 2.4% and other use 10.65) that we do not analyze here given their small numbers. In regions with a least one year of presence, households dedicate a higher percentage of land to perennial crops and idle land. Households living in rural districts with at least one violent shock last year dedicate less land to mixed crops and more land to cattle ranching and seasonal crops.

[Table 3 goes about here]

Table A6 reports descriptive statistics for control variables for the overall sample, divided by presence of NSAA and incidence of conflict shocks. Household characteristics for those leaving in rural districts with at least one year of presence of non-state armed actors are systematically different from those without presence. Nonetheless, the difference is driven mostly by geographic characteristics and not by household characteristics. The former have a younger population with a lower number of members at working age, are less wealthy, and have less access to water sources for agricultural production. The land plots of households living in regions with NSAA presence are more fertile. In rural districts where non-state armed actors are present, weather variability is higher (more months of dry and rainy season), but are drier weather historically. These rural districts are located at higher altitudes and are more isolated, which facilitates the actions of non-state armed actors, and

the prices of agricultural goods are higher. Lastly, these municipalities have a longer history of violence, as average municipal rates are higher for both periods.

Differences in household characteristics between rural districts with and without conflict shocks are large. Compared to rural district without shocks, households living in district with at one shock are more frequently male-headed, with larger sizes and more members below 14 years of age. These households have smaller land plots with more legal titles of their land and their plots are more fertile, yet have less access to water sources. These districts are closer to the state capital but farther away to primary road and illicit crops. During the previous year, households living in districts with at least one violent shock faced more dry months and cattle theft. The prices of agricultural goods are lower. Homicide rates in the municipalities in which these districts are located were lower from 1993 to 2000 for those that faced at least one shock compared to those without shocks.

The descriptive statistics show small differences in household characteristics in districts with and without NSAA presence. Nonetheless, community and geographic characteristics differ systematically according to presence of NSAA. Our estimation strategy reduces this endogeneity bias by creating contiguous pairs of communities and including a rich set of geographical controls. Table A7 shows whether our estimation strategy is effective in reducing household, land plot and community characteristics for rural districts with and without the presence of NSAA. We first regress each control on a dummy variable equal to one if the household lives in a rural district with armed group presence. Then, we estimate the same regression but we control for contiguous pair fixed effects. The coefficient estimate for the dummy variable on armed group shows that the differences between household characteristics are even lower after we control for the fixed effect on the contiguous pairs. The difference for some of the land plot and community characteristics is no longer statistically significant or the gap is lower. Nonetheless, the difference in cattle theft and homicide rates at the municipal level is stronger after controlling for the contiguous pair fixed effects. We expected this to be the case as these variables are strongly correlated with presence of NSAA. The differences in geographic characteristics are also smaller. Two of the coefficient estimates are no longer statistically significant, and the magnitude for almost all the others decreases considerably. We did not expect these differences to disappear as most of the geographical variables are distances. The results of Tables A3 and A7 show that

controlling for the contiguous pairs and the geographical variables reduce the bias from the non-randomness of the presence from non-state armed actors.

4.4.Estimation Results

This paper examines the association between conflict and agricultural production decisions of small farmers, namely land use. We explore two channels through which conflict affects agricultural production: presence of NSAA and incidence of violent shocks. Panel A in each table reports the results for the aggregated number of type of shocks and Panel B presents the results with the type of shocks disaggregated. We cluster the standard errors at the municipal level.

Table 4 reports the estimation results for the percentage of land dedicated to perennial crops, seasonal crops, mixed crops, cattle ranching and idle land. Similarly to findings in other papers (Bozzoli and Brück 2009; Verpoorten 2009), we find an association between violent shocks and production decisions. Incidence of violent shocks are associated to less land dedicated to seasonal crops and more land dedicated to mixed crops and cattle ranching. Similarly, a longer presence of NSAA is associated with less seasonal crops and more mixed crops and cattle ranching. The coefficient for years of presence of NSAA is large: one additional year of NSAA presence is associated with 0.04 less seasonal crops (a quarter of current land dedicated to these crops), 0.03 more mixed crops (15% of current land allocated to these crops) and 0.06 cattle ranching (more than one third of current land dedicated to cattle ranching). The interaction of shocks and years of presence suggest households adjust their behavior in regions with presence of NSAA when shocks occur. One additional shock in a community with NSAA presence is associated with a strong shift to seasonal crops. Households may shift to activities with lower investment and less risk, which in addition provides food for subsistence or for rebel groups (Weinstein 2007; Bozzoli and Brück 2009).

In panel B we examine how households adapt their behavior differently in response to each type of shock. Shocks may not necessarily exert the same effect as they signal different levels of territorial control from NSAA. For example, homicides, an acute act of violence, or threats to the civilian population may not destroy productive assets, yet may signal an unstable environment: NSAA may recur to killing or threatening people to force allegiance to their cause when other groups are contesting a territory (Weinstein 2007). On

the other hand, land seizure implies the expropriation of a productive asset and the loss of investments that are not transferable if the farmer migrates. Nonetheless, land seizure is likely to occur in regions with strong control of NSAA. Table 4 indeed shows a differentiated effect by type of shocks. If homicides occur in regions with presence of NSAA, the coefficient for the interaction term shows a strong positive effect for seasonal crops. Land seizure is strongly related to changes in land use. As expected, in rural districts with illegal land seizure the previous year, farmers cultivate less perennial crops, more seasonal crops, less mixed crops and more cattle ranching. The coefficient is particularly large for perennial crops, almost thrice the sample average. Households seem to concentrate in agricultural activities that require less investment (seasonal crops) and are easily transferable or sellable (cattle ranching). Land seizure in rural districts with NSAA presence seems to push households to even lower levels of production. Households living in districts with one year of NSAA presence and the incidence of land seizure have less land dedicated to seasonal crops and cattle ranching while more land is idle.

A note of caution is in order. We are not able to identify whether the shocks happened before or after the land use decisions. Since information on violent shocks is for the year previous to the survey, it is more likely that farmer's decisions on land use for seasonal, mixed crops and cattle ranching occurred within that time frame. This is not necessarily the case for perennial crops. This might explain why we find statistically significant effects of shocks on seasonal, mixed crops and cattle ranching, while no effect on perennial crops. However, we are controlling for homicides before 2009 which partially captures the previous decisions on land use.

The results show that households presumably habituate to living amid conflict once the presence of non-state armed actors is more prolonged, albeit at a lower income trajectory. Once the presence of non-state armed actors is deemed permanent, production seems to concentrate on less profitable activities. In regions with presence of NSAA and incidence of violent shocks, households seem to concentrate even more in subsistence activities, by shifting to seasonal crops fully, and to reduce agricultural production, by having more idle land.

[Table 4 goes about here]

Since years of NSAA presence covers from 2000 to 2010, some NSAA might have been present in the community several years ago but not recently. The coefficient on years of presence might not be capturing the effect of NSAA on farmers' decisions, but other dynamics correlated with NSAA presence and agricultural decisions. We estimate the regressions including a dummy variable equal to one if NSAA had been present at least a year between 2008 and 2010 (Table A8). The dummy variable is negative and statistically significant for seasonal crops and cattle ranching, showing the effect is indeed stronger when NSAA presence is recent and confirming our results are capturing the association between NSAA presence and farmers' planting decisions.

The presence of NSAA in the territory might affect households' behavior through different mechanisms. One first mechanism is the uncertainty brought about when two groups are contesting the region. In Table 5 we explore whether the presence of more than one NSAA in the territory explains a portion of the effect by restricting the sample to only the communities with NSAA presence and substituting years of NSAA presence with a dummy variable equal to one when more than one NSAA group is present. The presence of more than one NSAA in the rural district affects land use when interacted with the incidence of shocks. In regions with more than one NSAA, more type of shocks are associated with less land dedicated to perennial crops, more to seasonal crops and less idle land. Signaling again that uncertainty seems to push households to subsistence production. When we separate by type of shocks other interesting features emerge. The effects on land use for rural districts with more than one NSAA group are mostly driven by kidnapping and threats. However, the effects diverge significantly. On the one hand, kidnapping in these districts is related to more land allocated to perennial and seasonal crops, and less to cattle ranching and idle land. The victims of kidnapping in Colombia are wealthy families that can afford to pay the ransom. Thus, our households are not likely victims of this type of violence. Willingness to invest in perennial crops may be the result of lower uncertainty for the ELCA households in spite of other households facing more violence and uncertainty. On the other, land use for rural districts with more than one NSAA and incidence of threats is associated with less land allocated to perennial crops and more to cattle ranching, NSAA may use threats to control the territory, instill fear and alienate the population against the opposing group. This may lead to high uncertainty pushing households to cattle ranching.

[Table 5 goes about here]

Other mechanism through which NSAA presence affects the behavior of households is the norms and regulation they impose on the population. In order to explore this, we estimate the regressions again restricting the sample to those districts with NSAA presence and substitute years of presence with two dummy variables. The first dummy variable is equal to one when NSAA impose social norms and the second is equal to one when NSAA impose economic regulations (NSAA seized or forcefully demand cattle and/or crops, tax the population or forced households to cultivate illicit crops). Because we only have data on NSAA behavior for those districts in which the community leaders report NSAA presence, we have to restrict the sample further than in Table 5. Table 6 only reports the result for the continuous number of type of shocks. The coefficient estimates for the interaction terms disaggregated by type of shock drop for many of the regressions. Not surprisingly, imposition of economic regulations has a stronger association with the outcomes for land use than imposition of social norms. In regions with imposition of economic regulations, farmers allocate more land to crops with lower profitability that provide food for subsistence and diversify risks (seasonal and mix), while dedicating less land to perennials. In addition, less land is left idle. This suggests NSAA might be coercing farmers to produce food to sustain combatants (Weinstein 2007). If violent incidents occur in these regions, farmers seem to reduce drastically agricultural production by dedicating less land to seasonal crops and having more idle land. Because the economic regulations imposed by NSAA extract economic surplus from farmers, the incentives for agricultural production beyond food production might be low. When violence erupts and groups lose their grip on the population, households may decide to reduce agricultural production. On the other hand, rural districts in which NSAA impose social norms households dedicate less land to perennials and mixed crops while more to cattle ranching, which has lower profitability. If there are also violent shocks, households decrease cattle ranching and increase the land dedicated to perennial crops. In both cases the change is of higher magnitude than when there were no violent shocks. This may indicate that households are forced (probably by means of threats) to use land more productively.

[Table 6 goes about here]

4.5. Robustness Check

Spillovers across boundaries of the rural district are a potential confounding factor. These spillovers may arise because the presence of non-state armed actors may influence household decisions beyond the borders of the rural district, and households may migrate to neighboring districts to avoid the impacts of conflict. If this is the case, we would expect also the presence of NSAA to include land use in neighboring communities indicating that our results may underestimate the true effect of armed group presence on land use. We perform two robustness checks to test for potential spillover effects.

First, we conducted a placebo test. For each rural community without presence of NSAA, we assigned the average number of years of presence of the bordering communities with presence of armed groups. We estimated then the regressions using only the sample of the communities without NSAA presence. A statistically significant coefficient for years of presence would be indicative of spillover effects. Table A9 shows in Panel A the baseline results we report in Table 4 and the results for this placebo test in Panel B. We find that the coefficients are not statistically significant. These results strongly suggest that spillover effects are unlikely to affect our results.

Second, we drop migrants from the estimations in order to estimate the effect only for those households whose members were born and have lived in the rural district in which they were interviewed. The results for the sample of permanent residents in Panel C of Table A9 show stronger coefficients. Permanent residents have stronger ties to their communities and are less likely to migrate. Thus, we expect the association between shocks and the presence of non-state armed actors, on the one hand, and agricultural decisions, on the other, to be stronger. The coefficient estimates for permanent residents have in most cases the same signs as the original results, yet their magnitude is larger.

5. Conclusions

This paper explores the association between conflict dynamics and households' agricultural decisions. We explore whether households respond differently to conflict shocks and uncertainty brought about by the presence of non-state armed actors. Households may learn

to live amid conflict, adapt their behavior to prevent aggression from non-state armed actors, and mitigate the economic consequences of violence.

We first propose a model that highlights the distortions faced by a small farmer living in autarky who is hit by violent shocks but is uncertain of the nature of the shocks. Shocks may arise when either the government or the non-state armed actor is hegemonic in the region; in the latter case, shocks tend to be worse (in the likelihood ratio sense). Therefore a more violent shock leads the farmer to update beliefs and think that there is a higher probability that the non-state armed actor will dominate in his region. We concentrate on the impact of violent shocks and uncertainty on land use.

The model shows that more pessimistic beliefs lead the agent to exchange perennial crops for other agricultural activities, which are less risky but also less profitable. Similarly, a violent shock will also reduce the land used for perennial crops. However, the effect of a violent shock on other agricultural activities is ambiguous. On one hand, if the farmer is certain about the distribution of the shocks, then a violent shock will also decrease the land used for other agricultural activities since there is less available production. On the other hand, if the farmer is uncertain about the distribution of the shocks, a violent shock will induce more pessimistic beliefs and the farmer may increase the land dedicated to other agricultural activities for self-insurance purposes.

We apply a household survey representative of four Colombian micro-regions to explore these predictions. Colombia has faced civil war for more than half a century; thus, it is the ideal context in which to investigate how households adjust their decisions in conflict-ridden regions. Because the presence of non-state armed actors is not random, our empirical strategy creates contiguous pairs of rural districts with and without the presence of non-state armed actors. We include fixed effects for each contiguous pair, which control for unobservables that are potentially correlated with armed group presence and may bias our coefficient estimates. We also include a rich set of controls at the household, land plot, rural district, and municipality levels. Despite reducing the endogeneity bias, we are not claiming causality. Our results are indicative of a potential causal impact of violent shocks and presence of non-state armed actors, on the one hand, and land use, on the other.

Similarly to Kalyvas (2006), we find that the presence of armed groups does not necessarily coincide with violent assaults against the civilian population. In fact, the

incidence of violent shocks is lower in rural districts where non-state armed actors are present. This implies that households may adjust their behavior to prevent future assaults, become less visible to armed groups, or reduce other costs of conflict. The results suggest that households may learn to live amid conflict, yet at a lower income trajectory. The resilience of households and their ability to navigate conflict become evident when we explore the effects of the years of presence of NSAA. If NSAA stay for a longer period of time, a proxy for beliefs of hegemonic control, households continue agricultural production but shift away from activities that require higher investments, such as perennial crops, and concentrate on activities with short-term yields and lower profitability. When violence erupts in regions with NSAA presence, farmers seem to even shift away from these activities and concentrate on subsistence production which may provide food for themselves and probably for NSAA. The uncertainty brought by having more than one NSAA in the territory and the imposition of economic regulations are two mechanisms that seem to be driving part of the results.

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 create favorable conditions to reduce uncertainty. An initial step would be to rapidly improve the rule of law. In addition, policies that go beyond individual beneficiaries and target the community could improve trust among households, reducing the perception of uncertainty. Reducing uncertainty, paired with increased access to formal credit, 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.

Acemoglu, D., J. A. Robinson, et al. (2012). "Finding El Dorado: Slavery and Long-Run Development in Colombia." Journal of Comparative Economics **40**(4): 534-564.

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

Athey, S. (2002). "Monotone Comparative Statics under uncertainty." The Quaterly Journal of Economics: 187-223.

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.

Dube, A., T. W. Lester, et al. (2010). "Minimum Wage Effects Across State Borders: Estimates Using Contiguous Counties." Review of Economic and Statistics **92**(4): 945-964.

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.

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.

GMH, G. d. M. H.-. (2013). ¡Basta ya! Colombia: memorias de guerra y dignidad, Gobierno Nacional de Colombia.

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 (2010b). 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.

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 (2013). "Poverty Dynamics, Violent Conflict and Convergence in Rwanda." Review of Income and Wealth **59**(1): 66–90.

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.

Naidu, S. (2012). Suffrage, Schooling, and Sorting in the Post-Bellum US South. **NBER Working Paper No. 18129**.

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, 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.

Weinstein, J. (2007). Inside Rebellion. The Politics of Insurgent Violence. New York, NY, USA.

Wood, E. J. (2003). Insurgent Collective Action and Civil War in El Salvador. New York, United States, Cambridge Universty Press.

Table 1. Years of presence: number and percentage of rural districts

Years of presence	Rural district	Percentage
0	123	60,29
1	31	15,20
2	9	4,41
3	9	4,41
4	20	9,31
5	4	1,96
6	4	1,96
7	0	0
8	1	0,49
9	4	1,96
Total	204	100%
Mean (Standard deviation)	1.17 (1.95)	

Source: ELCA, First Wave. Government. Author's Calculations.

Table 2. Incidence of shocks during the last year: overall sample and by presence of non-state armed actors (NSAA)

	All rural districts	No NSAA presence	NSAA Presence
Number of shocks	0,18	0,22	0,15
	(0.46)	(0.52)	(0.41)
=1 if a covariate violent shock during previous year	15,41%	13,82%	18,52%
Homicides	11,57%	11,38%	11,11%
Land seizure	0,92%	0,81%	1,23%
Kidnaps	1,10%	0,81%	2,47%
Threats from armed groups	3,82%	2,44%	7,41%

NSAA: Non-State armed actors

Source: ELCA, First Wave. Author's calculations.

Table 3. Descriptive statistics: outcome variables

	Overall sample	=1 at least one year of NSAA presence				=1 at least one conflict-induced shock			
		No	Yes		pvalues	No	Yes		pvalues
% of land used in perennial crops	19.5%	18.2%	21.64%	**	0.002	19.65%	18.84%		0.586
	(0.32)	(0.30)	(0.35)			(0.32)	(0.31)		
% of land used in seasonal crops	15.4%	16.29%	13.88%		0.013	14.99%	17.49%	**	0.057
	(0.29)	(0.30)	(0.27)			(0.28)	(0.31)		
% of land used in mixed crops	21.0%	21.61%	20.02%		0.133	21.85%	16.31%	***	0.000
	(0.31)	(0.31)	(0.31)			(0.32)	(0.28)		
% of land used for cattle ranching	14.1%	13.86%	14.47%		0.554	13.41%	17.91%	**	0.001
	(0.30)	(0.30)	(0.31)			(0.30)	(0.34)		
% of idle land	6.2%	5.417%	7.43%	***	0.001	5.98%	7.29%		0.116
	(0.18)	(0.17)	(0.20)			(0.18)	(0.20)		
% land used in forest	2.4%	2.228%	2.60%		0.321	2.33%	2.61%		0.578
	(0.11)	(0.11)	(0.10)			(0.11)	(0.10)		
% land with other use	10.6%	10.948%	10.14%		0.321	10.95%	8.94%	**	0.068
	(0.24)	(0.23)	(0.25)			(0.24)	(0.21)		
Observations	3735	2313	1422			3167	568		

Source: Authors' Calculations Based on ELCA (Wave I) and National Government.

* p<0.10, ** p<0.05, ***p<0.01. Standard Deviation in Parenthesis

Table 4. Land use: linear probability model with contiguous pair fixed effects

Variable	Perennial crops	Seasonal Crops	Mixed Crops	Cattle Ranching	Idle Land
PANEL A					
Years of presence NSAA	-0.00739	-0.0408**	0.0256***	0.0593***	-0.00414
	[0.0196]	[0.0150]	[0.00810]	[0.0145]	[0.0155]
Number of type of violent shocks	0.176	-0.322***	0.290***	0.181**	0.0228
	[0.104]	[0.0641]	[0.0655]	[0.0678]	[0.0894]
Years of presence*number of type of shocks	-0.829	3.185***	-1.415	-0.501	-0.203
	[0.788]	[0.773]	[0.909]	[0.521]	[0.635]
Observations	3,735	3,735	3,735	3,735	3,735
R-squared	0.218	0.198	0.403	0.239	0.114
PANEL B					
Years of presence NSAA	-0.0160	-0.0460***	0.0293**	0.0603***	-0.00627
	[0.0267]	[0.0138]	[0.0120]	[0.0151]	[0.0144]
=1 if homicide in rural districy previous year	0.168*	-0.327***	0.294***	0.182**	0.0208
	[0.0856]	[0.0633]	[0.0679]	[0.0668]	[0.0885]
=1 if land seizure in rural district previous year	-0.583***	0.197**	-0.183*	0.106**	-0.0484
	[0.118]	[0.0765]	[0.0872]	[0.0444]	[0.0756]
=1 if kidnapping in rural district previous year					
=1 if threat in rural district previous year	-15.07	-42.59***	23.45	6.595	-3.435
	[26.00]	[14.42]	[20.27]	[15.03]	[10.76]
Years of presence*Homicide	-1.801	2.597**	-0.996	-0.384	-0.442
	[1.552]	[1.054]	[1.048]	[0.343]	[0.903]
Years of presence*Land seizure	0.0363	-0.0734*	0.154**	-0.0602**	0.0309*
	[0.0452]	[0.0373]	[0.0550]	[0.0279]	[0.0162]
Years of presence*Kidnapping	0.00610	0.0250	-0.140***	0.0339	0.00835
	[0.0392]	[0.0358]	[0.0416]	[0.0481]	[0.0244]
Years of presence*threats	1.658	4.689***	-2.488	-0.800	0.410
	[2.877]	[1.605]	[2.244]	[1.644]	[1.190]
Observations	3,735	3,735	3,735	3,735	3,735
R-Squared	0.218	0.198	0.403	0.239	0.114
Mean dependent variable	0,20	0,15	0,21	0,14	0,06
Standard deviation dependent variable	(0.32)	(0.29)	(0.31)	(0.30)	(0.18)

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. Clustered standard errors

NSAA: Non-state armed actors

Years of presence of NSAA: number of years non-state armed actors were present in the community between 2010 and 2013

Number of type of violent shocks: number of type of violent shocks that occurred the year previous to the survey. The type of shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to 4

Controls include gender household head, age household head, years of education household head, household size, number of members below 14 years of age, number of members between 14 and 60, number of members older than 60, =1 if househod beneficiary of Familia en Acción, size of land plot, =1 households has formal legal title of land plot, rental value of land plot, soilt fertily dummy variables (1 to 9), =1 access to water sources, altitude above sea level, distance to state capital, distance to primary roads, distance to other roads, distance to nearest seashore, distance to nearest illicit crop cultivation, rainfall historic mean, number of months during previous years with rain below historic mean, number of months during previous years with rain below historic mean squared, number of months during previous years with rain above historic mean, number of months during previous years with rain below historic mean squared, =1 if cattle theft the previous years, price index of agricultural goods produced in rural district, =1 if problems to obatain credit, average municipal homicide rates from 1993 to 2000 and average municipal homicide rates from 2000 to 2008

Table 5. Land use: linear probability model with contiguous pair fixed effects
Sample restricted to rural districts with non-state armed actors' (NSAA) presence

Variable	Perennial crops	Seasonal Crops	Mixed Crops	Cattle Ranching	Idle Land
=1 if more than one NSAA in rural district	0.0205	0.000331	-0.0142	-0.0347	-0.00471
	[0.0197]	[0.0113]	[0.0218]	[0.0217]	[0.0195]
Number of type of shocks	0.0224	-0.00268	-0.00527	-0.0161	0.0447**
	[0.0219]	[0.0241]	[0.0264]	[0.0249]	[0.0199]
=1 if more than one NSAA in district*number of type of shocks	-0.0836***	0.0701**	0.0452	0.0153	-0.0450*
	[0.0231]	[0.0240]	[0.0308]	[0.0245]	[0.0254]
Observations	1,422	1,422	1,422	1,422	1,422
R-Squared	0.199	0.092	0.398	0.145	0.078
=1 if more than one NSAA in rural district	0.0233	-0.000425	-0.00520	-0.0362*	-0.0114
	[0.0194]	[0.0139]	[0.0193]	[0.0198]	[0.0202]
=1 if homicide in rural districy previous year	0.0185	0.0159	0.0171	0.0114	0.00930
	[0.0295]	[0.0526]	[0.0257]	[0.0191]	[0.0112]
=1 if land seizure in rural district previous year	-0.0233	-0.131***	0.116**	0.0601	-0.0588**
	[0.0512]	[0.0361]	[0.0395]	[0.0453]	[0.0233]
=1 if kidnapping in rural district previous year	-0.0811*	-0.123**	0.163**	0.0487	0.180***
	[0.0418]	[0.0521]	[0.0632]	[0.0341]	[0.0412]
=1 if threat in rural district previous year	0.0858**	0.0329	-0.124**	-0.0946**	0.0589*
	[0.0365]	[0.0467]	[0.0474]	[0.0325]	[0.0335]
=1 if more than one NSAA in district*Homicide	-0.0517	0.0417	-0.0983**	0.0160	0.00264
	[0.0341]	[0.0812]	[0.0357]	[0.0322]	[0.0649]
=1 if more than one NSAA in district*Land seizure					-0.133
					[0.0858]
=1 if more than one NSAA in district*Kidnapping	0.153**	0.147*	0.0580	-0.165***	-0.261***
	[0.0613]	[0.0758]	[0.0692]	[0.0390]	[0.0760]
=1 if more than one NSAA in district*threats	-0.282***	0.0721	0.190***	0.149***	-0.0174
	[0.0536]	[0.0549]	[0.0578]	[0.0376]	[0.0330]
Observations	1,422	1,422	1,422	1,422	1,422
R-Squared	0.202	0.095	0.406	0.148	0.085
Mean dependent variable	0,22	0,14	0,20	0,14	0,07
Standard deviation dependent variable	(0.35)	(0.27)	(0.31)	(0.31)	(0.20)

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. Clustered standard errors

NSAA: Non-state armed actors

Years of presence of NSAA: number of years non-state armed actors were present in the community between 2010 and 2013

Number of type of violent shocks: number of type of violent shocks that occurred the year previous to the survey. The type of shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to 4

Controls include gender household head, age household head, years of education household head, household size, number of members below 14 years of age, number of members between 14 and 60, number of members older than 60, =1 if househod beneficiary of Familia en Acción, size of land plot, =1 households has formal legal title of land plot, rental value of land plot, soilt fertily dummy variables (1 to 9), =1 access to water sources, altitude above sea level, distance to state capital, distance to primary roads, distance to other roads, distance to nearest seashore, distance to nearest illicit crop cultivation, rainfall historic mean, number of months during previous years with rain below historic mean, number of months during previous years with rain below historic mean squared, number of months during previous years with rain above historic mean, number of months during previous years with rain below historic mean squared, =1 if cattle theft the previous years, price index of agricultural goods produced in rural district, =1 if problems to obatain credit, average municipal homicide rates from 1993 to 2000 and average municipal homicide rates from 2000 to 2008

Table 6. Land use: linear probability model with contiguous pair fixed effects
Sample restricted to rural districts with non-state armed actors' (NSAA) presence report in rural district questionnaire

Variable	Perennial crops	Seasonal Crops	Mixed Crops	Cattle Ranching	Idle Land
=1 if NSAA impose economic regulations	-0.0781***	0.0483**	0.0323**	-0.0173	-0.0492**
	[0.0132]	[0.0186]	[0.0137]	[0.0365]	[0.0161]
=1 if NSAA impose social norms	-0.0453***	0.00995	-0.0235*	0.0766*	0.0172
	[0.0129]	[0.0182]	[0.0113]	[0.0361]	[0.0247]
Number of type of shocks	-0.178***	0.131***	-0.0306	0.0613	0.0313
	[0.0183]	[0.0213]	[0.0325]	[0.0505]	[0.0293]
=1 if NSAA impose economic regulations*number of type of shocks	0.00809	-0.0832**	0.0298	0.0818	0.0847**
	[0.0249]	[0.0364]	[0.0355]	[0.0513]	[0.0338]
=1 if NSAA impose social norms*number of type of shocks	0.142***	0.00812	0.0382	-0.179***	-0.0889***
	[0.0372]	[0.0510]	[0.0460]	[0.0333]	[0.0228]
Observations	865	865	865	865	865
R-Squared	0.195	0.128	0.338	0.144	0.081
Mean dependent variable	0,27	0,12	0,13	0,18	0,05
Standard deviation dependent variable	(0.37)	(0.27)	(0.26)	(0.34)	(0.17)

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. Clustered standard errors

NSAA: Non-state armed actors

Years of presence of NSAA: number of years non-state armed actors were present in the community between 2010 and 2013

Number of type of violent shocks: number of type of violent shocks that occurred the year previous to the survey. The type of shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to 4

Controls include gender household head, age household head, years of education household head, household size, number of members below 14 years of age, number of members between 14 and 60, number of members older than 60, =1 if household beneficiary of Familia en Acción, size of land plot, =1 households has formal legal title of land plot, rental value of land plot, =1 access to water sources, altitude above sea level, distance to state capital, distance to primary roads, distance to other roads, distance to nearest seashore, distance to nearest illicit crop cultivation, rainfall historic mean, number of months during previous years with rain below historic mean, number of months during previous years with rain below historic mean squared, number of months during previous years with rain above historic mean, number of months during previous years with rain below historic mean squared, =1 if cattle theft the previous years, price index of agricultural goods produced in rural district, =1 if problems to obtain credit, average municipal homicide rates from 1993 to 2000 and average municipal homicide rates from 2000 to 2008

Appendix

Table A1. Presence of Non-State Armed Actors: National Government and Rural District Questionnaire

% of rural communities (ELCA)		NSAA presence (Government)		
		No	Yes	Total
NSAA presence (rural district questionnaire)	No	51,2%	15,3%	66,5%
	Yes	8,9%	24,6%	33,5%
	Total	60,1%	39,9%	100,0%

NSAA: Non-state armed actors

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

Table A2. Probability of selection into the sample: linear probability model

Variable	
=1 if Household Head is Male	-0.00104
	[0.00932]
Age of Household Head	0.000961
	[0.00171]
Years of Education of Household Head	0.000351
	[0.00121]
Number of Household Members	-0.174***
	[0.0542]
Number of Members Less than 14 Years of Age	0.170***
	[0.0543]
Number of Members Between 14 and 60 Years of Age	0.176***
	[0.0543]
Number of Members Older than 60 Years of Age	0.174***
	[0.0546]
=1 if Household is a Beneficiary of *Familias en Acción*	0.000952
	[0.00864]
Wealth Index	0.00216
	[0.00158]
Size of Land Plot (Hectaries)	-0.000104
	[0.000560]
=1 if Household has a Formal Legal Title over Land Plot	-0.0200**
	[0.00802]
Rental Value of Land Plot	5.15e-09
	[4.41e-09]
=1 if Land Plot has Access to Water Sources	-0.00437
	[0.00800]
Altitude Above Sea Level	2.48e-05*
	[1.27e-05]
Distance from Land Plot to State Capital (km)	-0.000858
	[0.000602]
Distance to Primary Roads (km)	0.00351***
	[0.000789]
Distance to Other Roads (km)	-0.00256
	[0.00171]
Distancia to Nearest Seashore (km)	0.000920***
	[0.000101]
Distance to Nearest Illicit Crop Cultivation (km)	0.0200***
	[0.00165]
Number of Months during Previous Year with Rain Below Historic Mean	-0.123***
	[0.0162]
Number of Months during Previous Year with Rain Above Historic Mean	0.125***
	[0.0175]
Rainfall Historic Mean	-0.000312
	[0.000251]
Average Municipal Homicide Rates from 1993 to 2000	-0.000983**
	[0.000458]
Average Municipal Homicide Rates from 2000 to 2008	0.00124
	[0.000835]
Observations	

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. Standard Error in Parenthesis

Table A3. Rural district characteristics: coefficient of non-state armed actors' (NSAA) presence without and with contiguous pair fixed effects

Variable	Without Contiguous Pair Fixed Effects	With Contiguous Pair Fixed Effects
=1 if rural development programs in the rural district	-0.130**	0.0174
	[0.0620]	[0.123]
=1 if road access in good condition	0.0485	-0.140
	[0.0644]	[0.106]
Time to Urban Center	9.274*	8.692
	[5.228]	[8.744]
=1 if rural district has supply of machinery for rent	-0.0554	-0.0698
	[0.0522]	[0.113]
=1 if agricultural goods sold to middlemen or agricultural cooperatives	0.119*	0.209
	[0.0650]	[0.136]
Number of Problems for Agricultural Production	-0,133	0.535
	[0.203]	[0.397]
Daily Agricultural Wage	1,920***	532.0
	[441.7]	[1,363]
Observations	204	204

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

* p<0.10, ** p<0.05, ***p<0.01. Standard Error in Parenthesis

Table A4. Probability of non-state armed actors (NSAA) imposing social norms and economic regulations: Linear probability at the rural district level

Variables	NSAA impose economic regulationsMechanisms	NSAA impose social norms
Years of presence NSAA	0.215***	0.239***
	(0.0243)	[0.0448]
Years of presence NSAA - squared	-0.0153***	-0.0183**
	(0.00391)	[0.00641]
Number of type of violent shocks	0.00384	0.0591
	(0.0468)	[0.0567]
Observations	173	173
R-squared	0.391	0.456

NSAA: Non-state armed actors

Years of presence of NSAA: number of years non-state armed actors were present in the community between 2010 and 2013

Number of type of violent shocks: number of type of violent shocks that occurred the year previous to the survey. The type of shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to

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

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table A5. Probability of non-state armed actors' (NSAA) presence: Linear probability model at the rural district level

Variable	**Probability of NSAA presence**
Altitude Above Sea Level	0.000296***
	[8.48e-05]
Distance to State Capital (km)	0.0110***
	[0.00368]
Distance to State Capital (km) sq.	-5.84e-05***
	[2.10e-05]
Distance to Nearest Illicit Crop Cultivation (km)	0.0176
	[0.0144]
Distance to Nearest Illicit Crop Cultivation (km) sq.	-5.68e-05
	[7.31e-05]
Distance to Nearest Seashore (km)	0.000179
	[0.000867]
Distance to Primary Roads (km)	0.00306
	[0.00600]
Distance to Other Roads (km)	-0.0347***
	[0.0130]
Observations	204
R-squared	0.177

NSAA: Non-state armed actors

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

* p<0.10, ** p<0.05, ***p<0.01. Robust Standard Errors in Parenthesis

Table A6. Descriptive statistics: control variables

Variable	Overall sample	=1 at least one year of NSAA presence				=1 at least one violent shock			
		No	Yes		pvalue	No	Yes		pvalue
=1 if Household Head is Male	80,24%	80,89%	79,18%		0,204	79,29%	85,56%	***	0,001
	(0.4)	(0.39)	(0.41)			(0.41)	(0.35)		
Age of Household Head	47,01	47,36	46,44	**	0,039	46,91	47,57		0,272
	(13.18)	(13.58)	(12.47)			(13.11)	(13.56)		
Years of Education of Household Head	4,21	4,27	4,11		0,163	4,24	4,02		0,142
	(3.37)	(3.46)	(3.23)			(3.37)	(3.35)		
Number of Household Members	4,57	4,60	4,50		0,121	4,53	4,75	**	0,018
	(1.98)	(2.01)	(1.92)			(1.98)	(1.97)		
Number of Members Less than 14 Years of Age	1,32	1,31	1,34		0,587	1,30	1,45	**	0,013
	(1.35)	(1.34)	(1.36)			(1.35)	(1.34)		
Number of Members Between 14 and 60 Years of Age	2,74	2,79	2,66	**	0,005	2,74	2,78		0,520
	(1.41)	(1.42)	(1.38)			(1.41)	(1.39)		
Number of Members Older than 60 Years of Age	0,50	0,50	0,50		0,873	0,50	0,52		0,539
	(0.72)	(0.73)	(0.71)			(0.72)	(0.77)		
=1 if Household is a Beneficiary of *Familias en Acción*	41,50%	42,15%	40,44%		0,301	41,52%	41,37%		0,947
	(0.49)	(0.49)	(0.49)			(0.49)	(0.49)		
Wealth Index	-0,02	0,12	-0,23	***	0,000	-0,02	0,04		0,601
	(2.52)	(2.72)	(2.14)			(2.52)	(2.53)		
Size of Land Plot (Hectaries)	2,81	2,88	2,68		0,468	2,95	2,01	**	0,012
	(8.14)	(0.20)	(0.12)			(8.75)	(2.81)		
=1 if Household has a Formal Legal Title over Land Plot	33,41%	33,46%	33,33%		0,935	32,81%	36,80%	*	0,064
	(0.47)	(0.47)	(0.47)			(0.47)	(0.48)		
Rental Value of Land Plot	431473	454547	393941		0,097	439083	389037		0,311
	(1083179)	(1156582)	(950965)			(1142025)	(664863)		
=1 if Land Plot has Access to Water Sources	52,34%	54,86%	48,24%	***	0,000	52,92%	49,12%	*	0,095
	(0.50)	(0.50)	(0.50)			(0.50)	(0.50)		
Soil fertility index: level 1 (highest)	2,20%	1,90%	2,67%		0,119	2,53%	0,35%	***	0,001
	(0.15)	(0.14)	(0.16)			(0.16)	(0.06)		
Soil fertility index: level 2	1,61%	0,91%	2,74%	***	0,000	1,11%	4,40%	***	0,000
	(0.13)	(0.09)	(0.16)			(0.10)	(0.21)		
Soil fertility index: level 3	11,22%	10,42%	12,52%	**	0,049	11,05%	12,15%		0,446
	(0.32)	(0.31)	(0.33)			(0.31)	(0.33)		
Soil fertility index: level 4	22,92%	17,99%	30,94%	***	0,000	21,91%	28,52%	***	0,001
	(0.42)	(0.38)	0,46			(0.41)	(0.45)		
Soil fertility index: level 5	11,73%	8,47%	17,02%	***	0,000	12,31%	8,45%	***	0,008
	(0.32)	(0.28)	(0.38)			(0.33)	(0.28)		
Soil fertility index: level 6	23,67%	32,08%	9,99%	***	0,000	24,41%	19,54%	**	0,012
	(0.43)	(0.47)	(0.30)			(0.43)	(0.40)		
Soil fertility index: level 7	1,31%	1,73%	0,63%	***	0,004	1,55%	0,00%	***	0,003
	0,11	0,13	0,08			(0.12)	0,00		
Soil fertility index: level 8	7,87%	5,58%	11,60%	***	0,000	6,69%	0,00%	***	0,000
	(0.27)	(0.23)	(0.32)			(0.25)	0,00		
Soil fertility index: level 9 (lowest)	16,41%	20,10%	10,41%	***	0,000	17,18%	12,15%	***	0,003
	(0.37)	(0.40)	(0.31)			(0.38)	(0.33)		
Altitude Above Sea Level	1268,06	1219,92	1346,37	***	0,000	1258,25	1322,76		0,175
	(1042.98)	(1066.41)	(999.12)			(1058.7)	(949.59)		
Distance from Land Plot to State Capital (km)	68,21	66,31	71,29	***	0,000	69,22	62,58	***	0,000
	(41.5)	(43.84)	(37.17)			(40.54)	(46.1)		
Distance to Primary Roads (km)	7,74	6,11	10,40	***	0,000	7,17	10,91	***	0,000
	(9.06)	(7.25)	(10.90)			(8.06)	(12.87)		
Distance to Other Roads (km)	3,54	3,84	3,06	***	0,000	3,58	3,36	**	0,050
	(2.45)	(2.53)	(2.25)			(2.53)	(1.94)		
Distancia to Nearest Seashore (km)	173,67	169,50	180,45	*	0,006	177,10	154,54	***	0,000
	(117.2)	(128.04)	(96.66)			(118.32)	(108.87)		
Distance to Nearest Illicit Crop Cultivation (km)	88,03	84,68	93,47	***	0,000	87,07	93,40	***	0,000
	(34.41)	(31.68)	(37.83)			(34.30)	(34.58)		
Number of Months during Previous Year with Rain Below Historic Mea	1,45	1,31	1,66	***	0,000	1,38	1,82	***	0,000
	(1.12)	(1.15)	(1.04)			(1.09)	(1.19)		
Number of Months during Previous Year with Rain Above Historic Mea	0,81	0,77	0,89	***	0,000	0,83	0,72	*	0,008
	(0.92)	(0.96)	(0.83)			(0.92)	(0.88)		
Rainfall Historic Mean	141,87	143,80	138,72	***	0,000	140,96	146,91	***	0,000
	(30.40)	(28.22)	(33.43)			(30.3)	(30.52)		
=1 if cattle theft the previous year	28,09%	27,63%	28,83%		0,426	27,34%	32,22%	**	0,017
	(0.45)	(0.45)	(0.45)			(0.45)	(0.47)		
Price Index of Agricultural Goods Produced in Rural District	1,18	1,14	1,22	***	0,000	1,19	1,09	***	0,000
	(0.31)	(0.33)	(0.27)			(0.28)	(0.44)		
=1 If Problems to Obtain Credit	0,39	0,41	0,36	**	0,001	0,40	0,32	***	0,000
	(0.49)	(0.49)	(0.48)			(0.49)	(0.47)		
Average Municipal Homicide Rates from 1993 to 2000	56,89	51,36	65,87	***	0,000	57,66	52,59	**	0,013
	(44.54)	(41.19)	(48.17)			(45.82)	(36.28)		
Average Municipal Homicide Rates from 2000 to 2008	37,28	33,81	42,91	***	0,000	37,24	37,49		0,839
	(27.45)	(24.18)	(31.27)			(28.12)	(23.44)		
Observations	3735	2313	1422			3167	568		

NSAA: Non-state armed actors

The type of violent shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to 4

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. Standard Error in Parenthesis

Table A7. Differences in sample means for rural districts with and without non-state armed actors' (NSAA) presence

Variable	Without Contiguous Pair Fixed Effects	With Contiguous Pair Fixed Effects
=1 if Household Head is Male	-0.0171	0.0211
	[0.0134]	[0.0296]
Age of Household Head	-0.916**	-0.814
	[0.444]	[0.947]
Years of Education of Household Head	-0.159	-0.0673
	[0.114]	[0.247]
Number of Household Members	-0.103	0.214
	[0.0666]	[0.145]
Number of Members Less than 14 Years of Age	0.0246	0.162*
	[0.0454]	[0.0976]
Number of Members Between 14 and 60 Years of Age	-0.132***	0.0893
	[0.0475]	[0.104]
Number of Members Older than 60 Years of Age	0.00389	-0.0371
	[0.0244]	[0.0535]
=1 if Household is a Beneficiary of *Familias en Acción*	-0.0172	-0.0376
	[0.0166]	[0.0347]
Wealth Index	-0.351***	-0.106
	[0.0848]	[0.178]
Size of Land Plot (Hectaries)	-0.199	-0.110
	[0.274]	[0.608]
=1 if Household has a Formal Legal Title over Land Plot	-0.00130	-0.0882***
	[0.0159]	[0.0333]
Rental Value of Land Plot	-60,605*	-97,626
	[36,493]	[77,444]
=1 if Land Plot has Access to Water Sources	-0.0662***	-0.147***
	[0.0168]	[0.0337]
Soil fertility index: level 1 (highest)	0.00770	0.000892
	[0.00494]	[0.00648]
Soil fertility index: level 2	0.0183***	-0
	[0.00423]	[0.00431]
Soil fertility index: level 3	0.0210**	-0.0593***
	[0.0106]	[0.0109]
Soil fertility index: level 4	0.130***	0.336***
	[0.0140]	[0.0122]
Soil fertility index: level 5	0.0854***	-0.129***
	[0.0108]	[0.0116]
Soil fertility index: level 6	-0.221***	-0.0381***
	[0.0139]	[0.0106]
Soil fertility index: level 7	-0.0110***	-0.00208
	[0.00383]	[0.00290]
Soil fertility index: level 8	0.0603***	0.00298
	[0.00902]	[0.0120]
Soil fertility index: level 9 (lowest)	-0.0970***	-0.107***
	[0.0124]	[0.00952]
Altitude Above Sea Level	126.4***	76.29***
	[35.09]	[19.42]
Distance from Land Plot to State Capital (km)	4.976***	-4.712***
	[1.396]	[0.659]
Distance to Primary Roads (km)	4.294***	1.782***
	[0.297]	[0.0902]
Distance to Other Roads (km)	-0.775***	-0.442***
	[0.0817]	[0.0543]
Distancia to Nearest Seashore (km)	10.95***	-31.59***
	[3.946]	[2.201]
Distance to Nearest Illicit Crop Cultivation (km)	8.786***	0.0159
	[1.151]	[0.455]
Number of Months during Previous Year with Rain Below	0.349***	-0.00356
	[0.0373]	[0.0266]
Number of Months during Previous Year with Rain Above	0.123***	0.180***
	[0.0308]	[0.0190]
Rainfall Historic Mean	-5.078***	6.885***
	[1.021]	[0.531]
=1 if cattle theft the previous year	0.0121	-0.192***
	[0.0151]	[0.00699]
Price Index of Agricultural Goods Produced in Rural Distri	0.0793***	0.0158***
	[0.0105]	[0.00188]
=1 If Problems to Obtain Credit	-0.0534***	-0.0540***
	[0.0164]	[0.00915]
Average Municipal Homicide Rates from 1993 to 2000	14.51***	22.97***
	[1.482]	[0.677]
Average Municipal Homicide Rates from 2000 to 2008	9.098***	12.64***
	[0.913]	[0.368]
Observations	3,735	3,735

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.B41 Standard Error in Parenthesis

Table A8. Land use: linear probability model with contiguous pair fixed effects

Variable	Perennial crops	Seasonal Crops	Mixed Crops	Cattle Ranching	Idle Land
PANEL A					
Years of presence NSAA	-0.0121	-0.0451***	0.0245**	0.0650***	-0.00522
	[0.0250]	[0.0152]	[0.00919]	[0.0164]	[0.0153]
Number of type of violent shocks	0.133	-0.362***	0.280***	0.233**	0.0130
	[0.131]	[0.0660]	[0.0710]	[0.0828]	[0.0879]
Years of presence*number of type of shocks	-0.878	3.139***	-1.427	-0.440	-0.214
	[0.787]	[0.785]	[0.910]	[0.510]	[0.637]
=1 if presence at least one year 2008-2010	-0.215	-0.198**	-0.0515	0.263***	-0.0493
	[0.200]	[0.0863]	[0.0744]	[0.0851]	[0.0419]
Observations	3,735	3,735	3,735	3,735	3,735
R-squared	0.218	0.198	0.403	0.239	0.114
PANEL B					
Years of presence NSAA	-0.0197	-0.0496***	0.0280**	0.0655***	-0.00711
	[0.0319]	[0.0139]	[0.0127]	[0.0172]	[0.0142]
=1 if presence at least one year 2008-2010	-0.187	-0.182***	-0.0643	0.262***	-0.0425
	[0.218]	[0.0602]	[0.0633]	[0.0799]	[0.0330]
=1 if homicide in rural districy previous year	0.131	-0.363***	0.281***	0.234**	0.0124
	[0.116]	[0.0628]	[0.0719]	[0.0822]	[0.0873]
=1 if land seizure in rural district previous year	-0.653***	0.130	-0.207*	0.202***	-0.0642
	[0.170]	[0.0834]	[0.101]	[0.0617]	[0.0809]
=1 if kidnapping in rural district previous year	-	-	-	-	-
=1 if threat in rural district previous year	-13.55	-41.12**	23.97	4.473	-3.090
	[25.56]	[14.08]	[20.26]	[14.86]	[10.67]
Years of presence*Homicide	-1.799	2.599**	-0.995	-0.387	-0.442
	[1.543]	[1.062]	[1.050]	[0.345]	[0.907]
Years of presence*Land seizure	0.0523	-0.0579	0.159**	-0.0826**	0.0346**
	[0.0586]	[0.0388]	[0.0585]	[0.0308]	[0.0162]
Years of presence*Kidnapping	0.00248	0.0214	-0.141***	0.0390	0.00753
	[0.0423]	[0.0364]	[0.0423]	[0.0473]	[0.0243]
Years of presence*threats	1.498	4.533**	-2.543	-0.577	0.374
	[2.836]	[1.566]	[2.241]	[1.628]	[1.180]
Observations	3,735	3,735	3,735	3,735	3,735
R-Squared	0.218	0.198	0.403	0.239	0.114
Mean dependent variable	0.20	0.15	0.21	0.14	0.06
Standard deviation dependent variable	(0.32)	(0.29)	(0.31)	(0.30)	(0.18)

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. Clustered standard errors

NSAA: Non-state armed actors

Years of presence of NSAA: number of years non-state armed actors were present in the community between 2010 and 2013

Number of type of violent shocks: number of type of violent shocks that occurred the year previous to the survey. The type of shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to 4

Controls include gender household head, age household head, years of education household head, household size, number of members below 14 years of age, number of members between 14 and 60, number of members older than 60, =1 if househod beneficiary of Familia en Acción, size of land plot, =1 households has formal legal title of land plot, rental value of land plot, soilt fertily dummy variables (1 to 9), =1 access to water sources, altitude above sea level, distance to state capital, distance to primary roads, distance to other roads, distance to nearest seashore, distance to nearest illicit crop cultivation, rainfall historic mean, number of months during previous years with rain below historic mean, number of months during previous years with rain below historic mean squared, number of months during previous years with rain above historic mean, number of months during previous years with rain below historic mean squared, =1 if cattle theft the previous years, price index of agricultural goods produced in rural district, =1 if problems to obatain credit, average municipal homicide rates from 1993 to 2000 and

Table A9: Robustness checks – Baseline regression, placebo test and sample of permanent residents

Variable	Perennial crops	Seasonal Crops	Mixed Crops	Cattle Ranching	Idle Land
PANEL A: Main regresions					
Years of presence NSAA	-0.00739	-0.0408**	0.0256***	0.0593***	-0.00414
	[0.0196]	[0.0150]	[0.00810]	[0.0145]	[0.0155]
Number of type of violent shocks	0.176	-0.322***	0.290***	0.181**	0.0228
	[0.104]	[0.0641]	[0.0655]	[0.0678]	[0.0894]
Years of presence*number of type of shocks	-0.829	3.185***	-1.415	-0.501	-0.203
	[0.788]	[0.773]	[0.909]	[0.521]	[0.635]
Observations	3,735	3,735	3,735	3,735	3,735
R-squared	0.218	0.198	0.403	0.239	0.114
PANEL B: testing spillover effects					
Years of presence NSAA	0.317	-0.0509	-0.188	0.193	-0.0615
	[0.273]	[0.240]	[0.286]	[0.225]	[0.208]
Number of type of violent shocks	0.344	-0.122	-0.269	0.507	-0.142
	[0.502]	[0.433]	[0.493]	[0.375]	[0.383]
Years of presence*number of type of shocks	-0.340	0.112	0.122	-0.176	0.0635
	[0.219]	[0.214]	[0.231]	[0.227]	[0.169]
Observations	2,313	2,313	2,313	2,313	2,313
R-squared	0.197	0.232	0.389	0.268	0.089
PANEL C: only permanent residents					
Years of presence NSAA	-0.0536*	-0.0487*	0.0646**	0.0949***	0.00370
	[0.0289]	[0.0253]	[0.0254]	[0.0311]	[0.0263]
Number of type of violent shocks	0.506**	-0.415***	0.363	-0.0148	0.118
	[0.201]	[0.112]	[0.233]	[0.122]	[0.181]
Years of presence*number of type of shocks	-2.146	2.714**	-2.796*	0.836	0.124
	[1.332]	[1.019]	[1.401]	[0.920]	[1.166]
Observations	1,760	1,760	1,760	1,760	1,760
R-squared	0.288	0.272	0.477	0.358	0.164

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. Clustered standard errors

NSAA: Non-state armed actors

Years of presence of NSAA: number of years non-state armed actors were present in the community between 2010 and 2013

Number of type of violent shocks: number of type of violent shocks that occurred the year previous to the survey. The type of shocks includes homicides, land seizsure, kidnapping and threats from armed groups. Number of shocks ranges from 1 to 4

Controls include gender household head, age household head, years of education household head, household size, number of members below 14 years of age, number of members between 14 and 60, number of members older than 60, =1 if househod beneficiary of Familia en Acción, size of land plot, =1 households has formal legal title of land plot, rental value of land plot, soilt fertily dummy variables (1 to 9), =1 access to water sources, altitude above sea level, distance to state capital, distance to primary roads, distance to other roads, distance to nearest seashore, distance to nearest illicit crop cultivation, rainfall historic mean, number of months during previous years with rain below historic mean, number of months during previous years with rain below historic mean squared, number of months during previous years with rain above historic mean, number of months during previous years with rain below historic mean squared, =1 if cattle theft the previous years, price index of agricultural goods produced in rural district, =1 if problems to obatain credit, average municipal homicide rates from 1993 to 2000 and average municipal homicide rates from 2000 to 2008