

Ibáñez, Ana María; Arteaga, Julián; Cárdenas Campo, Juan Camilo; Arjona, Ana; Justino, Patricia

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The effects of wartime institutions on households' ability to cope with shocks: Evidence for Colombia

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WIDER Working Paper 2019/84

The effects of wartime institutions on households' ability to cope with shocks

Evidence for Colombia

Ana María Ibáñez,¹ Julián Arteaga,¹ Juan Camilo Cárdenas,¹ Ana Arjona,² Patricia Justino³

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Abstract: This paper studies the legacies of wartime institutions, measured as rebelocracy, on the ability of households to cope with negative income shocks. Rebelocracy is the social order established by non-state armed actors in the communities they control. By providing public goods and a predictable framework within which to operate, rebelocracy may generate incentives for households to expand production and accumulate wealth, placing them in a higher income trajectory than households living in war zones amid violence and chaos. If these better economic conditions persist after non-state armed actors leave the territory, households in communities that had stronger rebelocracy levels will be better able to cope with negative income shocks. The empirical strategy identifies households' responses to random weather shocks and estimates their heterogeneous impact by the level of rebelocracy. Using a household panel in four conflict regions in Colombia, the estimation controls for time-invariant unobservables. The study finds that in regions with strong rebelocracy, households are better able to cope with negative weather shocks than those living in regions with non-state armed actor presence but with limited or no intervention. The former households face a lower economic impact of weather shocks and resort less to survival migration. The effect of rebelocracy is driven mostly by the provision of public goods by non-state armed actors. While this paper is not claiming causal impacts of rebelocracy, its coefficient estimates are robust to controlling for confounders that may explain rebelocracy in the first place.

Key words: armed conflict, Colombia, institutions, migration, weather shocks

JEL classification: D74, H56, O54, Q54, R23

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¹ Department of Economics, Universidad de los Andes, Colombia, corresponding author: aibanez@uniandes.edu.co; ² Department of Political Science, Northwestern University, Evanston, USA; ³ Institute of Development Studies, Brighton, UK

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

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1 Introduction

The decline in the number of armed conflicts after the end of the Cold War has recently reversed itself. In 2014, there were 40 active armed conflicts worldwide, representing an increase of 18 per cent over 2013 levels, the highest figure since 1999. Thirty-nine were internal conflicts. The number of battle-related deaths in 2014 was the highest of any year in the post-Cold War period (Pettersson and Wallensteen 2015). Conflict and poverty are intertwined. In 2013, 471 million people lived in fragile and conflict-affected countries and 78 per cent of the world's poor lived in these countries (181 million people).¹

Armed conflict exerts a heavy toll on economic and social development.² Over the long term, countries may recover from physical and human capital destruction if a threshold is not exceeded (Justino and Verwimp 2013; Miguel and Roland 2011; Murdoch and Sandler 2002). However, the legacy of conflict can be long lasting through the negative impacts of conflict on children while in utero or during early childhood (Camacho 2008; Ichino and Winter-Ebmer 2004; León 2012), changes in preferences and behaviour (Bauer et al. 2016; Moya 2018; Moya and Carter 2019; Voors et al. 2012), and institutional transformations (Arjona 2016; Gilligan et al. 2014; Justino and Stojetz 2018; Kalyvas et al. 2008; Mampilly 2011; Tilly 1992).

This paper studies the persistence of the economic legacies of internal conflict through one specific mechanism: rebelocracy. Rebelocracy is the broad intervention of non-state armed actors (NSAAs) in civilian affairs that emanates from a social contract between civilians and combatants, allowing both groups to have clear expectations and a framework in which to operate (Arjona 2016). NSAAs have incentives to establish rebelocracy in certain regions for the purpose of monitoring civilians and extracting rents from the population (Arjona 2016; Olson 1993). In imposing rebelocracy, NSAAs control civilian affairs, provide security and public goods, adjudicate disputes, collect taxes, and regulate economic activities (Arjona 2014, 2016; Sanchez de la Sierra 2013; Wood 2003; Wood 2010). This generates incentives for households to invest in expanding agricultural production and accumulating wealth, and a higher income for armed groups to tax (Arias et al. 2019; Besley and Persson 2009, 2010; Olson 1993; Sanchez de la Sierra 2013). Although a large literature has studied the economic impacts of violence, this is the first paper to examine the economic legacies of wartime institutions. Our paper explores whether rebelocracy, by providing a clear framework in which to operate, controlling violence, and delivering some public goods, leaves households better off vis-à-vis those living amid violence and chaos.

The paper uses a longitudinal household survey we designed and applied in four conflict areas in Colombia. We collected baseline data in 2010 and conducted two follow-ups in 2013 and 2016. Besides the traditional household information, the survey contains information on direct exposure to violence and community characteristics. We complement the household survey with detailed data at the community level on the informal institutions established by NSAAs based on the methodology developed by Arjona (2016). For each NSAA present in the community throughout the conflict, these datasets gather yearly information on the imposition of rules to regulate economic, political, and social conduct in the community, and the provision of public goods and security, as well as the social interaction between civilians and combatants. Based on this information, we build a Rebelocracy Index to measure the scope of intervention by NSAAs in the

¹ <http://data.worldbank.org/data-catalog/world-development-indicators>, retrieved 25 August 2019. Poverty defined as less than US\$1.90 a day.

² For detailed literature reviews, see Bauer et al. 2016; Blattman and Miguel 2010; Justino 2011.

communities (Arjona 2016). We restrict our sample to only the communities with NSAA presence and estimate the impact of rebelocracy at the intensive margin. In the communities of our sample, NSAAs left on average 11.2 years before we applied the survey, rendering this data unique for a study the persistence of the legacies of conflict.

We exploit a random weather shock and identify its impact on household economic conditions and their subsequent migratory response to compensate for the negative income shock. In order to uncover the long-term legacies of rebelocracy, we estimate the heterogeneous impact of the shock with respect to rebelocracy levels at the community level. If living under rebelocracy puts households in higher income trajectories than those living amid violence and chaos, households will be better able to cope with the negative income shock and will rely less on migration as a coping mechanism.

The presence of rebelocracy in the territories is non-random. NSAAs will seek to impose rebelocracy in regions with high strategic value, resources for rent extraction, or enabling conditions such as weak local institutions. These regional characteristics also determine households' income trajectories, thereby affecting their ability to cope with weather shocks and migratory responses. While we are not claiming to identify causal impacts, our empirical strategy controls for several confounding factors and carries out robustness regressions to test for the stability of coefficients. Because NSAAs left the communities on average 11.2 years before the baseline, we are concerned only with unobservable variables. We use household fixed effects to control for time-invariant unobservables that were affected by rebelocracy, such as risk or time preferences, and municipality fixed effects interacted with year fixed effects to control for any changes between 2010 and 2016 that could be correlated to rebelocracy, such as the government's counter-insurgency policies. We also control for a vector of household and community variables, including other economic shocks and the incidence of violence at the community level.

Our results show that households living in stronger rebelocracy communities are better off than those living in conflict-affected communities without any social order from NSAAs, where weather shocks reduce agricultural production and welfare levels, pushing households to survival migration to substitute for the income drop. In communities with higher rebelocracy levels, the negative impact of the shock on agricultural production and on aggregate consumption is lower, which reduces their need to resort to survival migration. The provision of public goods and, to a lesser extent, the adjudication of disputes are the dimensions of the Rebelocracy Index that drive these results. By providing clear rules by which to operate, and some public goods, rebelocracy seemingly reduces uncertainty and creates incentives for households to invest, accumulate wealth, and produce.

These positive effects may be the result of the conditions that created the incentives for NSAAs to establish rebelocracy in the first place, and not a consequence of rebelocracy. We perform several robustness tests to evaluate the stability of the coefficients for potential confounders. First, NSAAs may impose rebelocracy in wealthier regions to extract more rents from households. Since we do not have initial economic conditions at the community level, we use two variables that reflect wealth levels and economic dynamics at the municipality level: the percentage of land plots over 500 hectares in 1984, and the percentage of land dedicated to agricultural production in 1970. After controlling for the interaction of these variables with both weather shocks, our coefficients of interest are robust. Second, state presence and the effects of rebelocracy might be also related. NSAAs may more easily establish rebelocracy in communities where state presence is lacking. Once NSAAs leave the territory, state presence may increase as a counter-insurgency strategy. We create two variables at the community level to measure state presence one year before the arrival of the first NSAA and state presence in 2010, the baseline year. Lastly, low levels of migration in strong rebelocracy communities could be the result of strong networks of support in close-knit

communities that experienced intense out-migration during conflict periods. We construct a variable at the municipality level measuring the total number of internally displaced persons in the municipality during the years of NSAA presence and interact it with both weather shocks. Our results are robust to all these additional controls. We also calculate Oster bounds and find that even for the more stringent value for R_{max} , which is the R-square from a hypothetical regression of the outcome on observable and unobservable controls, the coefficient intervals do not contain zero, suggesting further that the effects of rebelocracy are likely to be causal.

These positive effects vis-à-vis violence and chaos do not imply that conflict generates economic benefits to households affected by weather-related shocks. What these results suggest is that, despite households' living in conflict-affected communities and presumably under violence and fear, some forms of rebelocracy may reduce uncertainty and provide some public goods, allowing households to operate within predictable rules. This provides incentives for more investment and economic production in the communities with stronger rebelocracy, which leads to better conditions today.

Our paper contributes to three strands of the economic and political science literature. A growing body of economic research estimates the negative economic impacts of conflict, where conflict is proxied by measures of violence. These papers find that conflict leads to the destruction of assets, deterioration of human capital, weakening of institutions, and changes in economic behaviour, all of which result in lower income and consumption levels (Akresh et al. 2011; Blattman and Miguel 2010; Camacho 2008; Grosjean 2014; Justino 2011; Justino and Verwimp 2013; León 2012; Rockmore 2016; Serneels and Verpoorten 2015; Singh 2012; Verpoorten 2009). Recent papers have found unexpected positive impacts of being exposed to violence and being forcibly recruited on political participation, collective action, and pro-social behaviour, yet these effects vary depending on the dynamics of conflict and violence against civilians (Arjona et al. 2017; Bauer et al. 2016; Bellows and Miguel 2009; Blattman 2009; Cassar et al. 2013; Gilligan et al. 2014; Voors et al. 2012). The persistence of these impacts across time is not clear. Some papers find that the negative costs from the destruction brought by violence subsides with time (Miguel and Roland 2011; Murdoch and Sandler 2002). Others show that these effects may persist for decades through the impact on human capital accumulation, social structures, and preferences (Acemoglu et al. 2011; Besley and Mueller 2012; Grosjean 2014; Ichino and Winter-Ebmer 2004; Justino et al. 2014; Kondylis 2008, 2010; León 2012). We contribute to this literature by studying an additional channel largely ignored by the economic literature: the creation of wartime institutions and the transformation of local institutions emerging from the interventions of NSAAAs on the communities. Our findings show that the consequences of conflict go beyond violence, which is the main proxy of conflict used in the papers mentioned above. We find that the impact of conflict is not unidimensional and depends on the behaviour of NSAAAs in the territory.

A growing body of work shows that NSAAAs often take on governance functions in territories under their control (Arjona 2016; Arjona et al. 2015; Mampilly 2011; Weinstein 2007; Wickham-Crowley 1987). As part of their governance strategy, NSAAAs establish new institutions—understood as the rules that structure human interaction (North 1990)—to regulate the social, economic, and political activities of civilians, creating new forms of local social order (Arjona 2016). Even though several studies have recognized that NSAAAs often tax the population, regulate economic activities, organize labour, transfer property rights, and restrict access to state institutions (Arjona 2016; Crost et al. 2014; Korf 2004; Sanchez de la Sierra 2013; Sanín and Giustozzi 2010; Weintraub 2016; Wood 2003; Wood 2010), to our knowledge no study has investigated the economic legacies of these phenomena in the post-conflict period. One noteworthy exception is Justino and Stojetz (2018), who studied the causal link between wartime governance, participation in armed groups, and the future civic engagement of ex-combatants. Our paper provides the first attempt to trace these effects by focusing on the economic

consequences of wartime social order on individuals' decision to migrate in order to cope with extreme weather shocks.

Finally, our paper contributes to the nascent literature on migration as an ex-post strategy to mitigate the negative impacts of extreme weather shocks (Bohra-Misra et al. 2014; Bryan et al. 2014; Cattaneo and Peri 2016; Dillon et al. 2011; Gray and Mueller 2012; Grögger and Zylberberg 2016; Halliday 2006; Jessoe et al. 2018; Mueller et al. 2014; Yang 2008). Because people relocate in response to drops in income, ex-post migration movements tend to take place to nearby locations for short periods, and might not be an option for people with incomes close to subsistence levels (Bryan et al. 2014; Cattaneo and Peri 2016; Kleemans 2014; Yang 2008). Our contribution to this literature is twofold. First, we study whole-household migration, which is more permanent and entails higher costs (Agesa and Kim 2001; Bohra-Misra et al. 2014), while most other papers concentrate on the individual migration of some household members. Second, we explore how the legacies of conflict and extreme weather events interact to shape migration responses.

The remainder of the paper proceeds as follows. Section 2 discusses the existing literature on the link between weather shocks and migration and theorizes how the legacies of wartime institutions shape this link. Section 3 briefly describes the Colombian conflict, and the economic, social, and political interventions undertaken by NSAs in the territory. Section 4 describes the panel household survey we designed and administered, as well as community-level data, to characterize the interventions of NSAs in the communities. We discuss the empirical strategy, the results, and the robustness tests in Section 5. Section 6 concludes and discusses policy implications.

2 Migration, weather shocks, and the legacies of rebelocracy

Rural households resort to different strategies to cope with the negative impact on income after a weather shock. To compensate for the loss of income, households may rely on private transfers, such as loans or the sale of assets (Kleemans 2014; Munshi and Rosenzweig 2016; Rosenzweig and Stark 1998). These private resources and transfers depend on households' initial wealth and on their access to financial markets. If financially constrained or asset poor, households may resort to transfers from community members to mitigate the negative income shock. The insertion of each household into the communities' social networks and the effectiveness of these organizations determine the flow of transfers from community members in times of need.

Migration is a coping strategy used by households if access to financial markets is limited or the support from social networks is not sufficient (Grögger and Zylberberg 2016). After a negative weather shock, households may decide to send some household members to nearby towns to earn additional income or may even take the more radical step to migrate altogether (Bohra-Misra et al. 2014; Cattaneo and Peri 2016; Dillon et al. 2011; Grögger and Zylberberg 2016; Halliday 2006; Jessoe et al. 2018; Kleemans 2014).

Migration takes place if the gains from migrating outweigh the costs of migrating and of forgoing transfers from social networks (Kleemans 2014; Munshi and Rosenzweig 2016; Rosenzweig and Stark 1998). The gains from migrating are the difference between the expected income at the destination and the agricultural income at the place of origin, which at the present time is negatively affected by the weather shock. After a negative weather shock, migration is often temporary and to nearby locations given the lower cost (Kleemans 2014).

The relationship between initial income and the likelihood of migration after a weather shock is nonlinear. Households with the ability to mitigate the negative income shock using private

transfers do not need to resort to a costlier strategy, such as migration, to cope with the shock. On the other hand, households living near subsistence levels or highly dependent on transfers from community members are also less likely to migrate (Munshi and Rosenzweig 2016). Since migration outcomes are risky and require an upfront investment, these households may not be able to migrate to mitigate weather-related shocks (Bryan et al. 2014; Cattaneo and Peri 2016; Gray and Mueller 2012; Yang 2008).

The long-term effects of conflict on income trajectories and wealth stocks may shape the ability of households to mitigate a negative income shock. The violence present in conflict-affected regions destroys physical and human capital and reduces present and future income (Akresh et al. 2011; Blattman and Miguel 2010; Camacho 2008; Grosjean 2014; Justino 2011; Justino and Verwimp 2013; León 2012; Rockmore 2016; Serneels and Verpoorten 2015; Singh 2012; Verpoorten 2009), weakening the ability of households to cope with negative income shocks. Lower wealth and income levels may constrain the mechanisms available for mitigating the impact of an extreme weather shock, pushing households to survival migration as one of the only options available to them.

Violence and anarchy are, however, not always present in conflict zones. NSAAs have incentives to impose rebelocracy and regulate civilian behaviour. Clear rules and a predictable framework facilitate rebel monitoring of civilians, which is crucial for achieving the monopoly of violence. Also, the provision of public goods might be an effective way to muster the support of the civilian population (Arjona 2016). In addition, NSAAs have economic incentives to provide a peaceful social order, or at least a predictable framework with low levels of violence and some public goods, in order to extract rents from the population (Olson 1993). NSAAs will thus seek to impose rebelocracy in regions with strategic value or with enabling characteristics such as weak pre-existing local institutions, which can be more easily co-opted into their social order (Arjona 2016; Olson 1993; Sanchez de la Sierra 2013).

By creating stability, NSAAs generate incentives for households to invest, expand agricultural production, and accumulate wealth. This increases the income of households and the potential rents that NSAAs can extract from the population (Arias et al. 2014; Besley and Persson 2009, 2010; Olson 1993; Sanchez de la Sierra 2013). If NSAAs plunder and steal, people may stop producing altogether or produce the minimum required to ensure subsistence (Olson 1993). Some social order is preferable for NSAAs to achieve war objectives and guarantee a stable source of rent extraction (Arjona 2016; Olson 1993). Evidence suggests that indeed in some regions, NSAAs provide protection and public goods, adjudicate disputes, and regulate economic activities (Arjona 2014, 2016; Sanchez de la Sierra 2013; Wood 2003; Wood 2010).

Once the conflict ends, households in strong rebelocracy communities might have higher incomes and more wealth than those that lived amid violence and chaos. If the better economic conditions persist years after the conflict ends, households in the strong rebelocracy communities will be better able to cope with negative income shocks and thus may be less inclined to migrate for survival.

Rebelocracy is nonetheless an unstable and autocratic form of governance. NSAAs face a high likelihood of contestation from the state or other NSAAs. Their time horizons are shorter than those of democratically elected regimes, leading to little investment in public goods and more effort to redistribute assets to NSAA members and their network of supporters (Besley and Persson 2009, 2010). The decision of NSAAs to regulate economic activity and to engage in asset redistribution—not necessarily to the most productive households in the community but via patronage links—is not aimed at increasing aggregate efficiency (Acemoglu et al. 2011; Arias et al. 2019; Besley and Persson 2009; Bozzoli and Brück 2009; Rockmore 2016; Serneels and Verpoorten

2015; Singh 2012; Verpoorten 2009). For example, NSAAs force households in some regions to cultivate food crops for combatants or to retrieve them from certain markets (Arias et al. 2019; Brück 2004; Cassar et al. 2013; Serneels and Verpoorten 2015; Singh 2012; Wood 2003).

This paper examines whether households that lived in communities with stronger rebelocracy are better equipped to mitigate extreme weather shocks than conflict-affected communities with no clear and stable rules. We use first the aggregate Rebelocracy Index, which measures the extent of social order imposed by NSAAs on the communities, and then test whether the provision of public goods and the adjudication of disputes are the mechanisms driving the results.

3 The Colombian conflict and the interventions of non-state armed actors

Colombia has faced more than 50 years of conflict. After enduring a bloody conflict in the mid-20th century, the Liberal and Conservative parties brokered a peace deal in 1956 and signed a power-sharing agreement. The end of the violent confrontations between the parties was not, however, the end of violence in the country. Liberal guerrilla and self-defence groups remained in isolated rural regions of the country (Sánchez and Meertens 1983). In 1964, some of these groups created the Revolutionary Armed Forces of Colombia (*Fuerzas Armadas Revolucionarias de Colombia*, or FARC), a left-wing guerrilla group pushing for agrarian reform and better opportunities for the rural population. In 1963, another left-wing guerrilla group, the National Liberation Army (*Ejército de Liberación Nacional*, or ELN), emerged.

By the end of the 1980s, the conflict had intensified. Both guerrilla groups had expanded their presence to wealthier regions of Colombia to fund combat activities by extracting economic resources through kidnapping and extortion (González 2014). In addition, illicit coca production provided massive monetary resources for rebel groups to operate and expand their geographic outreach. Drug dealers, some large landowners, and peasant groups created self-defence groups in several regions of the country to combat guerrilla groups. In 1997, most of these right-wing groups came together under an umbrella organization, the United Self-Defence Forces of Colombia (*Autodefensas Unidas de Colombia*, or AUC). Violence against civilians reached unprecedented levels. Between 1985 and 2015, more than 166,000 people died due to conflict, 1,982 massacres were perpetrated by NSAAs, and 7.4 million hectares were illegally seized (Arteaga et al. 2017; Comisión Nacional de Reparación y Reconciliación (Colombia) 2013). Eight million people were officially recognized by the state as victims of conflict.³

The balance of military power shifted after several years of large investments in the government's armed forces. The national government expanded its territorial control and struck important military blows against the FARC, killing some of its leaders and pushing them back to their historical territorial strongholds. In 2006 most paramilitary groups demobilized, and in 2016, the FARC signed a peace agreement with the government that led to their demobilization and transition to a political party. Violence subsided in some regions of the countries. Some residual groups of the AUC and the FARC did not demobilize, however, and the ELN is still active and operating in some regions, where narco-trafficking remains strong.

During the 50 years of conflict, rebel and paramilitary groups intervened in the social, economic, and political life of the communities they controlled (Arjona 2016). NSAAs regulated private life, imposed social norms, restricted mobility, dictated political behaviour, and limited freedom of

³ <https://www.unidadvictimas.gov.co>, retrieved on 30 September 2017.

speech (Acemoglu et al. 2013; Arjona 2016; Comisión Nacional de Reparación y Reconciliación et al. 2011; Gutiérrez-Sanin and Barón 2005; Ronderos 2014). Armed groups also transformed and captured local institutions to further their political agendas, collected information, and controlled the population (Arjona 2016; Gáfaró et al. 2014; Ronderos 2014). In communities with a weak state presence, NSAAs often became the de facto court, adjudicating disputes and property rights over land (Arjona 2016; González 2014). Their influence over economic life was often substantial. NSAAs collected taxes, enforced environmental regulations, regulated salaries and working conditions, pushed for the cultivation of certain crops, including coca, and invested in public goods, among other activities (Arjona 2016; Ronderos 2014; Sánchez and Centro Nacional de Memoria Histórica (Colombia) 2014; Sanín and Giustozzi 2010). The goal of these economic interventions was to increase territorial control, extract economic rents, and earn political legitimacy among the peasant population (Arjona 2016; Sanín and Giustozzi 2010).

4 Data

We use a longitudinal household dataset—the Colombian Longitudinal Survey of Universidad de los Andes (*Encuesta Longitudinal Colombiana de la Universidad de los Andes*, for its Spanish acronym, ELCA)—that tracks migrants before and after migration. The survey was purposely designed to understand the impacts of conflict on household economic conditions and behaviour, but it also tracks migratory movements abroad. ELCA was conducted in 2010, 2013, and 2016 among 4,555 rural households. The 2010 sample covers four regions, 17 municipalities, and 224 rural communities. We selected regions and municipalities within them to maximize variation in conflict intensity. Two regions, Middle-Atlantic and Central East, had a high intensity of conflict, and two, Cundi-Boyacense and the coffee region, experienced low-intensity conflict. Within each municipality, rural communities were chosen at random. The sample is representative of these four regions.

In the follow-ups, we resurveyed households and, if they had split off or migrated, we tracked the households' core group in their new households or host communities. The core group within each household comprises the head, spouse, and children under nine years of age in 2010 of the original household. The attrition rate for 2016 was 13.5 per cent.

The household questionnaire contains information on household composition and characteristics, employment, land tenure, asset ownership, agricultural production, consumption, and participation in organizations, among other details. We designed a detailed module on the incidence of traditional economic shocks and direct exposure to violence between the three waves of the survey. Each household location is geo-coded.

We also applied a community questionnaire in a focus group discussion setting to three community leaders. The purpose of the questionnaire was to collect information on public infrastructure, delivery of public services, access to markets, land quality, and incidence of violent events at the community level. The questionnaire also contains a detailed module on the presence of armed groups, the history of conflict during the last 10 years for the baseline and three years for the follow-up surveys, and the behaviour of armed groups.

To gather detailed information on the social order NSAAs imposed on the communities and the interventions they pursued, we collected qualitative and quantitative data at the community level based on the methodology developed by Arjona (2016). The information on the community questionnaire of the first wave allowed us to identify the communities with prolonged presence of non-state armed actors between 2000–10. We contacted community leaders before starting the

fieldwork to find out whether NSAAAs had been present for at least six consecutive months during the time span of the conflict. Thirty-five communities reported such armed group presence. We visited all these communities and identified specific individuals with in-depth local knowledge to participate in key informant interviews, historic memory workshops, and quantitative surveys. The interviews elicited information on the imposition of rules to regulate economic, political, and social conduct in the community, the provision of public goods and security, and the social interaction between civilians and combatants. For each dimension, we collected yearly information for each armed group present on a range between two and five variables. We also collected information on the conditions before NSAAAs arrived in the community.

Based on this information, we build a Rebelocracy Index that measures the scope of economic, social, and political interventions of NSAAAs in the communities. We sum the variables that comprise each of the six dimensions by dyad of year and NSAA and normalize them. We then sum all dimensions to build and normalize the yearly Rebelocracy Index by NSAA and calculate the maximum overall value for each community. An index equal to zero means that interventions are restricted to security or taxation, while an index equal to one means full rebelocracy, implying intervention of an NSAA on all six dimensions (Arjona 2016). Our variables of interest are the maximum aggregate Rebelocracy Index at the community level, and two dimensions that might strongly influence economic activity: provision of public goods, and ruling of political conduct, whose main component is the adjudication of disputes. Appendix A provides a detailed description of the data, and the Rebelocracy Index.

Because presence of an NSAA is highly correlated to community characteristics that also determine economic conditions and migration responses, we restrict the sample to the communities with NSAA presence. Our analysis thus concentrates on the intensive margin—the impact of rebelocracy levels given NSAA presence—and not on the extensive margin—the impact of having lived under rebelocracy. In addition, we dropped two communities that lacked information on the incidence of violence between 2010–16.⁴ The NSAA sample contains 33 rural communities and 527 households. In order to check for attrition bias, we estimate the probability of falling from the sample on household and community characteristics. Table B1 in Appendix B shows that attrition is not correlated with observable characteristics. In particular, the coefficient index for rebelocracy levels is not statistically significant for any specification, and most of the control variables are not statistically significant, suggesting that falling from the sample is random.

Descriptive statistics at the community level for these data are presented in Table 1. NSAAAs were present in the community for 11.2 years on average, with a maximum of 38 years. The average Rebelocracy Index is 0.17, indicating a limited scope of interventions in the communities. Nonetheless, there is large variation across communities with a minimum Rebelocracy Index of 0 and a maximum of 0.53. Figure A1 in Appendix A depicts yearly maximum rebelocracy levels for the 33 communities. The figure shows a large variation in rebelocracy levels both within and between the 33 communities. However, rebelocracy levels are quite stable for several communities, while just a few communities exhibit sharp variations for some years. In four communities, social order imposed by NSAAAs is largely absent and, when rebelocracy is present, the levels of the Rebelocracy Index are low. Communities with a longer presence of NSAAAs have higher rebelocracy levels, a correlation that is corroborated in Figure A2.

⁴ We estimate the regressions using the 35 communities without controlling for violence, and the coefficient estimates are robust. Results are available upon request.

Table 1: NSAA interventions in 33 ELCA communities

	Obs	Mean	Std. Dev	Min	Max
Rebelocracy	33	0.17	0.13	0	0.53
Imposition of social norms	33	0.26	0.39	0	1.00
Rules over private conduct	33	0.09	0.17	0	0.67
Provision of public goods	33	0.03	0.10	0	0.33
Provision of protection	32	0.44	0.33	0	1.00
Regulation of economic activities	33	0.15	0.15	0	0.40
Rule over political conduct	33	0.27	0.32	0	1.00
(Year since first NSAA arrived - Year since last NSAA left)	33	11.52	9.86	1	38.00
Years with NSAA presence	33	11.15	9.83	1	38.00
Years with no presence in 2010	33	11.52	7.70	1	32.00
Initial presence year	33	1990.97	8.12	1975	2005
Final presence year	33	2001.48	7.70	1981	2012

Source: authors' calculations based on NSAA data and Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM) data.

The strongest dimensions of the Rebelocracy Index on the 33 communities are the provision of protection (0.44), the imposition of social norms (0.26), and ruling over political conduct (0.27). In 71.9 per cent of the communities, NSAAs regulated the population's mobility, and in half of them, freedom of speech was restricted. Regulation of economic activities, albeit weaker, was also important: in 40.6 per cent of communities, NSAAs requested food contributions, and in nearly 33.3 per cent they regulated economic activities. In addition, in 30.3 per cent of them, NSAAs adjudicated disputes, and in 9.1 per cent they improved the communities' infrastructure (see Table A1).

We merge the ELCA dataset with daily data on rainfall collected between 1980–2016 for 1,365 monitoring stations of the Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM). Using the geographic coordinates of each household, we merge each to the three closest weather stations.⁵ These data allow us to calculate indexes of excessive rainfall and drought shocks.

Colombia faced two extreme weather events between 2010–16. In July 2010, after we finished collecting the ELCA baseline, *La Niña* started, and it lasted until April 2011. *La Niña* caused rainfall well above historical averages and reached maximum historical levels in some regions. Several regions of the country suffered flooding and landslides, which affected nearly 7 per cent of the population (3.2 million people).⁶ To estimate the index of excessive rainfall, we use the following procedure: (i) calculate the monthly historical averages and standard deviations per monitoring station; (ii) calculate the monthly number of days per monitoring station in which the rainfall was 1.5 standard deviations above the monthly historical averages during the three years before each wave;⁷ and (iii) average the number of days for the three monitoring stations. The excessive rainfall index measures the average number of days with rainfall 1.5 standard

⁵ The average distances to the closest, second closest, and third closest stations are 6.38 km, 9.69 km, and 12.87 km, respectively.

⁶ www.cepal.org/publicaciones/xml/0/47330/OlainvernalColombia2010-2011.pdf, retrieved on 7 September 2017.

⁷ The three periods are: (i) 2008–2010; (ii) 2011–2013; and (iii) 2014–2016.

deviations above the historical mean. We conduct robustness tests using 0.5 and 1 standard deviation above the historical mean.

In May 2015, the second strongest *El Niño* since 1950 began in Colombia. The high temperatures lasted until May 2016 and caused severe droughts as well as a significant reduction in river flows and reservoir water levels. Indeed, in some cases, water levels reached historical minimum levels.⁸ The droughts severely affected agricultural production, reducing the food supply and causing a sharp increase in food prices. Food inflation increased to 10.9 per cent in 2015 from 4.7 per cent in 2014.⁹ We use the Standardized Precipitation Index (SPI) to measure the drought shock. We calculate the monthly SPI for each monitoring station and define that a drought shock occurs in a monitoring station when the SPI is less than -1. We define a household as having had a month with a drought shock if at least two of the three monitoring stations had an SPI lower than -1. The drought index for each household measures the number of months with a drought shock during the three years before each wave.¹⁰ We test the robustness of the results by modifying the drought shock: (i) using the SPI threshold of -1.5 and (ii) defining a drought when at least one weather station had an SPI below -1.

In Table B2, we report the descriptive statistics for each shock. Between 2011 and 2013, when *La Niña* occurred, the average number of days of excessive rainfall was 190.3, with some households facing 266 days of excessive rainfall. The average number of months with drought between 2014 and 2016, the period of *El Niño*, was 4.6, with a maximum of 11 months.

We use the CEDE (Research Center of Economic Development) municipal panel and the Agricultural Census of 1970 for variables at the municipal level on land distribution, agricultural production, and stocks of internally displaced persons.

5 Empirical strategy and results

5.1 Estimates for welfare and agricultural production

To identify the impact of weather shocks on households' economic conditions and examine the role of rebelocracy on this impact, we estimate the following regression:

$$y_{ijkt} = \beta_0 + \beta_1 \sigma_{ijkt}^r + \beta_2 R_{jk} * \sigma_{ijkt}^r + \beta_3 \sigma_{ijkt}^d + \beta_4 R_{jk} * \sigma_{ijkt}^d + \beta_5 V_{jkt} + \beta_6 X_{ijkt} + \gamma_i + \delta_k * \lambda_t + \varepsilon_{ijkt} \quad (1)$$

where y_{ijkt} are the logarithmic transformations of the value of annual agricultural production, and aggregate annual consumption for household i from community j located in municipality k in period t .¹¹ Descriptive statistics for all outcomes are in Table B3.

The rainfall shock (σ_{ijkt}^r) measures the number of days with rainfall levels 1.5 standard deviations above historical levels three years before each survey. σ_{ijkt}^d is the drought shock and measures the

⁸ www.ideam.gov.co/web/tiempo-y-clima/clima/fenomenos-el-nino-y-la-nina, retrieved on 7 September 2017.

⁹ www.banrep.gov.co/docum/Lectura_finanzas/pdf/informe-gerente-2017-abr.pdf, retrieved on 7 September 2017.

¹⁰ The three periods are: (i) 2008–2010; (ii) 2011–2013; and (iii) 2014–2016.

¹¹ Table B3 reports descriptive statistics for the outcome variables.

number of months during the last three years in which at least two monitoring stations matched to the household had an SPI below -1. The coefficients $\hat{\beta}_1$ and $\hat{\beta}_3$ estimate the impact of excessive rainfall and drought, respectively, on annual aggregate consumption and the annual value of agricultural production. We expect both coefficients to be negative. However, if households smooth consumption fully, the coefficient estimate for annual consumption should not be statistically significant.

R_{jk} represents the maximum overall rebelocracy levels for community j throughout the period that NSAAs were present in the community. β_2 and β_4 are the coefficients of interest and estimate the effect of rebelocracy levels on the ability of households to mitigate weather shocks. Figures A1 and A2 illustrate the variation we are exploiting to estimate the effects of rebelocracy. We are comparing the response of households across communities with similar rainfall or drought shocks, like the four communities mapped, but with different rebelocracy levels. Positive coefficient estimates ($\hat{\beta}_2 > 0; \hat{\beta}_4 > 0$) imply that households from stronger rebelocracy communities are better able to mitigate the impact of the shock, suggesting that the economic conditions of households living in those communities are better than those of households living amid violence and chaos.

Some of the conditions that favoured the intervention of NSAAs also influence the households' economic conditions and their ability to respond to weather shocks. Because NSAAs left on average 11.2 years before the baseline survey, our main concern for endogeneity bias is unobservable variables. While we do not claim to be identifying causal estimates, our empirical strategy allows us to control for several confounding factors.

We first exploit the panel data nature of our data. We control for household fixed effects (γ_i) that absorb all time-invariant unobservables, such as risks and time preferences or direct victimization during times of conflict, which determine households' ability to cope with shocks and are also shaped by the legacies of conflict (Bauer et al. 2016; Moya 2018; Moya and Carter 2019; Voors et al. 2012). Other unobservable dynamics correlated with rebelocracy levels might bias our coefficient estimates. For example, the state may decide to invest more funds in communities with high rebelocracy levels once NSAAs leave as a counter-insurgency strategy, or other NSAAs may take advantage of the power vacuum left by the departed NSAA. To control for these potential confounders, we include municipality fixed effects (δ_k) interacted by year fixed effects (λ_t).

Violence affects the economic conditions of households and is potentially correlated with rebelocracy. Household fixed effects control for direct exposure to violence while NSAAs were present in the community. We also include a control for the number of types of violent incidents during the year before each survey (V_{jkt}), which include cattle theft, illegal land seizure, threats, kidnappings, and homicides. This variable controls for the effects of violence once NSAAs leave the community.

Lastly, we also control for household and community variables that change over time. X_{ijkt} includes the gender of the household head, household composition (number of household members between 0 and 5 years of age, 6 and 17 years of age, 18 and 65 years of age, and above 65 years of age), and incidence of other shocks at the household level during the three years before each survey (health, family, employment, production, and asset shocks¹²). We report the results

¹² Adverse shocks are defined according to whether households report having been affected during the three years prior to the survey by any of the following situations: *health*: illness of any member obstructing their normal activities, accident of any member obstructing their normal activities; *family*: death of the household head or spouse, death of other members of the household, abandonment by household head or spouse, divorce of spouses; *employment*:

with and without controls for these shocks, as weather shocks are strongly correlated with these other shocks, decreasing the preciseness of our coefficient estimates. ε_{ijkt} is the error term. We cluster the standard errors at the original community levels, that is, the community where households resided in 2010.

Table 2 reports the results of the regression on aggregate annual consumption and the value of annual agricultural production. We estimate each regression without (columns 1 and 3) and with controls for other shocks (columns 2 and 4). The drought shock causes a negative impact on the value of agricultural production and aggregate consumption. The impact is sizeable: an increase of one standard deviation (SD) in the drought shock decreases the value of annual agricultural production by 0.35SD and aggregate consumption by 0.24SD. The impact of the drought shock for households living in communities with stronger rebelocracy levels is lower. Evaluated at the median level for rebelocracy, the impact of the drought shock on agricultural production decreases by 0.18SD. These households are also better able to insure consumption against the negative drought shock. The negative impact on consumption decreases by 0.07SD when evaluated at the median for rebelocracy, although the coefficient estimate for the interaction terms is not statistically significant.

Table 2: Value of annual agricultural production and annual aggregate consumption: fixed effects regressions

	Value of annual agricultural production (log million \$COP2016)		Annual aggregate consumption (log million \$COP2016)	
Number of days > 1.5 SD	-0.00259 (0.00410)	-0.00271 (0.00408)	-0.000719 (0.000852)	-0.000839 (0.000933)
Number of days > 1.5 SD*Rebelocracy	0.0140* (0.00698)	0.0135* (0.00691)	0.00470** (0.00177)	0.00458** (0.00174)
Number of months < -1 SPI	-0.102*** (0.0373)	-0.100*** (0.0352)	-0.0329** (0.0146)	-0.0330** (0.0149)
Number of months < -1 SPI*Rebelocracy	0.306** (0.114)	0.288** (0.113)	0.0647 (0.0491)	0.0589 (0.0480)
Number of observations	937	937	1,054	1,054
R-squared	0.122	0.127	0.278	0.285
Household shock controls	No	Yes	No	Yes
Mean	1.085		2.329	
Standard Deviation	(0.982)		(0.481)	

* p<0.10, ** p<0.05, ***p<0.01. Clustered standard errors at the community level. This table reports the OLS regressions for the log transformation of the value of annual agricultural production and annual aggregate consumption. All regressions include household fixed effects, municipality fixed effects*year fixed effects, number of different types of covariate violence shocks at the original community in the past three years, gender of household head, number of members below 5 years of age, number of members between 6 and 17, number of members between 18 and 65, and number of members older than 65.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

We check the robustness of our results using different definitions for both weather shocks. For rainfall shocks, we estimate all outcomes using 0.5 and 1SD above the historical means. We also estimate all the outcomes with two additional definitions of the drought shock: (i) using the SPI

household head or spouse lost their job, other family member lost their job; *production*: bankruptcy or closing of family businesses, failure of crops or livestock loss; *assets*: loss of dwelling or land plots, destruction of household goods through burglary or fires, loss of remittances.

threshold of -1.5; and (ii) defining a drought when at least one weather station had an SPI below -1. Results reported in Table B4 show that the signs of the coefficient estimates are robust to the different definitions of the weather shocks.

The positive coefficient estimates for the interaction between weather shocks and rebelocracy indicate that living in communities with stronger rebelocracy levels partially mitigates the impact of the negative shocks. This might result from the effects of rebelocracy on households' economic conditions or the decision of NSAAAs to exert control and impose rebelocracy on better-off communities to extract rents. In sub-section 5.3, we perform additional regressions to test the stability of the coefficients to potential confounders. In sub-section 5.4 we explore some transmitting mechanisms to gauge whether these apparently better conditions are indeed a consequence of stronger rebelocracy levels.

5.1 Probability of migration

To explore further the risk-coping mechanisms that households use to mitigate the negative income shock, we examine the impact of the shock on migratory responses and the heterogeneous effects of rebelocracy. Survival migration is an extreme coping strategy when access to financial markets or networks of support is restricted. We explore whether households in stronger rebelocracy regions are less likely to rely on survival migration using the same empirical strategy as above:

$$m_{ijkt} = \alpha_0 + \alpha_1 \sigma_{ijkt}^r + \alpha_2 R_{jk} * \sigma_{ijkt}^r + \alpha_3 \sigma_{ijkt}^d + \alpha_4 R_{jk} * \sigma_{ijkt}^d + \alpha_5 X_{ijkt} + \gamma_i + \delta_k * \lambda_t + \varepsilon_{ijkt} \quad (2)$$

where m_{ijkt} are outcome variables for migratory responses for household i in community j located in municipality k at time t . To account for distance of migration, we estimate the regressions for overall migration, migration to rural areas, and migration to urban areas. Survival migration is usually to nearby locations and for short periods (Kleemans 2014). Therefore, migration to rural areas in our data captures survival migration. These dichotomous variables are equal to 1 when the household migrated between 2010 and 2013, or between 2013 and 2016. Almost 10 per cent of households migrated in 2013 and 19.0 per cent in 2016 (see Table B3). The bulk of migration in both periods was to rural areas (9.3 per cent of households in 2013 and 10.1 per cent of households in 2016).

Table 3 reports the results for these regressions. Excessive rainfall and drought increase migration. The impact is large: one additional standard deviation in the rainfall and drought shock increases the probability of migration by 0.15 and 0.20 percentage points (pp), respectively. Rural migration drives the bulk of the increment, with increases of 0.14 and 0.17 pp for the rainfall and drought shocks, respectively, signalling potential temporary survival migration to nearby locations, which has lower migration costs (Kleemans 2014).

Households living in regions with high rebelocracy levels are less prone to migrate in response to weather shocks. The migratory response from an increase of 1SD in both shocks evaluated at the mean of rebelocracy (0.18) decreases by 0.02 pp and 0.08 pp for rainfall and drought shocks, respectively. This is equivalent to 16.0 per cent and 55 per cent of the increase in migration caused by one additional SD in both weather shocks. The lower reliance on survival migration as a response to weather shocks suggests that households living in stronger rebelocracy communities are less vulnerable and may have available several other strategies to mitigate the weather shocks. The results are robust to the alternative definitions of weather shocks (see Table B4).

Table 3: Overall, urban, and rural migration: linear probability model

=1 if household migrates	Overall migration		Urban migration		Rural migration	
Number of days > 1.5 SD	0.00380*	0.00396**	0.000408	0.000520	0.00368*	0.00355**
	(0.00198)	(0.00188)	(0.00100)	(0.000989)	(0.00185)	(0.00174)
Number of days > 1.5 SD* Rebelocracy	-	-	-	-	-	-
	0.00412*	-0.00339*	8.85e-05	0.000493	0.00466**	0.00427**
	(0.00205)	(0.00173)	(0.000839)	(0.000809)	(0.00188)	(0.00181)
Number of months < -1 SPI	0.0634***	0.0596***	0.0263*	0.0268**	0.0520**	0.0482***
	(0.0182)	(0.0159)	(0.0137)	(0.0125)	(0.0191)	(0.0169)
Number of months < -1 SPI*Rebelocracy	-0.160***	-0.131***	-0.0534*	-0.0406	-0.122**	-0.0989**
	(0.0542)	(0.0442)	(0.0272)	(0.0277)	(0.0502)	(0.0433)
Number of observations	1,054	1,054	882	882	954	954
R-squared	0.346	0.390	0.536	0.548	0.215	0.259
Household shock controls	No	Yes	No	Yes	No	Yes
Mean	0.144		0.048		0.099	
Standard Deviation	(0.351)		(0.213)		(0.298)	

* p<0.10, ** p<0.05, ***p<0.01. Clustered standard errors at the community level. This table reports the linear probability regressions for overall migration, urban migration and rural migration. All regressions include household fixed effects, municipality fixed effects*year fixed effects, number of different types of covariate violence shocks at the original community in the past three years, gender of household head, number of members below 5 years of age, number of members between 6 and 17, number of members between 18 and 65, and number of members older than 65.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Another way to interpret the results is to evaluate the changes in agricultural production, consumption, and migration for identical communities that face a 1SD deviation increase in the drought shock, but different rebelocracy levels. Table 4 reports changes in the value of annual agricultural production, aggregate consumption, and overall migration for a 1SD increase in the drought shock for communities with a rebelocracy level of 0 and located at the 25th, 50th, and 75th percentiles. An increase of 1SD in the drought shock for communities with a 0 rebelocracy level decreases the value of annual agricultural production by 0.35SD and aggregate consumption by 0.23SD, while it increases overall migration by 0.20 pp. Higher rebelocracy levels are associated with lower impacts on economic conditions and on overall migration. Comparing the value for communities located at the 25th and 75th percentiles, the impact of the shock decreases from 0.25SD to 0.13SD on agricultural production, and from 0.19SD to 0.14SD on aggregate consumption, while the overall migration impact falls from 0.16 pp to 0.11 pp. This again is indicative of better economic conditions for households living in communities with stronger rebelocracy levels.

If stronger rebelocracy generates more incentives to invest, produce, and accumulate wealth, households will be placed on a higher income trajectory and have more alternatives to mitigate income shocks. Households will thus rely less on survival migration as a coping mechanism. Rural migration drives the bulk of the reduction, which is probably survival migration and not a decision to seek better income opportunities.

Table 4: Evaluating the magnitude of a 1SD increase in the drought shock

	Value of annual agricultural production	Value of aggregate consumption	Overall migration
	(SD)	(SD)	(percentage points)
Impact of 1SD	-0.354	-0.233	0.204
Impact of 1SD (rebelocracy at 25th percentile=0.105)	-0.247	-0.189	0.157
Impact of 1SD (rebelocracy at median=0.176)	-0.175	-0.160	0.125
Impact of 1SD (rebelocracy at 75th percentile=0.22)	-0.130	-0.141	0.106

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

5.3 Testing robustness to potential confounders

The decision by NSAAAs to establish a presence in a community, exert territorial control, and impose rebelocracy is partially driven by community characteristics that also determine the economic conditions of the households living in these communities. We need to control for community characteristics before the arrival of the NSAA to uncover casual estimates. Since we have limited information on initial conditions at the community level, we instead probe the coefficient stability of our results after controlling for potential confounders and estimate Oster bounds (Oster 2019).

Non-state armed actors seek to control territories with strategic value, potential for rent extraction, or conditions enabling the imposition of rebelocracy (Arjona 2016; Olson 1993; Sanchez de la Sierra 2013). The potential to extract rents might be correlated to weather shocks if communities with less extreme weather shocks, and thus less income variation, have higher income levels as a result. Although household fixed effects control for the historical weather conditions of the community, past rebelocracy levels and current weather events could still be correlated. Table B5 explores whether this is the case, regressing rainfall levels between 2010–13 (the period of *La Niña*), drought levels between 2013–16 (the period of *El Niño*), and municipal fixed effects on rebelocracy levels. The coefficient estimates for the two weather shocks are not statistically significant after controlling for municipal fixed effects, yet these are not precise given the low number of observations. Figure B1 probes further the relationship between weather shocks and rebelocracy levels. We plot yearly rainfall and drought shocks from 1966 to 1976, before NSAAAs arrived in the communities, for ELCA communities (i) with and without NSAA presence (panel A) and (ii) with rebelocracy levels below and above the median levels (panel B). Yearly rainfall shocks are almost identical for communities with and without NSAA presence, while for drought shocks the similar trends happen from 1971 onward. Drought shocks are more intense in communities with no NSAA presence, which is the opposite of our argument. Panel B depicts a similar trend for communities with rebelocracy levels above and below the median. The trends for rainfall shocks in communities below and above the median for rebelocracy are similar throughout the 10 years. Before 1972, the difference in drought shocks is wider between communities below and above the median, but for some years, communities above the median face more intense drought shocks, while for others the intensity is higher for those below the median.

We cannot rule out the possibility that unobservable variables related to potential rent extraction are biasing our coefficient estimates. To test the stability of our coefficient estimates, we include controls at the municipal level (the next level of administrative unit) that capture wealth levels before NSAAAs arrived in the communities. We interact these proxies of municipal wealth with the drought and rainfall shocks. In the 1960s, when the conflict started, Colombia depended heavily on agricultural production and the conflict took place mostly in rural areas. We capture wealth

with two variables related to agricultural production and rural wealth: (i) the percentage of land plots over 500 hectares in 1984; and (ii) the percentage of land used for agricultural production in 1970. Table 5 reports the coefficient estimates for the interaction terms between both weather shocks and rebelocracy levels for the baseline regressions and after the inclusion of each of the two variables in a separate regression. We report the coefficient estimates for the three main outcomes: value of annual agricultural production, aggregate annual consumption, and overall migration.¹³ The coefficient estimates for both shocks are robust to controlling for initial wealth and economic dynamics. In fact, after controlling for the percentage of land used for agricultural production, some coefficient estimates become more precise.

Another potential confounder is state presence. Lack of state presence is an enabling factor for NSAAAs to operate in the territories, provide state-like services, and impose rebelocracy. Once NSAAAs leave the territory, the state may establish a presence and increase investment as a counter-insurgency strategy. The municipality fixed effects interacted with year dummies control partially for this, but we include more granular controls for state presence. We test for robustness of the coefficients including interactions between both weather shocks and variables, capturing state presence before NSAAAs arrived in each community and in 2010. Table 5 presents the results. We collected information on state presence in the community the year before the first NSAA arrived for six state dimensions: police presence, health centres, phone services, paved roads, military presence, and court presence. We measure state presence by summing these six dimensions. The coefficient estimates for both shocks are robust to this inclusion. The second variable measures state presence at the community level in 2010, summing whether the community had child day care, nutrition programmes, primary and secondary schools, and a functioning health centre. Controlling for state presence in 2010 increases the magnitude of the coefficient estimates of both weather shocks, which suggests that we might be underestimating the effects of rebelocracy. Given that this may signal that additional unobservable variables might be biasing our coefficient estimates, we estimate coefficient intervals using Oster bounds.

Lastly, the coefficient estimate for the Rebelocracy Index could be simply picking the effects of close-knit communities that experienced high out-migration during conflict times. Solidarity among members of the community might be stronger, generating incentives for people to migrate less (Kleemans 2014; Munshi and Rosenzweig 2016; Rosenzweig and Stark 1998). To rule out this possibility, we control for the total number of internally displaced persons in the municipality during the years that the NSAAAs were present in the community. We interact this variable with both weather shocks and report the results in Table 5. The coefficient estimates for both weather shocks are again robust to this control and, as with the controls for state presence in 2010, the magnitude increases.

¹³ For the sake of space, we report the results only for the probability of overall migration. However, the results for rural and urban migration are also robust to including additional controls and are available upon request.

Table 5: Coefficient estimates for β_2 and β_4

Panel A. Value of annual agricultural production	Obs.	R²	Rain shock*Rebelocracy	Drought shock*Rebelocracy
Baseline	937	0.133	0.0127*	0.249**
Percentage of land plots over 500 hectares in 1984, municipality level	936	0.129	0.0114	0.228*
Land in use (% land plot): transitory, permanent, and pasture	936	0.144	0.0153**	0.204**
Number of state institutions in 2010, community level	875	0.154	0.0345***	0.553***
Number of state institutions one year before NSAA arrived in the community, community level	913	0.144	0.0133*	0.280**
Number of internally displaced persons during years NSAA were present, municipality level	937	0.140	0.0201***	0.392***
=1 if paved road in good condition, paved road in bad condition, or dirt road in good condition	937	0.13	0.0150**	0.349**
Panel B. Aggregate annual consumption				
Baseline	1,054	0.200	0.00587***	0.0274
Percentage of land plots over 500 hectares in 1984, municipality level	1,045	0.186	0.00556**	0.0207
Land in use (% land plot): transitory, permanent, and pasture	1,052	0.196	0.00699***	0.0111
Number of state institutions in 2010, community level	984	0.202	0.0107***	0.108*
Number of state institutions one year before NSAA arrived in the community, community level	1,026	0.210	0.00656***	0.0777
Number of internally displaced persons during years NSAA were present, municipality level	1,054	0.208	0.00654**	0.0490
=1 if paved road in good condition, paved road in bad condition, or dirt road in good condition	1054	0.29	0.00437**	0.0849
Panel C. Overall migration				
Baseline	1,054	0.390	-0.00339*	-0.131***
Percentage of land plots over 500 hectares in 1984, municipality level	1,045	0.345	-0.00227	-0.105**
Land in use (% land plot): transitory, permanent, and pasture	1,052	0.383	-0.00414**	-0.127***
Number of state institutions in 2010, community level	984	0.396	-0.00585	-0.181**
Number of state institutions one year before NSAA arrived in the community, community level	1,026	0.388	-0.00220	-0.116**
Number of internally displaced persons during years NSAA were present, municipality level	1,054	0.390	-0.00314	-0.127***
=1 if paved road in good condition, paved road in bad condition, or dirt road in good condition	1054	0.39	-0.00349*	-0.152***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Each row reports the coefficient estimate of an individual OLS regression (value of annual agricultural production and annual aggregate consumption) or linear probability model (overall migration). Clustered standard errors at the community level. Each row represents the additional control defined in the row interacted with both weather shocks. All regressions include household fixed effects, municipality fixed effects*year fixed effects, number of different types of covariate violence shocks at the original community in the past three years, gender of household head, number of members below 5 years of age, number of members between 6 and 17, number of members between 18 and 65, and number of members older than 65. Controls for state presence at 2010 levels include provision of child day care and nourishment programmes, primary and secondary schools, and functioning health posts. Variation in state presence after armed groups left is measured as the change in average total investment by the municipality three years before and three years after groups left. State presence levels one year before armed groups arrived include provision of health posts, telephone land lines, paved roads, and police stations at the community level, and army presence and judicial courts at the municipality level.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

A small omitted variable bias is not the only explanation for the robustness of coefficient estimates to the inclusion of additional controls (Oster 2019). We estimate three sets of Oster bounds for the coefficient estimates of the interaction between both weather shocks and rebelocracy in the baseline regressions for the value of annual agricultural production, aggregate annual consumption, and overall migration. Columns 1 and 2 in Table 6 report the coefficient estimates for both weather shocks interacted with rebelocracy from the uncontrolled and controlled regression, respectively, as well as the R-square values. Assuming three values for the R_{max} , which is the R-square from a hypothetical regression of the outcome on observable and unobservable variables, we calculate the coefficient intervals for each interacted term of rebelocracy and weather shocks. The corresponding coefficient intervals are reported in Columns 3, 4, and 5. We find that even in the more stringent assumption for R_{max} the coefficient interval does not contain zero. This provides further evidence that the effects of rebelocracy on households' economic conditions and the likelihood of migration are likely to be causal.

Table 6: Oster bounds: testing for coefficient stability

	Regression without controls	Regression with controls	$R_{Max} = 1.3\tilde{R}$	$R_{Max} = 2\tilde{R} - \dot{R}$	$R_{Max} = 2.2\tilde{R}$
Value of annual agricultural production					
Rain shock*Rebelocracy (β)	0.0005	0.0135*	[0.0135,0.2828]	[0.0135,1.0318]	[0.0135,1.2429]
Standard error	(0.003)	(0.007)			
R ²	0.0001	0.1265			
R _{Max}	-	-	0.164	0.253	0.278
Drought shock*Rebelocracy (β)	-0.0339	0.2882**	[0.2882,3.2096]	[0.2882,11.5189]	[0.2882,13.9976]
Standard error	(0.060)	(0.113)			
R ²	0.0012	0.1265			
R _{Max}	-	-	0.164	0.252	0.278
Aggregate annual consumption					
Rain shock*Rebelocracy (β)	-0.0035	0.0046**	[0.0046,0.2729]	[0.0046,0.9296]	[0.0046,1.2127]
Standard error	(0.002)	(0.002)			
R ²	0.020	0.285			
R _{Max}	-	-	0.371	0.55	0.627
Drought shock*Rebelocracy (β)	0.0351	0.0589	[0.0589,18.1004]	[0.0589,72.3733]	[0.0589,90.0923]
Standard error	(0.030)	(0.048)			
R ²	0.0056	0.2851			
R _{Max}	-	-	0.371	0.564	0.627
Overall migration					
Rain shock*Rebelocracy (β)	-0.0026	-0.0034*	[-1.3447,-0.0034]	[-3.9824,-0.0034]	[-4.9021,-0.0034]
Standard error	(0.002)	(0.002)			
R ²	0.012	0.390			
R _{Max}	-	-	0.507	0.768	0.859
Drought shock*Rebelocracy (β)	0.0408	-0.1390***	[-2.7861,-0.1390]	[-8.4259,-0.1390]	[-10.3017,-0.1390]
Standard error	(0.035)	(0.047)			
R ²	0.0087	0.3931			
R _{Max}	-	-	0.511	0.777	0.865

*** p<0.01, ** p<0.05, * p<0.1. Dependent variable in bold. Each row represents the coefficient intervals for the drought or rainfall shock interacted with rebelocracy. Set intervals estimation using the unrestricted estimator developed by Oster (2016). \tilde{R} is the R-square for regressions with all controls for each dependent variable. \dot{R} denotes the R-square for regressions without controls.

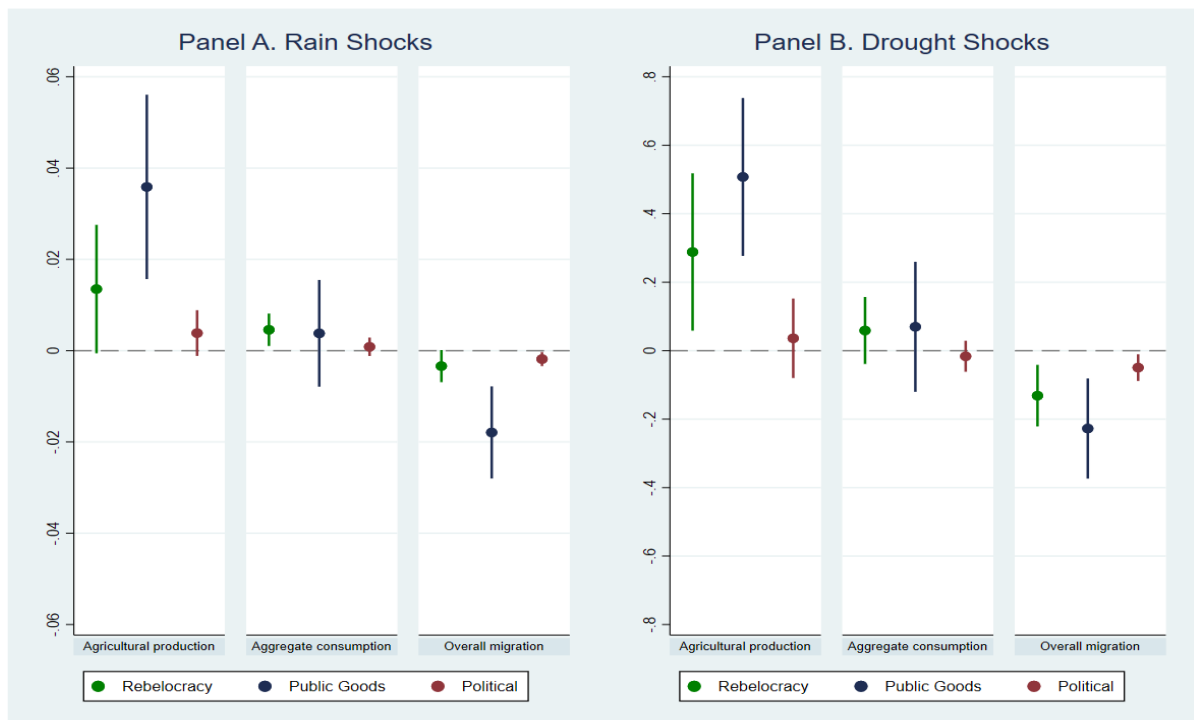
Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

5.4 Mechanisms: provision of public goods and adjudication of disputes

The above results suggest that the impact of negative weather shocks is smaller for households that lived in communities with stronger rebelocracy communities than for other conflict-affected communities. These households seem to rely on several coping mechanisms to protect consumption from reductions in agricultural income due to extreme weather shocks, reducing the need to rely on survival migration. In this section we explore whether the apparently positive effects of rebelocracy stem from NSAAAs providing public goods and some level of certainty, measured by the involvement of NSAAAs in the adjudication of disputes.

We estimate the baseline regressions for the value of annual agricultural production, annual aggregate consumption, and overall migration, separating the provision of public goods from the adjudication of disputes.¹⁴ Figure 1 shows the coefficient estimates for the interaction term of both dimensions and the rainfall shock (Panel A) and drought shock (Panel B). Table B6 reports the regression estimates. The bulk of the effect of rebelocracy comes from the provision of public goods. In communities in which the index for the provision of public goods is higher, the impact of both shocks on agricultural production is smaller and the need to resort to survival migration less frequent. Adjudication of disputes also contributes, although the effect is weaker. The magnitude of the coefficient estimate is smaller and less precise. In regions with a higher index for adjudication of disputes, people use survival migration less often in response to the negative impact of the shock.

Figure 1: Coefficient estimates β_2 and β_4 : value of annual agricultural production, aggregate consumption, and overall migration



These graphs plot the coefficient estimates for regressions (1) and (2) interacting the rainfall shock (Panel A) and the drought shock (Panel B) in separate regressions with (i) rebelocracy, (ii) the provision of public goods, and (iii) political conduct.

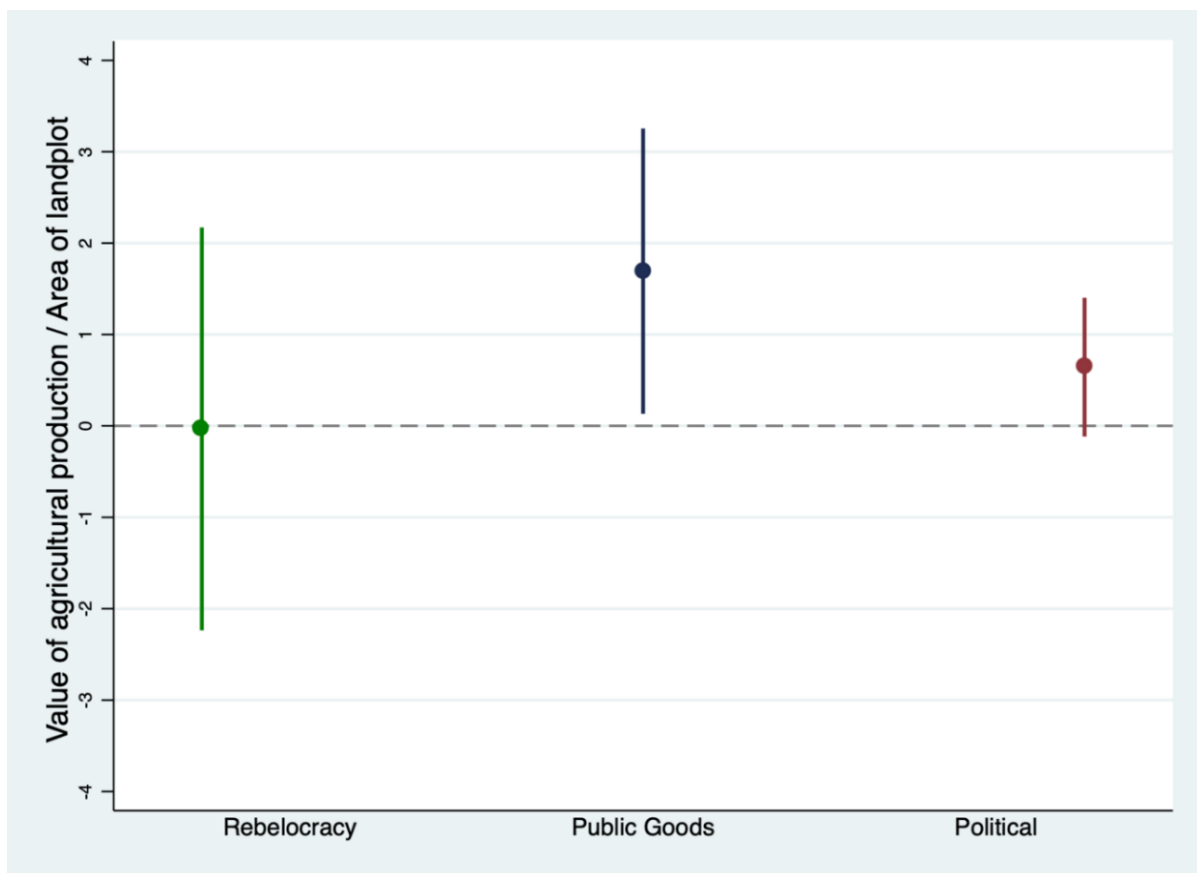
Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

¹⁴ Results for the six dimensions are available upon request.

The provision of public goods, although limited, increases the productive capacity of households and generates incentives for investing. This may lead to higher income and more wealth accumulation (Besley and Persson 2009, 2010). The adjudication of disputes, which includes the protection of property rights, may create some sense of predictability by providing rules within which households may operate. However, decisions by NSAAAs might be arbitrary and may protect only some segments of the population, specifically their members or support networks (Besley and Persson 2009, 2010; Olson 1993). This may explain the weak effect of the adjudication of disputes on households' ability to cope with shocks.

The provision of public goods by NSAAAs may have long-lasting impacts on the economic conditions of households through an increase in productivity and/or an improvement in local institutions. If households invested more in places with higher rebelocracy to expand their agricultural production, productivity could be higher in these communities in 2010. Figure 2 reports the coefficient estimates of rebelocracy, or the two dimensions of the index, on the value of land productivity in 2010. These regressions include household controls, the incidence of other shocks three years before the survey, and municipality fixed effects. The results suggest a positive correlation between the index for the provision of public goods and the value of land productivity. Although this is not a causal relationship, the positive relationship between the provision of public goods and land productivity is suggestive of higher investment and production in rebelocracy regions. Table B7 reports the regression estimates.

Figure 2: Coefficient estimates for rebelocracy, the provision of public goods, and political conduct on land productivity



This figure plots the coefficient estimates for a regression of rebelocracy, the provision of public goods, and political conduct on the value of land productivity.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

The provision of public goods may also strengthen local institutions. The supply of local public goods, such as roads and other infrastructure, is a labour-intensive and collective activity (Justino and Stojetz 2018). Besides its immediate impact on agricultural productivity, the delivery of infrastructure may strengthen local institutions through this labour-intensive and collective activity. We explore this other potential mechanism by controlling for road infrastructure at the community level. We create a dummy variable equal to 1 when the community has paved roads in good condition, paved roads in bad condition, and dirt roads in good condition. The regression interacts this dummy with both weather shocks. Results show that the coefficient estimates for the interaction term of weather shocks and rebelocracy levels are robust to controlling for road conditions (Table 5). The provision of infrastructure may not only cause an immediate boost in productivity, but also unleash additional local processes with long-lasting legacies.

Our results suggest that a strong rebelocracy might provide clear and stable rules according to which community members are able to operate and conduct their daily lives, as well as providing valuable public goods. The predictability of these interventions, and shared expectations between NSAAs and civilians about behaviour, might encourage civilians to invest more, produce more, and accumulate more wealth. These legacies seem to persist after NSAAs leave the territory, when households are still better able to cope with a negative income shock and to partially smooth consumption. While we are not claiming causality, the robustness tests we performed in the previous section, the fact that the provision of public goods is driving most of the effect, and the effects of rebelocracy on land productivity are strong indications that rebelocracy does indeed explain the marginally better conditions of households living in stronger rebelocracy communities.

A word of caution is, however, in order. Our results compare communities living in conflict-affected regions across different levels of rebelocracy and suggest that some of the negative impacts of conflict are reduced when armed groups provide public goods. In these contexts, households are better able to make choices and behave in predictable ways, which is not possible in situations where violence and anarchy dominate over rebel order. Nonetheless, it is important not to forget that these are still communities affected by violent conflict, where rules are imposed under the threat of violence.

6 Conclusion

This paper studies the economic legacies of conflict and identifies rebelocracy as an important transmitting channel. Non-state armed actors have incentives to impose a minimum of social order in the territories they control in order to monitor the civilian population and muster their support, as well as to extract rents from them. This social order may involve the provision of some public goods, the adjudication of disputes, and the imposition of taxes, among other things. By imposing a framework within which households may operate, rebelocracy may generate incentives for them to expand production and accumulate more wealth. In conflict-affected regions, communities with stronger rebelocracy might imply better economic conditions than communities facing violence and anarchy.

We study how rebelocracy may shape the ability of households to mitigate negative income shocks years after the conflict has ended. Our hypothesis is that the clear rules that households must observe during conflict and the provision of public goods, albeit minimal, place households in rebelocracy communities in higher income trajectories than those in conflict-affected communities with no clear rules, allowing the former to better cope with negative income shocks. We use a household panel survey from Colombia and collect additional and detailed information at the community level on the economic, social, and political interventions of NSAAs. Using the

community data, we construct a Rebelocracy Index to measure the extent of these interventions in all aspects of the social, political, and economic life of each community.

The empirical strategy exploits the exposure of households to random weather shocks to estimate the heterogeneous effects across rebelocracy levels on the ability of households to cope with negative shocks. The estimations use the panel nature of the dataset to control for time-invariant unobservables at the household level, and municipality fixed effects interacted with year fixed effects. Because NSAAs may impose rebelocracy in better-off communities to extract potential rents, we are not claiming causal impacts. Nonetheless, we perform several robustness tests to gauge the stability of our coefficients of interest to potential confounders and estimate Oster bounds. We then explore whether the provision of public goods and the adjudication of disputes by NSAAs are two potential mechanisms driving the results.

The results show that households living in communities with stronger levels of rebelocracy in the past are better able to cope with the negative income shock caused by extreme weather events. The negative income shock has a sizeable impact on agricultural production and welfare levels, pushing many poor households to resort to migration to compensate for the income drop. In communities with higher rebelocracy levels, the impact of the negative shock on agricultural production and aggregate consumption is lower and relying on migration as coping strategy is less frequent. The results are robust to controlling for the conditions in the communities or the municipalities before NSAAs arrived, namely wealth proxies and state presence. The positive effects of rebelocracy on households' economic conditions are mostly driven by the provision of public goods. We interpret these results as suggestive that households benefit from the clear and stable rules imposed by rebelocracy, thereby being able to operate efficiently and make predictable decisions, on the basis that disputes are adjudicated and valuable public goods are provided (Arjona 2016). These interventions by NSAAs may reduce uncertainty, provide a predictable environment, and thus create incentives for investing, saving, engaging in more profitable economic activities, and accumulating wealth (Besley and Persson 2009, 2010; Olson 1993). It is, however, important to note that the marginally better conditions of these households do not necessarily translate into an overall positive economic impact of conflict. The paper studies households living in conflict regions and compares their conditions across different levels of rebelocracy. Our results show that living with clear rules under conflict is better than living amid violence and chaos.

These results have three important implications. First, they illustrate the complexity of conflict zones, beyond their typical portrayals as areas of violence, destruction, and anarchy. In Colombia, as in many other conflict-affected contexts, NSAAs rule and govern communities as part of their attempt to control the territory. The consequences of these interventions may marginally mitigate the negative economic impacts of conflict on these communities and may persist over time. Second, internal conflict is often perceived as 'development in reverse'. The findings in this paper indicate that, in reality, conflicts are areas of institution building, where institutions are created and transformed (Justino 2014), affecting the economic conditions of communities well after NSAAs leave the territory. Third, because these NSAA interventions are autocratic and arbitrary, these marginally improved economic conditions may come at a cost. Using the same data, we find in another paper that enduring the authoritarian rule of armed groups has mixed effects on civilians' preferences for the rule of law. Despite not endorsing extra-legal measures to combat crime, people in communities that receive more support from NSAAs are more likely to disregard the rule of law (Arjona et al. 2016).

Additional research into the economic legacies of rebelocracy is important. Our paper concentrates on a particular context and a dataset that is representative of four regions in Colombia. In order to gauge the external validity of our results, new research in other countries is required. Also, future research should investigate the distributive implication of these interventions. NSAAs create new

elites, adjudicate property rights, force opponent households to relocate, and impose taxes on particular groups, among other effects. Since we concentrate on the households that stay in the conflict-affected regions, we are missing an important component of the economic impact of these interventions: the consequences for households that have been forced to migrate by NSAAs.

The results of this paper have important policy implications for post-conflict periods. Most post-conflict interventions concentrate on reconstruction; they often ignore the institutional transformations of the communities, and their ensuing economic impacts. Any policy or programme needs to take advantage of the positive impacts of these transformations and redress any negative redistributive impacts. A more nuanced understanding of the impacts of conflict may contribute to the design of better post-conflict policies.

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Appendix A: Building the Rebelocracy Index

We build the Rebelocracy Index using the information we collected on 33 of the 35 communities with prolonged NSAA presence, that is, the presence of an NSAA for more than six months. The fieldwork was carried out by political science researchers who spent a week in each community. In each community, we identified individuals with in-depth local knowledge to participate in key informant interviews, historic memory workshops, and quantitative surveys. The quantitative surveys asked questions about the following behaviour of NSAA: (i) imposition of social norms; (ii) regulation of economic activities; (iii) rules about political conduct; (iv) provision of protection; (v) provision of public goods; and (vi) social interactions with the civilian population.

For each dimension, we asked between two and five questions to measure the extent of intervention. Table A1 presents the descriptive statistics for all the questions included in each dimension. The responses show large variation in the behaviour of NSAA in the communities, some dimensions being particularly strong, such as limitations on freedom of speech, punishment of rape and robbery, food contributions, regulation of fishing, hunting, and forestry, adjudication of disputes, and restrictions on voting.

Table A1: Components of Rebelocracy Index (% of communities)

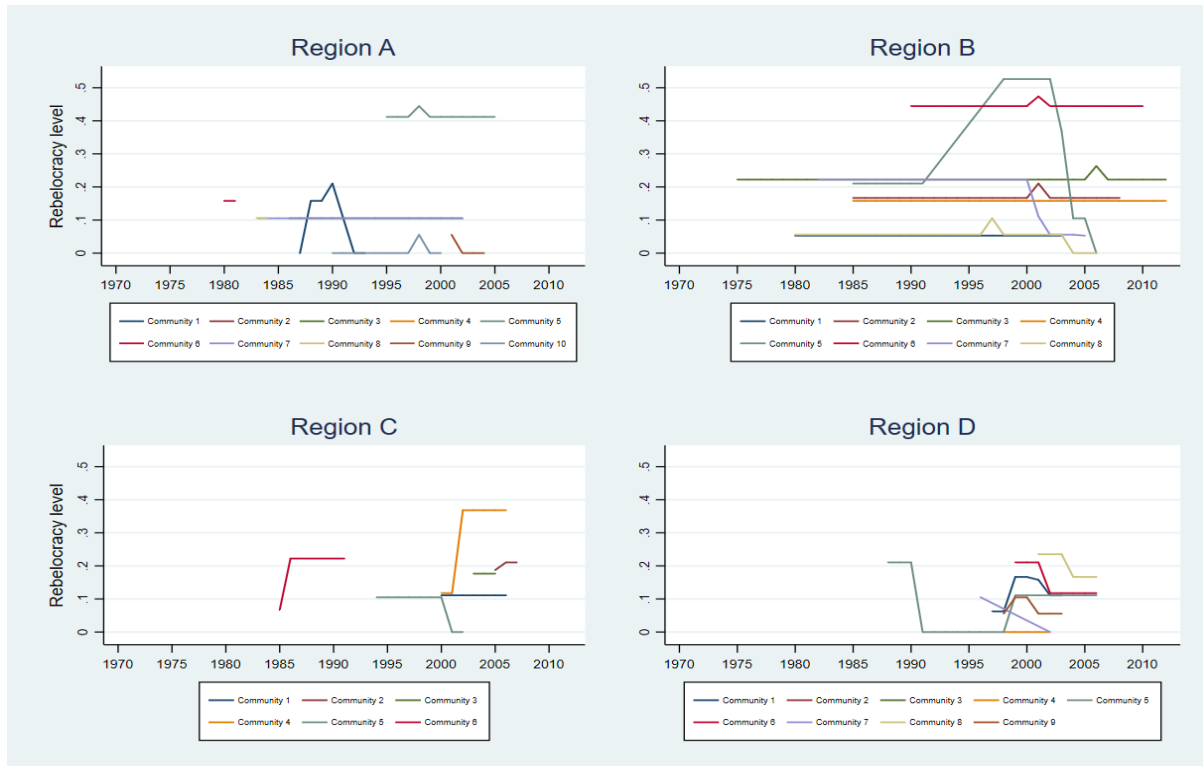
	Obs	Mean	Std. Dev
<i>Imposition of social norms</i>			
Domestic violence	32	0.188	0.397
Sexual behaviour	33	0.061	0.242
Personal image	33	0.030	0.174
Freedom of speech	32	0.500	0.508
Mobility	32	0.719	0.457
<i>Social interactions with NSAA</i>			
Soccer with NSAA	33	0.273	0.452
Beer with NSAA	33	0.273	0.452
Party with NSAA	33	0.242	0.435
<i>Provision of public goods</i>			
Infrastructure improvement	33	0.091	0.292
Education	33	0.000	0.000
Health	33	0.000	0.000
<i>Provision of protection/security</i>			
Punishment of rape or robbery	32	0.719	0.457
Protection	30	0.133	0.346
<i>Regulation of economic activities</i>			
Food contributions	32	0.406	0.499
Fishing, hunting or forestry	33	0.333	0.479
Mining or other illegal activities	33	0.000	0.000
Coca production and trade	33	0.000	0.000
State subsidies	33	0.030	0.174
<i>Rule over political conduct</i>			
Adjudication of disputes	33	0.303	0.467
Restriction on voting	31	0.355	0.486
Control of vote	29	0.103	0.310

Source: authors' calculations based on NSAA data.

Using this information, we calculated an index for each of the six dimensions. First, we summed the variables that compose each of the six dimensions by dyad of NSAA and year and then we normalized each of the six dimensions. To build the Rebelocracy Index, we summed the six

dimensions by each dyad of NSAA and year and normalized them. In the regressions, we used the maximum value over time and NSAA (see Table 1 for descriptive statistics). Figure A1 depicts the yearly maximum Rebelocracy Index for each community within the four ELCA regions. Variation of rebelocracy levels between the ELCA communities is large. The stability of rebelocracy through time varies across the communities. Some communities exhibit a stable social order over a long period while others are more unstable.

Figure A1: Yearly variation of maximum rebelocracy levels by community

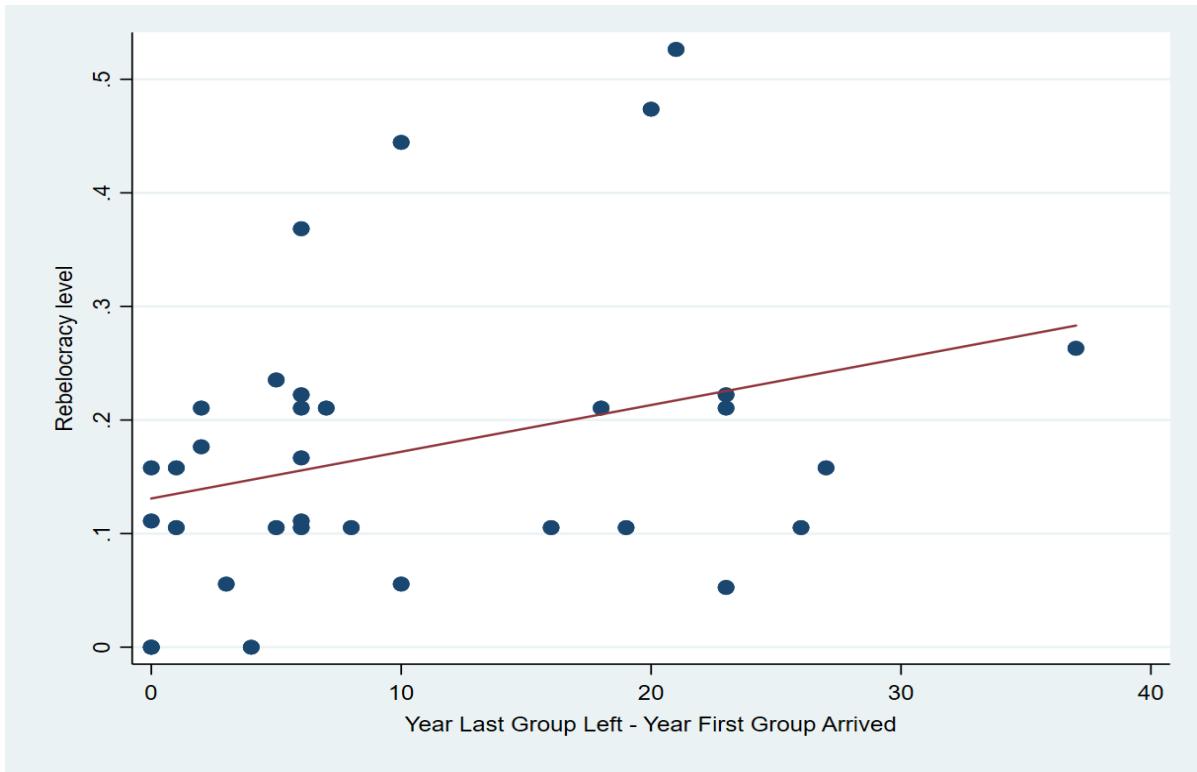


The graphs plot the maximum rebelocracy level by year for each of the 33 communities grouped in the four ELCA regions. Names of the regions and communities are not provided to preserve anonymity.

Source: NSAA data.

The years of presence of NSAA's also vary among communities, the longest presence being 38 years and the shortest 1 year. As expected, the number of years of presence in the community is strongly correlated with rebelocracy levels, as Figure A2 illustrates.

Figure A2: Correlation between years of NSAA presence and rebelocracy levels

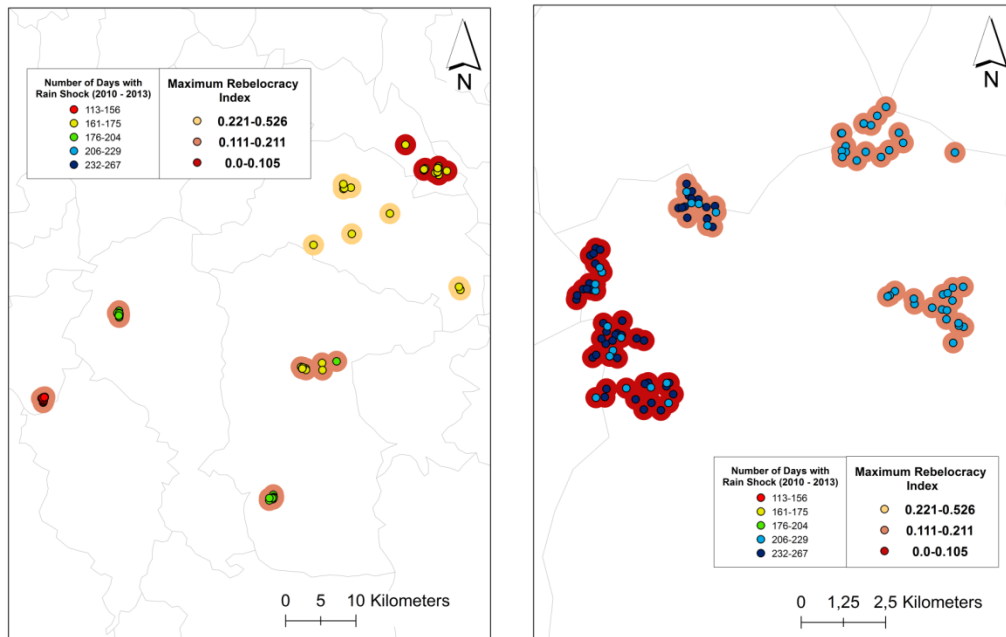


The figure plots a linear regression of years of presence, measured as year last group left minus year first group arrived, on rebelocracy levels.

Source: NSAA data.

Appendix B: Additional tables and figures

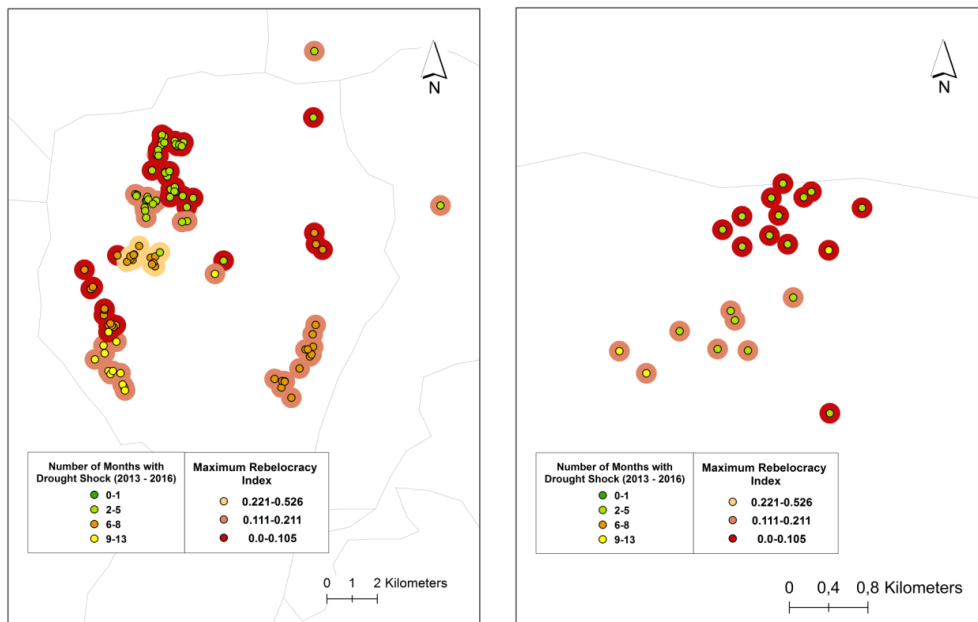
Figure B1: Rainfall shocks and rebelocracy levels



Each point on the map represents an individual household. Grey lines show municipality boundaries. A group of clustered households with equal levels of rebelocracy (represented as the larger circle in the background), belong to the same rural community.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Figure B2: Drought shocks and rebelocracy levels



Each point on the map represents an individual household. Grey lines show municipality boundaries. A group of clustered households with equal levels of rebelocracy (represented as the larger circle in the background), belong to the same rural community.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Table B1: Probability of falling from the sample in 2013 and 2016

	= 1 if household falls from sample			
Max rebelocracy	-0.113 (0.0947)	-0.0389 (0.0860)	-0.0675 (0.109)	-0.166 (0.239)
Household highest schooling grade, 2010		0.00196 (0.00358)	0.00156 (0.00376)	0.00206 (0.00377)
Household head woman, 2010		0.0231 (0.0287)	0.0186 (0.0309)	0.0174 (0.0311)
Household members 0–5, 2010		0.00540 (0.0139)	0.000971 (0.0149)	0.00762 (0.0151)
Household members 6–17, 2010		-0.00438 (0.00771)	-0.00727 (0.00838)	-0.00626 (0.00839)
Household members 18–65, 2010		-0.00817 (0.0107)	-0.0105 (0.0114)	-0.0240** (0.0119)
Household members 65+, 2010		0.0303 (0.0193)	0.0338* (0.0200)	0.0204 (0.0204)
Wealth index, 2010		0.00353 (0.00605)	0.00161 (0.00684)	0.00443 (0.00718)
Land plot size, 2010		-0.00158 (0.00270)	-0.00121 (0.00289)	-0.000252 (0.00291)
Number of households in community, 2010			0.000187 (0.000225)	6.49e-05 (0.000273)
Time to municipality urban centre (hours), 2010			0.0264 (0.0259)	0.0518 (0.0345)
Lack of water, 2010			-0.0188 (0.0278)	-0.0201 (0.0442)
Number of institutions present in community, 2010			-0.00308 (0.00708)	0.00929 (0.0125)
Altitude (m), 2010			1.13e-05 (1.77e-05)	-7.48e-05 (9.23e-05)
Distance to main road (km), 2010			0.000207 (0.00146)	0.00218 (0.00455)
Distance to river (km), 2010			-2.78e-05 (0.00144)	0.00573 (0.00555)
Distance to state capital (km), 2010			0.000132 (0.000411)	-0.00442 (0.00525)
Constant	0.121*** (0.0203)	0.0846** (0.0408)	0.0627 (0.0667)	1.187*** (0.348)
Observations	664	644	602	602
R-squared	0.002	0.010	0.020	0.055
Municipality fixed effects	No	No	No	Yes

* p<0.10, ** p<0.05, ***p<0.01. This table reports the linear probability regressions for falling from the ELCA sample in 2013 and 2016. We define a household as falling from the sample when it was not relocated for surveying in 2013 and 2016.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Table B2: Descriptive statistics: climate shocks

	Observations	Mean	Std. Dev	Min	Max
2008–10					
Days with rain shock	527	206.38	41.25	120	279.67
Months with drought shock	527	1.40	1.92	0	6
2011–13					
Days with rain shock	527	190.26	39.25	114.33	266.33
Months with drought shock	527	1.12	1.58	0	6
2014–16					
Days with rain shock	527	114.52	38.52	62.67	186.67
Months with drought shock	527	4.55	3.44	0.0	11.0
Pooled					
Days with rain shock	1,581	170.39	56.37	62.67	279.67
Months with drought shock	1,581	2.36	2.90	0	11

Source: authors' calculations based on ELCA (2010, 2013, 2016), and IDEAM.

Table B3: Descriptive statistics: outcomes

	Observations	2010	2013	2016
Aggregate consumption (million 2016 \$COP)	527	8.444 (4.478)	9.885 (5.504)	11.18 (6.318)
Value of annual agricultural production	469	4.233 (8.950)	3.863 (8.638)	5.654 (15.60)
Overall migration	527	-	0.0987 (0.299)	0.190 (0.392)
Rural migration	527	-	0.0930 (0.291)	0.101 (0.301)
Urban migration	527	-	0.00569 (0.0753)	0.0892 (0.285)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviation in parentheses.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Table B4: Robustness checks: different definitions of weather shocks

	Obs.	R ²	Rain shock	Rain shock*Rebelocracy	Drought shock	Drought shock*Rebelocracy
Value of annual agricultural production						
Baseline	937	0.122	-0.00259 (0.00410)	0.0140* (0.00698)	-0.102*** (0.0373)	0.306** (0.114)
Rain shock = (Days > 1S.D.)	937	0.122	-0.00282 (0.00371)	0.0133* (0.00662)	-0.105*** (0.0372)	0.311** (0.116)
Rain shock = (Days > 0.5 S.D.)	937	0.122	-0.00245 (0.00322)	0.0130** (0.00624)	-0.105*** (0.0372)	0.320*** (0.116)
Drought shock = (SPI < -1.5)	937	0.119	0.000498 (0.00345)	0.0100 (0.00608)	-0.0352 (0.0405)	0.552*** (0.160)
Drought shock = At least 1 station with SPI < -1.0	937	0.125	-0.00478 (0.00365)	0.0253*** (0.00686)	-0.0666*** (0.0203)	0.251*** (0.0612)
Aggregate annual consumption						
Baseline	1,054	0.278	-0.000719 (0.000852)	0.00470** (0.00177)	-0.0329** (0.0146)	0.0647 (0.0491)
Rain shock = (Days > 1S.D.)	1,054	0.278	-0.000852 (0.000748)	0.00458*** (0.00163)	-0.0338** (0.0146)	0.0675 (0.0491)
Rain shock = (Days > 0.5 S.D.)	1,054	0.278	-0.000695 (0.000661)	0.00451*** (0.00161)	-0.0339** (0.0146)	0.0712 (0.0495)
Drought shock = (SPI < -1.5)	1,054	0.276	-0.000343 (0.000867)	0.00390** (0.00148)	-0.0356 (0.0228)	0.158* (0.0871)
Drought shock = At least 1 station with SPI < -1.0	1,054	0.276	-0.00110 (0.000840)	0.00948*** (0.00233)	-0.0141 (0.00850)	0.0748*** (0.0273)
Overall migration						
Baseline	1,054	0.346	0.00380* (0.00198)	-0.00412* (0.00205)	0.0634*** (0.0182)	-0.160*** (0.0542)
Rain shock = (Days > 1S.D.)	1,054	0.345	0.00338* (0.00190)	-0.00372* (0.00192)	0.0657*** (0.0188)	-0.162*** (0.0544)
Rain shock = (Days > 0.5 S.D.)	1,054	0.344	0.00282 (0.00168)	-0.00346* (0.00198)	0.0635*** (0.0184)	-0.162*** (0.0558)
Drought shock = (SPI < -1.5)	1,054	0.333	0.00217 (0.00191)	-0.00107 (0.00257)	0.0577** (0.0276)	-0.266*** (0.0921)
Drought shock = At least 1 station with SP I< -1.0	1,054	0.336	0.00368* (0.00184)	-0.00590** (0.00258)	0.0341*** (0.00982)	-0.0876** (0.0320)

* p<0.10, ** p<0.05, ***p<0.01. Each row reports the coefficient of an individual OLS regression (value of annual agricultural production or annual aggregate consumption). Each row reports the weather shock used for the regression. Clustered standard errors at the community level. All regressions include household fixed effects, municipality fixed effects*year fixed effects, number of different types of covariate violence shocks at the original community in the past three years, gender of household head, number of members below 5 years of age, number of members between 6 and 17, number of members between 18 and 65, and number of members older than 65.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Table B5: Community maximum rebelocracy levels and climate shocks

	Maximum rebelocracy		
Rain shock	-0.000251 (0.000432)	-0.000793 (0.00147)	0.000112 (0.00187)
Drought shock	0.0219* (0.0107)	0.0303 (0.0327)	-0.0131 (0.0519)
Constant	0.198* (0.104)	0.402 (0.269)	1.668** (0.634)
Observations	33	33	30
R-squared	0.136	0.466	0.876
Municipality FE	No	Yes	Yes
Controls	No	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. Controls include number of households in community, time to closest urban centre, index of lack of water for agricultural production [=1], number of state institutions in the community, altitude, distance of main road (in km), distance to closest river route (in km), distance to the state capital (in km).

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Table B6: Value of annual agricultural production, annual aggregate consumption, and overall migration: fixed effects regressions

	Value of annual agricultural production (log million \$COP2016)		Annual aggregate consumption (log million \$COP2016)		Overall migration	
Number of days > 1.5 SD	-0.00259	-0.00271	-0.000719	-0.000839	0.00380*	0.00396**
	(0.00410)	(0.00408)	(0.000852)	(0.000933)	(0.00198)	(0.00188)
Number of days > 1.5 SD* Rebelocracy	0.0140*	0.0135*	0.00470**	0.00458**	-0.00412*	-0.00339*
	(0.00698)	(0.00691)	(0.00177)	(0.00174)	(0.00205)	(0.00173)
Number of months < -1 SPI	-0.102***	-0.100***	-0.0329**	-0.0330**	0.0634***	0.0596***
	(0.0373)	(0.0352)	(0.0146)	(0.0149)	(0.0182)	(0.0159)
Number of months < -1 SPI*Rebelocracy	0.306**	0.288**	0.0647	0.0589	-0.160***	-0.131***
	(0.114)	(0.113)	(0.0491)	(0.0480)	(0.0542)	(0.0442)
Number of observations	937	937	1,054	1,054	1,054	1,054
R-squared	0.122	0.127	0.278	0.285	0.346	0.390
Number of days > 1.5 SD	-0.000807	-0.00100	0.000103	-5.36e-05	0.00365**	0.00386**
	(0.00354)	(0.00359)	(0.000762)	(0.000854)	(0.00168)	(0.00165)
Number of days > 1.5 SD* Public goods	0.0380***	0.0359***	0.00413	0.00379	-0.0211***	-0.0179***
	(0.00927)	(0.00991)	(0.00600)	(0.00574)	(0.00545)	(0.00495)
Number of months < -1 SPI	-0.0517	-0.0524*	-0.0230*	-0.0241**	0.0354**	0.0365***
	(0.0306)	(0.0306)	(0.0115)	(0.0117)	(0.0143)	(0.0123)
Number of months < -1 SPI* Public goods	0.539***	0.507***	0.0778	0.0696	-0.266***	-0.228***
	(0.111)	(0.113)	(0.0981)	(0.0932)	(0.0784)	(0.0718)
Number of observations	937	937	1,054	1,054	1,054	1,054
R-squared	0.120	0.125	0.276	0.283	0.345	0.390
Number of days > 1.5 SD	-0.000312	-0.000441	0.000405	0.000275	0.00389*	0.00397**
	(0.00376)	(0.00371)	(0.000847)	(0.000896)	(0.00195)	(0.00183)
Number of days > 1.5 SD* Political conduct	0.00404	0.00385	0.000785	0.000851	-0.00221**	-0.00184**
	(0.00253)	(0.00246)	(0.00104)	(0.000990)	(0.000907)	(0.000754)
Number of months < -1 SPI	-0.0537	-0.0535	-0.0198	-0.0206	0.0446***	0.0434***
	(0.0348)	(0.0333)	(0.0122)	(0.0124)	(0.0129)	(0.0115)
Number of months < -1 SPI* Political conduct	0.0457	0.0362	-0.0128	-0.0164	-0.0645***	-0.0496**
	(0.0604)	(0.0570)	(0.0243)	(0.0222)	(0.0229)	(0.0191)
Number of observations	937	937	1,054	1,054	1,054	1,054
R-squared	0.115	0.120	0.277	0.286	0.345	0.388
Household shock controls	No	Yes	No	Yes	No	Yes
Mean	1.085		2.329		0.144	
Standard Deviation	(0.982)		(0.481)		(0.351)	

* p<0.10, ** p<0.05, ***p<0.01. Clustered standard errors at the community level. This table reports the OLS regressions for the log transformation of the value of annual agricultural production and annual aggregate consumption, and the linear probability regressions for overall migration. All regressions include household fixed effects, municipality fixed effects*year fixed effects, number of different types of covariate violence shocks at the original community in the past three years, gender of household head, number of members below 5 years of age, number of members between 6 and 17, number of members between 18 and 65, and number of members older than 65.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

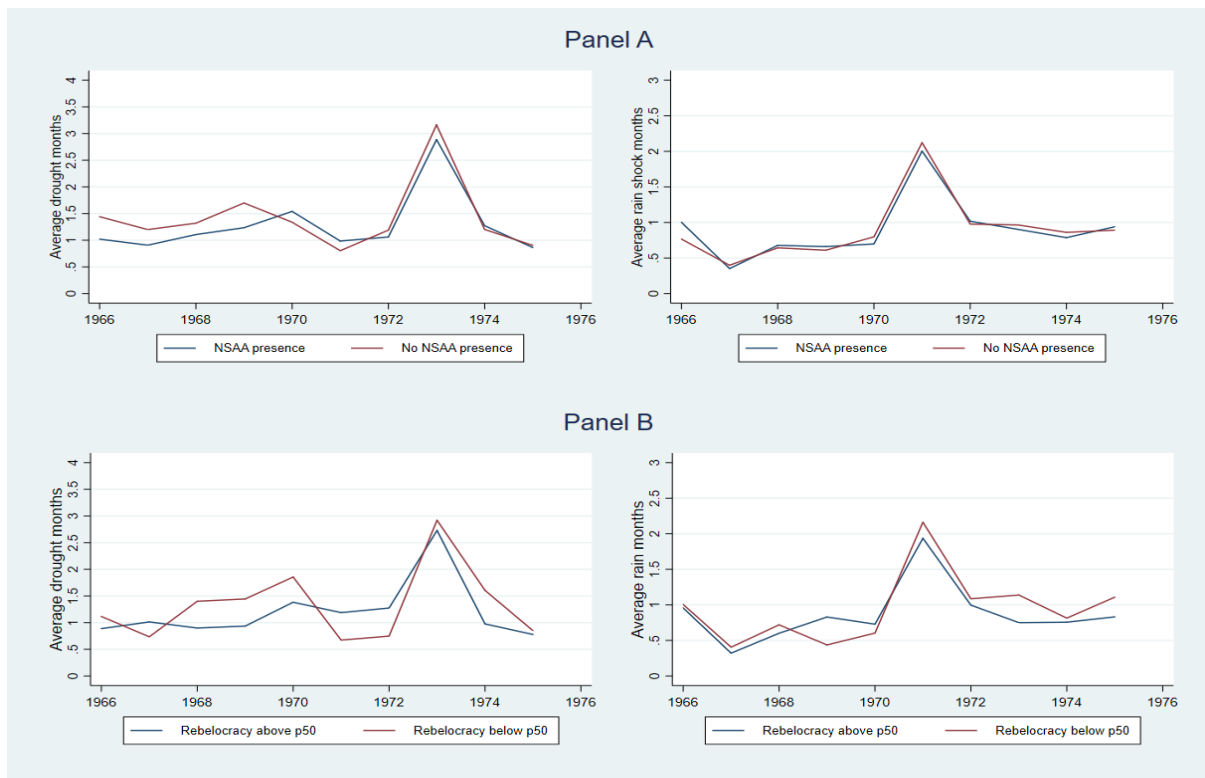
Table B7: Value of land productivity: fixed effects regressions

	Productivity (log million \$COP2016)	Productivity (log million \$COP2016)	Productivity (log million \$COP2016)
Rebelocracy	-0.0330 (1.079)	- -	- -
Public goods	- -	1.693** (0.764)	- -
Political	- -	- -	0.643* (0.372)
Number of days > 1.5 SD	0.00494 (0.00710)	0.00577 (0.00775)	0.00875 (0.00772)
Number of months < -1 SPI	0.121 (0.122)	0.148 (0.126)	0.0965 (0.112)
Number of observations	360	360	360
R-squared	0.168	0.174	0.170
Mean		0.313	
Standard Deviation		(1.670)	

* p<0.10, ** p<0.05, ***p<0.01. Clustered standard errors at the community level. Productivity defined as the value of production divided by the area of the land plot in Ha. All regressions include number of different types of covariate violence shocks at the original community in the past three years, gender of household head, number of members below 5 years of age, number of members between 6 and 17, number of members between 18 and 65, and number of members older than 65. Municipality fixed effects included.

Source: authors' calculations based on ELCA (2010, 2013, 2016), NSAA data, and IDEAM.

Figure B3: Drought shock (panel A) and rainfall shock (panel B) before NSAA arrived in the community: 1966–1976



Source: authors' calculations from IDEAM data.