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PEACE, FARM AND FOOD:
THE EFFECT OF PEACE ON INVESTMENT AND FOOD CONSUMPTION
DECISIONS

BY

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THESIS

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Abstract

This paper studies how peace driven by the demobilization of a non-state armed group affects household's investment decisions and their welfare in the short run. Starting in 2012, the government of Colombia engaged in a peace process that ended with the demobilization of the country's biggest non-state armed group, FARC. This process had multiple ceasefire arrangements in 2013 and 2014 that reduced the exposure to violence in those places that were previously under the control of an armed group. Using the presence of armed groups as a measure of exposure to the war through a difference in difference approach, I find that the FARC's demobilization process led to a more than threefold increase in farm investment in areas previously affected by the group, as farmers moved production from annual to perennial crops. I find no evidence that investment came at the expense of short-term consumption. Finally, I find evidence of substantial positive spillovers in investment to neighboring areas that were not directly affected by the FARC. The results suggest that decreased investment may be an important mechanism through which armed conflict affects economic development.

To my Adri who supports me during this journey.

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Chapter 1

Introduction

Economic growth and development crucially depend on private sector investment, but individuals and firms will only invest if they are confident of reaping the returns. Moreover, the level of risk firms are willing to accept in their investment portfolio depends on their faith in the future. Violence and conflict may create an environment where people are reluctant to make long term, risky investments. Peace brings a period of hope and stability that may change the household's willingness to undertake risky investments for the sake of improving their future.

The presence of a non-state armed group has the potential to severely undermine investment. Violence resulting from conflict between the armed group and the state can lead to the destruction of capital (Blattman and Miguel, 2010; Collier, 1999; Ibanez and Moya, 2010; Justino and Verwimp, 2013). Furthermore, armed groups often expropriate assets from the local population, either to fund their operations or to impose a new social order (Arjona, 2016; Azam and Hoeffler, 2002; Engel and Ibanez, 2007). We may therefore expect that the presence of an armed group will depress investment by making property rights less secure.

However, in many conflicts armed groups also perform state-like governing functions in areas where the state is unwilling or unable to do so (Sierra, 2020; Cunningham and Loyle, 2021; Arjona et al., 2015). For instance, in the Iraqi war, in some cases, civilians perceived IS rebels as a fairer and more effective actor for governance than the local state (Revkin, 2021). In Nepal's civil war, the Nepal-Maoist rebels created courts that evaluated property and domestic crimes, and the success of this rebel governance strategy increased the support of the local inhabitants to the Maoist cause (Loyle, 2021). The demobilization of an armed group could thus create a vacuum that, if not filled by the state, may decrease the security of property rights. On the other hand, there is also evidence that proximity to conflict may increase investment in some cases like Angola's civil war (Guidolin and Ferrara, 2007). Violence may also increase investment in buffer zones because the uncontrolled area is not taxed or regulated, creating an environment that firms can leverage to evade constraints from the government (Ch et al., 2018).

Empirical evidence on the effect of a transition to peace on investment is limited. Much of the previous literature on armed conflict and investment has focused on the behavior of investors in large multinational

firms, often involved in the mining or resource extraction sectors (Guidolin and Ferrara, 2007). Furthermore, this literature focuses on the effect of shocks of violence, but does not address the potential transition to a less violent environment. The effect of the reduction on the ability of households to make investment decisions rebuild their productive capital and household welfare. Identifying the effect of violence (or peace) is challenging because of the inherent endogeneity between violence and economic activity. Violence can be a result of disinvestment, or violence and under-investment might both be caused by a similar shock such as a climate or political event.

The contribution of this thesis to the existing literature comes from three areas. First, this article uses a natural experiment that overcome the problem associated with endogeneity between war and welfare. Second, this article studies the effect of an expected permanent positive shock on investment by household-led farms - one of the most ubiquitous commercial enterprises in developing countries. Third, unlike the previous literature I focus on the effect of demobilization process and not on marginal impacts of sporadic attacks.

To estimate the effect of peace on investment, I exploit a natural experiment created by the recent peace agreement between the government of Colombia and the FARC, the country's largest non-state armed group. Negotiations in this process began in 2012 and continued until a comprehensive peace agreement in 2016. Conflict violence continued during the first years of the negotiations, but decreased substantially after the FARC implemented two unilateral ceasefires at the end of 2013 and 2014. I take advantage of the data reported in La Encuesta Longitudinal de Colombia (ELCA), a longitudinal survey of 4.700 rural households that include a baseline in 2010 and two follow-ups in 2013 and 2016. I leverage the reported presence of armed groups by the leaders of the villages during baseline survey in 2010 to identify areas that were likely to be more affected by the cease fire. I argue that the historic presence of the armed group is a good measure of the influence of FARC and the peace agreement reduced its exposure at a high pace. The post-treatment period is defined as 2016 when ceasefires were in effect and an agreement was reached in the middle of the year. My primary outcomes are household farm investment and the dietary index that I created called the Food Diversity Index of the household, which measures the diversity of food purchases made in a month.

I find that the demobilization of the FARC led to a more than threefold increase in farm investment in areas previously affected by the group. This investment partly manifests itself in a switch from short term to perennial crops, consistent with the hypothesis that peace process leads to an increase in the security of property rights and a resulting expansion of farmers time horizons. I find no evidence that investment came at the expense of short-term consumption; exposure to demobilization doe not affect household nutritional welfare as measured by a dietary diversity index. I also find evidence for positive spatial spillovers: investment substantially increased in areas that were near former FARC strongholds but did not have historic FARC

presence.

This thesis suggests that peace processes and demobilization of armed groups can have large positive effects on investment by small household-based enterprises. A possible explanation for the difference between my results and those in the literature on FDI is that armed group presence can affect investment through two offsetting channels: by decreasing the security of property rights and by decreasing the state's capacity to regulate businesses. Small firms are less likely to benefit from the regulation channel, as they are less strongly regulated to begin with, but bear the full cost of insecure property rights. Furthermore, it is possible that large firms are less affected by the state's inability to guarantee property rights because they can safeguard their own property rights through private security forces. These results raise the possibility that the demobilization of armed groups can create a considerable peace dividend driven by local small-scale investment.

The remainder of this thesis is organized as follows. Section 2 presents the literature and context of the research. Section 3 describes the data and it shows some prelim analysis. Section 4 describes the empirical strategy used in this article. Section 5 presents the results. Finally, section 6 concludes the paper with summaries and remarks.

Chapter 2

Background

2.1 Context

Colombia suffered from the longest civil war in the history of Latin America. The conflict started with the foundation of the guerrilla FARC (Fuerzas Revolucionarias Armadas de Colombia) in 1962 and the guerrilla ELN (Ejercito de Liberacion Nacional) in 1963. In the beginning they pretended to represent the rural population necessities and aimed to overthrow the national government in an intent to implement rural development politics. This war highly influenced the political and economic activity of the country, where various actors like drug dealers, armed groups and the central government tried to control the state of law of multiple regions of Colombia (Pardo, 2020).

In the beginning, the insurrection was localized and the guerilla groups did not have the political or military power to disrupt the country as a whole. However, at the end of the 1980's and the beginning of the 90's the guerrillas started to use drug trafficking, illegal mining and extortion as sources of funds (Sanchez and Formisano, 2003; Rangel, 2003; Reyes, 2016). These sources enabled non-state armed groups to gain control of multiple territories in the country, especially in the rural and peripheral areas that were perfectly located to boost the drug profits. As a response to the increase of guerrillas presence , some sectors of the civil population created paramilitary groups in the middle of the 1990's and consolidated in 1997 with the creation of the AUC (Autodefensas Unidas de Colombia in spanish). Colombia faced a war with three actors for decades until the demobilization of AUC in 2006 and the peace process with FARC in 2016.

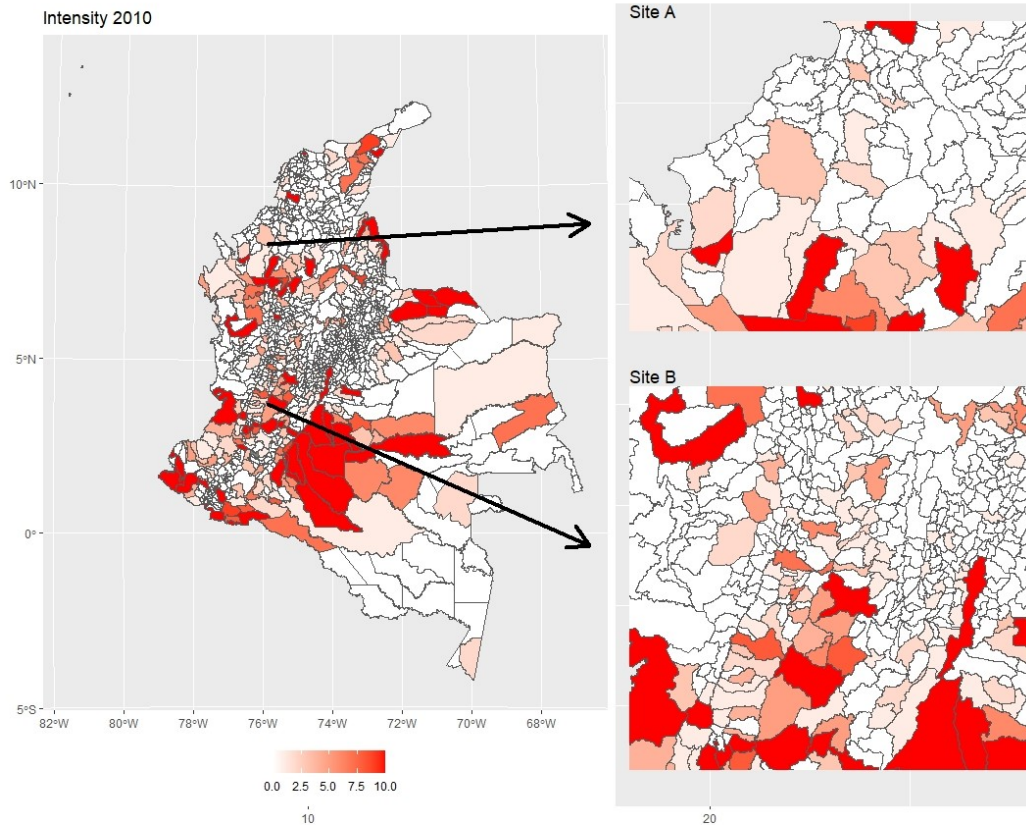
During the war FARC had a presence all over the country with a hierarchical organization that allowed the armed group to have between 10.000 to 20.000 soldiers in its army (Verdad Abierta, 2016). The non-state armed group fought on more than seventy fronts with the intention to achieve political and economic power. At the beginning of the peace agreement the armed group controlled 242 districts, which represents 23% of the total districts of the country and 12% of the total population (?). The presence of armed groups in the rural areas undermine the power of the state and the possibility to create a well-articulated economy with the country and the region (Medina et al., 2017). Moreover, the violence and the forced movement in the

rural areas limited development, perpetuating poverty (Reyes, 2016). Furthermore, this conflict has affected the country in many socioeconomic ways. The civil war reduced the productivity capacity of the country, constraining the GDP growth and productive capacity (Cardenas, 2002; Montenegro and Posada, 1994; Villa et al., 2014).

FARC captured territory all over the country until the government of Alvaro Uribe Velez created a turning point by investing in defense and increasing offensive operations (Vargas and Godoy, 2013). This situation helped the next president, Juan Manuel Santos, to initiate a peace negotiation in 2012. The negotiations lasted 4 years, and they mainly took place in Cuba. The national government and the guerrillas continued the fighting, while they were talking about the peace process in La Habana. This particular characteristic created many swings during the first two years of negotiation because sporadic attacks undermined the will to bargain. At the end of the second year of negotiation, FARC decided to implement an indefinite unilateral ceasefire. This ceasefire was violated various times until the 20th December of 2014 when the government and the non-state armed group agreed to create a definitive bilateral ceasefire. As a result, the country experienced a substantial reduction of violence in the last period of the process, where FARC offensive activities decreased by an astonishing 98% (CERAC, 2016). In 2016, both parties reached a settlement that included four cornerstones: Rural development, political participation, Illicit drugs and victims reparations. The rural development content aimed their efforts to support the farmers and help them to overcome the rural poverty gap (de la Calle, 2019).

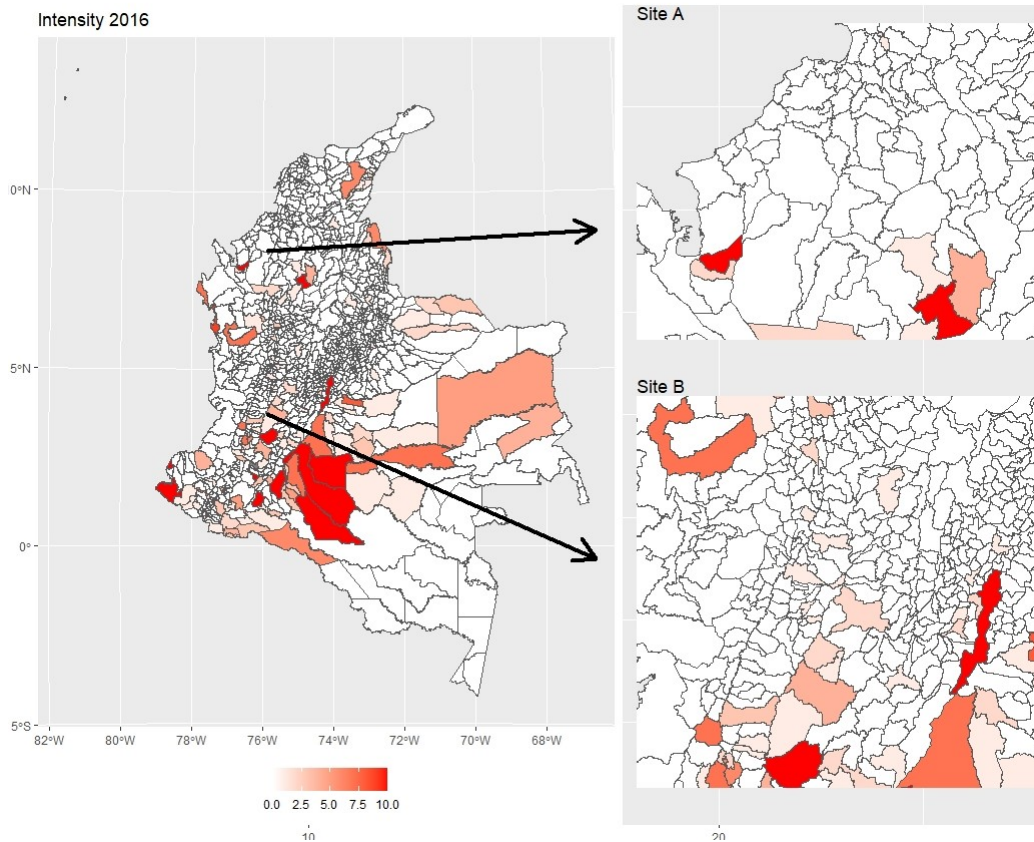
In the final stage of the peace agreement the fighters gave up their arms in transitory normalisation zones, where FARC stopped violent incursions and the national government promised to support the demobilized soldiers in their transition to a peaceful society. Moreover, the national government promised to create a National Plan that will create a "New Rural Colombia", where the state will invest in rural zones (Mesa de Conversaciones, 2018). Specifically, the final document focus the attention in provide public infrastructure to the rural zones, give subsidies and loans, provide technical support, and provide a regulatory framework for the land property rights. In order to show a clearer image of the peace agreement effect in the country Figure 1 and Figure 2 illustrate the evolution of violence in districts that had exposition to FARC. As it can be seen in the graphs the peace negotiation reduced the intensity of violence in most of the country.

Figure 2.1. 2010 Intensity



Notes: The left map represents the intensity of the conflict in Colombia's map. The right maps illustrate the zoom areas in the north and south part of the country. The scale of intensity goes from 0 to 10, where 0 is represented in white color and 10 in red color. The intensity scale was calculated summing FARC captures from the police and murders from FARC.

Figure 2.2. 2016 Intensity



Notes: The left map represents the intensity of the conflict in Colombia's map. The right maps illustrate the zoom areas in the north and south part of the country. The scale of intensity goes from 0 to 10, where 0 is represented in white color and 10 in red color. The intensity scale was calculated summing FARC captures from the police and murders from FARC.

2.2 Conflict, Peace and Investment

The recent peace agreement has created an opportunity for researchers in development economics and political science to evaluate the post-conflict situation of a country like Colombia. Various authors have highlighted the importance of the agreement in the improvement for the state to increase their presence in the rural areas, surge productivity of the land, and establish better commercial conditions for the farmers (Vargas and Godoy, 2016; Sanchez and Sanchez, 2019; Eufemia and Lana, 2018). The presence of armed groups in the territory created conditions of lawlessness that preserved bad economic practices like uncontrolled deforestation, unlicensed mining and production of coca leaf. Most of articles about the peace agreement focus their attention on the environmental footprint that FARC left in the country or the change in the supply chain of cocaine production. Prem et al. (2018) find that areas with violence exposure by FARC increased deforestation after the start of the ceasefire. They find that deforestation is weakened in municipalities with

high control of the state and increased in the districts with land intensive economies. Masse and Billon (2017) suggest that the illegal mining will persist in the post-war period because of the lack of institutions and effective regulation. Lopez et al. (2019) finds that the areas that had the presence of FARC before the peace agreement increased the coca leaf area instead of reducing it. Others authors find that the peace process changed the future expectations of the households, where municipalities increased several education outcomes and the total fertility rate after the permanent ceasefire in December 2014 (Guerra et al., 2021; Prem et al., 2021) Even though multiple studies evaluate the footprint left by FARC, none of them focus on the investment and food consumption decisions in the rural area after the demobilization of the armed group.

The literature identifies a strong relation between the armed groups and investment decisions, but the direction of causality may be ambiguous. The long standing presence of armed groups can change the structural characteristics of the region and their inhabitants (Grun, 2003; Verpoorten, 2009), and this condition may preserve non-optimal farm production practices (Bozzoli and Bruck, 2009; Bruck and Schindler, 2009). However, war can encourage investment under some circumstances. Firms can also benefit from the potential market power they gain by operating in an unsafe environment, with the loss of government regulation of environmental or other standards, and their ability to capture land or other resources (Smith and Rosenblum, 2011; Christensen and Wirtschafer, 2020)

The conflict literature in Colombia finds mixed results of non-state armed group presence on investment. The violence exposure of some regions in the country influenced the agricultural sector and rural development for decades. Even though the general effect for the country was bad, it was heterogeneous across regions. The armed groups aimed to move the local populations from subsistence agriculture to more profitable illegal activities like mining and production of coca leaf (Sanchez and Formisano, 2003; Rangel, 2003; Reyes, 2016). These highly profitable activities may support farmers in accessing the high profitable activities can support farmers getting access to more food and overcome poverty, but the presence of armed groups in the rural areas undermine the power of the state and limit the possibility of creating a well-articulated economy with the country and the region. Moreover, the presence of some groups with different ideological purposes may influence the decision of investment in some zones of the country, where left-oriented armed groups decrease investment but right-oriented groups increase investment of firms (Medina et al., 2017).

The long term conflict may have affected capital and assets of firms by violent attacks, looting and devastation reducing the production capacity of the farms (Blattman and Miguel, 2010; Justino, 2011). Even though the effect of civil conflict on rural investment may be ambiguous, it is expected that farmers and households may reap post conflict dividends. In some cases, economic activity like finance markets, external investment and trade grow rapidly after the cease fire (Abadie and Gardeazabal, 2003; Murdoch

and Sandre, 2002; Nillesen and Verwimp, 2010). In other cases, economic activity and welfare grow faster if the assets of the household are not widely affected by the conflict (Justino and Verwimp, 2013). Nevertheless, the decisions made in a new environment with a transition from high to low violent exposure may be complex because households affected by threatening shocks may have bad initial conditions limiting their ability to recover the capital that they had before war. And finally, farmers are also dealing with the fear and preserved risk's beliefs that changed their consumption patterns due to the presence of armed groups that imposed investment decisions (Ibanez and Moya, 2006; Blarel et al., 1992; Clay, 1996), they often use cope strategies that aim the portfolio investment of the farm to assets with high liquidity and low risk in case they need to move for an economic shock (Grun, 2003; Verpoorten, 2009). Nonetheless it is not clear if the imposed beliefs will linger in the farmer's decision process for a long time and if they would go back to an optimal capital track. Little evidence exists on whether and how individual investor decisions are affected by the imposition of peace. I try to fill this gap in this thesis.

Chapter 3

Data and Descriptive Statistics

3.1 Data

The dataset used in this research comes from the survey that the University of los Andes did during the years 2010, 2013 and 2016 in Colombia called Encuesta Logitudinal de Colombia (ELCA). ELCA has data from 16 randomized districts all over the country in 9 different states. The survey collected 4,700 observations in three years: 2010, 2013 and 2016. The survey follows the same invidious through the three rounds. This survey has observation of the households 2 years before the peace agreement started and two more observations during negotiations, which is a period of historic low violence rates in Colombia. I balanced the panel data, which left 7,670 observations for the three periods.

3.2 Conflict Exposure

One of the most difficult questions in violence research is how to measure the conflict exposure. In this paper exposure is identified by the presence of the armed group in the villages. The survey includes a question about presence of armed groups in the villages ¹. Households that are within those communities any year between 2006 and 2010 are specified as observations that had violence exposure during the war period. I assume that the village leaders knowledge about their community status are a good proxy of presence of an armed group². However, the question does not specify which armed group that had presence in the region, this may be a problem for existence the ELN non-state armed group, which had not been demobilized by 2016. Appendix 8.4 I shows that ELN did not have territory control in the villages sampled in the survey, then ELN activity is not affecting my identification strategy.

Moreover, I selected the years between 2006 and 2010 because it is a relative stable period of war with low changes of presence of the armed group, this assumption is explained in the appendix 8.2 with the parallel trend assumption. On average 7 per cent of the households are in zones that have presence of armed groups

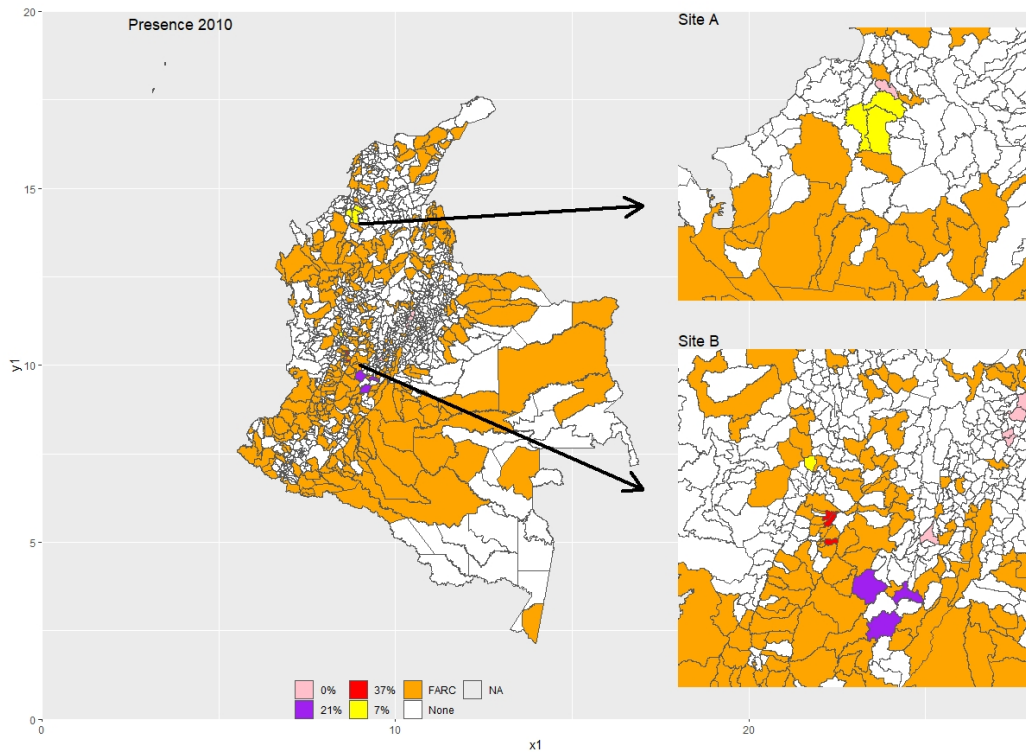
¹Specifically the question is : "Does this community have presence of the armed group during one of these periods?"

²This assumption is very plausible given that rural villages in Colombia are small communities

for at least one year between 2006 and 2010.

This article also takes into account the spillover effect that the reduction of violence may create. I am capturing this side effect with the neighbor villages within the same political district. Unfortunately the villages and the household locations are geocoded in order to protect the information of the respondents. However, I can use the information at district level. Figure 4 shows the location of the villages used in this research organized by percentage of villages with presence in the each district. The map shows that control groups are located all over the map. There is one located in the north, one in the south, and the most of them are in the middle of the country. The map also shows that the villages with historical presence of the armed group are located all over the map, however there is greater prevalence of these villages in the south.

Figure 3.1. Location of the Villages



Notes: The orange color represents areas that the ministry of defence classify as having some level of presence of the armed group. The colored districts that are not orange are the ones used in this research. The pink color represents district that have 0% of villages with reported presence, which mean that they are the control group. The yellow color showcase districts reporting to have 7% villages with presence or less within their territory. The purple color represents districts that have between 8% and 21% villages with presence. The red color represents districts that have between 21% and 37% villages with presence.

3.3 Investment

My primary outcome is investment by households in their farm. Specifically, I use the value reported by households of the total investment in the farm in the last 3 years. To avoid miss-specification due to the high proportion of 0s in the distribution of investment I employ the inverse hyperbolic sine transformation of the variable.

Moreover, this thesis also uses the proportion of land that households reported dedicated to perennial (permanent), annual (transitory) crops and short term crops³. Perennial crops are alive year-round and are harvested multiple times before dying, in Colombia those crops are mainly used for tree based products like banana, coffee, sugarcane and oil palm. Annual crops are plants that perform their entire life cycle from seed to flower. It is common that all roots, stems and leaves of the plant die before an annual cycle. Horticulture is the common use for annual crops. Farms that use mixed cropping grow more than one product simultaneously in the same field, trying to have multiple harvest at different times of the year. Specifically, I use the hectares dedicated to the general categories, and as I do with the total investment, I use the inverse hyperbolic sine transformation of these variables too.

3.4 Food Security Measure

This paper uses a food diversity index as the main measure of welfare. The index that I created is based on the Household Dietary Diversity Score (HDDS) Swindale and Bilinsky (2006). The food matrix of the households contains 20 different categories that include a variety of options of food purchases (Appendix 8.1). The household reports if they buy each product and the frequency. I used the monthly frequency as the selected period for the diversity score index⁴. The following equation describes the Dietary Diversity Index (DDI):

$$DDI_{it} = \frac{\sum_{i=0}^{20} P_{it}}{20} \quad (3.1)$$

The parameter P_{it} represents a dummy variable that takes the value of 1 if the category is purchased in a monthly or less frequency

³I classify short term crops as those that are either mixed or transitory crops because both land use strategies try to get multiple harvests in one year

⁴Check the appendix 8.1 to see the validation of this assumption

3.5 Descriptive Statistics

As I mentioned before, in the data, I observe one period prior to the negotiations and two periods during the peace agreement, one of those periods is after the ceasefire. The two consecutive ceasefires created an external variation of violence at the end of the peace process that this article is leveraging as its shock to treatment. The Figure 3.2 shows the variation of murders and perceived presence in the villages with FARC and in the places without FARC presence⁵. It looks that the presence has been decreasing since the negotiation of the agreement, but the violence only decreased after ceasefires of 2013 and 2014. Moreover, the trend of the investment on the farm ⁶ and the Food diversity index reported in figure 6 shows a parallel trend leading from 2010 to 2013. Then, it looks that the reduction of violence is having effect after that year.

Table 1 shows the balance characteristics of the main welfare features of the households, some properties of production, labor and market condition and some violence characteristics of the village. There is not a significant difference in the investment made to the farm between the two groups, neither the farm's size. Nevertheless, the farms with high exposure to the armed group have more area dedicated to permanent crops, which may be explained by their location in the map, they are in areas where it is easy to sow tree based crops like fruits. However, farms in villages with presence have more area dedicated to short term crops. Households with presence exposure are less likely to sell on farm, sell to other districts and they work less in agricultural sector as employed or farmer. It looks there is not a big difference selling to intermediaries.

Households with and without FARC presence are not statistically different in their total consumption. However, the food security measures are different between the groups. The observations located in the control area have an average of 0.69 in the DDI ⁷, and the households with presence and their neighbors have 3pp less DDI. Moreover, the proportion of resources that the households use to buy food is higher 2.79 pp in the locations with some violence exposure.

Households with presence of the armed group are more likely to have murders and kidnappings than the control villages. At the baseline, the treated sample shows the characteristics of areas with high exposure of violence: Low food diversity, less market activity, less work in the agricultural sector, and more land used in short term crops all of those combined with high rates of murders, kidnappings and presence of armed groups.

⁵I am not including the neighbors in this analysis for two main reasons. First, war may have spillover effects that I want to avoid in this preliminary analysis . Second, there is an entire section dedicated to them.

⁶The investment unit is Colombian pesos

⁷The maximum level of this index is 1, which means that the household bought the 20 categories

Figure 3.2. Violence

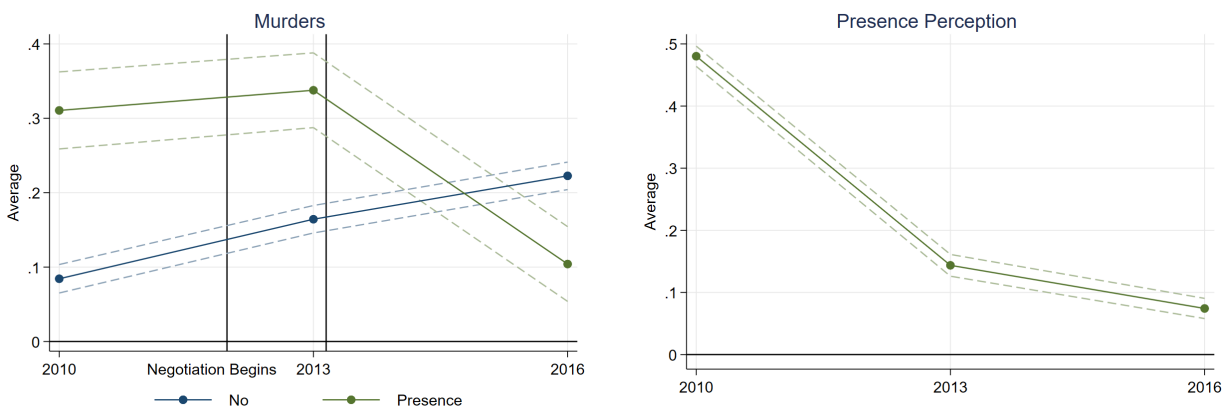


Figure 3.3. Farm Investment and DDI

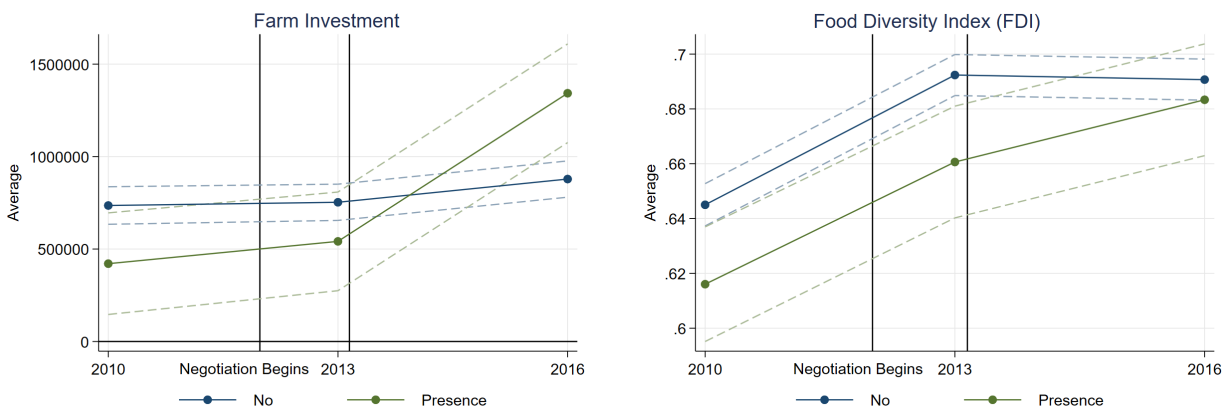


Table 3.1. Balance Table

| Variables | (1) Control | (2) Presence | (3) Presence v Control |
|-------------------------------|------------------------------|------------------------------|------------------------------|
| Consumption (pesos) | 449,237.41 (385,975.72) | 439,536.63 (370,328.59) | -9,700.76 (28,792.89) |
| Share food | 61.82 (18.06) | 64.62 (14.55) | 2.79** (1.33) |
| Dietary Diversity Index (DDI) | 0.69 (0.15) | 0.66 (0.15) | -0.03*** (0.01) |
| Investment (pesos) | 854,122.19 (2,827,647.00) | 609,509.88 (2,415,067.50) | -244,612.27 (208,533.80) |
| Farm's Size (Ha) | 3.15 (5.85) | 3.04 (6.17) | -0.11 (0.44) |
| Permanent Crops (Ha) | 0.31 (0.91) | 0.46 (1.19) | 0.15** (0.07) |
| Transitory Crops (Ha) | 0.32 (1.03) | 0.46 (1.87) | 0.13 (0.09) |
| Short Term Crops (Ha) | 0.63 (1.39) | 0.92 (2.21) | 0.28** (0.11) |
| Sell on Farm | 0.76 (0.43) | 0.44 (0.50) | -0.31*** (0.04) |
| Intermediary (Big Company) | 0.03 (0.17) | 0.04 (0.19) | 0.01 (0.02) |
| Sell Other Village | 0.05 (0.22) | 0.06 (0.25) | 0.02 (0.02) |
| Sell Other District | 0.13 (0.34) | 0.12 (0.32) | -0.02 (0.03) |
| Work in Farm | 0.48 (0.50) | 0.40 (0.49) | -0.08* (0.04) |
| Farm Employed | 0.51 (0.50) | 0.38 (0.49) | -0.13*** (0.04) |
| Murders | 0.16 (0.37) | 0.34 (0.47) | 0.17*** (0.03) |
| Kidnappings | 0.03 (0.18) | 0.22 (0.42) | 0.19*** (0.02) |
| Presence in Baseline | 0.00 (0.05) | 0.30 (0.80) | 0.30*** (0.02) |
| Observations | 1,499 | 202 | 1,884 |

Notes: Column (1) shows the average of the control group. Columns (2) showcases the average of the treated group. Column (3) shows the difference between the two groups. The share of food estimation is calculated as Food Expenditure/Total Expenditure. Intermediary variable shows the proportion of sales made by a big intermediary. The variables murders, kidnappings and presence are calculated in a village level. The p value significance is shown like: *** 0.01, **0.05, *0.1.

Chapter 4

Methods

I use the change in violence exposure experienced by those regions with and without prior FARC presence to use a difference and difference approach. The equation (2) resumes my empirical strategy. I use 2013 as the baseline year because it is the period immediately before the reduction in violence

$$Y_{it} = \alpha + \beta_1 P_i + \beta_3 T_i + \beta_4 P_i T_i + \theta_i + \epsilon_{it} \quad (4.1)$$

where Y_i is the outcome of interest, $T_i(\text{Post})$ represents the post period, the 2016. $P_i(\text{Presence})$ takes the value of 1 if the individual was in a zone that has exposure to the armed group at least one year during 2006 to 2010, 0 otherwise. θ_i represents household fixed effects and the ϵ_{it} shows the error of the model. This model constrains the sample in that, I do not include the villages that do not report FARC occupancy but are in one district that has at least one village with presence. In summary, I am not including the neighbor villages of the FARC strongholds because there may be a spillover effect that affects the identification strategy. I include these regions to measure spillover effects in section 5.2.

The two main assumptions of this empirical strategy are the parallel trend and that there are no confounding time-varying effects (Lechne, 2011). Basically, the empirical strategy assumes no time varying unobservable that affects the treatment and control regions differently. Various robustness checks of these assumptions are in the appendix 8.2.

Chapter 5

Results and Discussion

5.1 Main Estimates

5.1.1 Violence

Table 5.1 shows the reduction of three main outcomes associated with violence exposure: Murders and kidnappings. Villages that had an armed group presence before the peace negotiations experienced a reduction of 32 pp in the probability to murder, saw a no statistical reduction in the kidnappings by 22 pp. Even though the agreement was only in the negotiation stage, this table confirms that the ceasefires drove villages to decrease the levels of violence in zones with historic presence of the armed group.

Table 5.1. Violence

| | (1) Murders | (2) Kidnappings |
|-----------------|-------------------|--------------------|
| Presence * Post | -0.32** (0.16) | -0.22 (0.16) |
| Post | 0.73 (0.45) | 0.61** (0.30) |
| Constant | -0.15 (0.22) | -0.17 (0.15) |
| Observations | 3385 | 3385 |
| R^2 | 0.522 | 0.574 |
| Adjusted R^2 | 0.502 | 0.556 |

Notes: Column (1) & (2) show the effect of the treatment on the reported murders and the kidnappings at village level. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. These estimates include village and time fixed effects. The p value significance is shown as: *** 0.01, **0.05, *0.1, with errors calculated with cluster at village level.

5.1.2 Investment

Households may adapt their investment after the reduction of violence. As discussed above, exposure to violence may cause households to invest less overall, planting crops with short-run payoffs and low risk (Arias et al., 2019). In the short run, the reduction in exposure to violence may not affect the size of the assets, but may change the household allocation within its portfolio of investments. The table 5.2 shows the effect of the ceasefire on the household's investment decisions on the farm. The peace agreement it increased the amount of on-farm investment by 3.8 relative to areas with no armed group presence. However, the size of the farm is not increasing at all, which means that the households are not using their new investment to enlarge their asset.

Furthermore, farmers are changing the type of crops they invest in. As shown in Table 5.2, farm households in areas with prior FARC presence. increase the area dedicated to permanent crops by 29% more than the control, which means an increase in $90.2 m^2$ on perennial crops on average. Moreover, households diminish the area dedicated to short term crops by 28.8% , which means a reduction of almost $181 m^2$. Households change almost $271 m^2$ of their of land on average, which represents 28.8% of the total area dedicated to crop productive usage.

These results suggest that households in areas with prior history of armed groups exchange assets with low risk like short term crops for high risk positions like permanent crops¹. These are not small changes. they alter about 1/3 of their investment portfolio position. These results suggest that farmers perceive the ceasefires as a signal of a better investment environment because they increase their investment risk position and dedicate a large share of their available assets to this new strategy.

¹Short term crops crops can be classified as low risk assets because farmers do not invest too much on them and they return the benefit in a shorter period of time, allowing the households to avoid violent shocks that affect their wealth in the long run(Grun, 2003). Permanent crops have the opposite purpose, they need more investment and the returns are expected in a longer period of time

Table 5.2. Investment Decisions

| | (1) | (2) | (3) | (4) | (5) |
|-----------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | Investment | Farm's Size | Permanent Crops | Transitory Crops | Short Term |
| Presence * Post | 3.766*** (1.273) | -0.001 (0.101) | 0.291** (0.140) | -0.073 (0.068) | -0.288** (0.138) |
| Post | 6.729 (6.919) | -0.017 (0.613) | -0.103 (0.410) | 0.291 (0.338) | 0.650 (0.475) |
| Constant | 6.055*** (0.192) | 1.266*** (0.018) | 0.226*** (0.012) | 0.232*** (0.010) | 0.361*** (0.014) |
| Observations | 3382 | 3382 | 3382 | 3382 | 3382 |
| R^2 | 0.607 | 0.850 | 0.741 | 0.722 | 0.672 |
| Adjusted R^2 | 0.207 | 0.698 | 0.478 | 0.439 | 0.339 |

Notes: Column (1) & (2) show the effect of the treatment interacted with the post-period on the hyperbolic sine transformation of the investment and the farm's size. Column (3) & (4) show the effect of the treatment interacted with the pos-period on the hyperbolic sin transformation of the area of permanent and transitory crops. Column (5) shows the effect of the treatment interacted with the pos-period on the hyperbolic sin transformation of the area of transitory plus mix crop. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. These estimates have household and time fixed effect. The p value significance is shown as: *** 0.01, **0.05, *0.1, the errors are calculated with cluster at village level.

5.1.3 Consumption and Welfare

In this section I explore the effect of the ceasefire on household welfare as measured by food security. Table 5.3 shows that the food diversity index that I created does not increase in zones with prior presence of the armed group. Furthermore, the total consumption, the consumption dedicated to food and the proportion of consumption that the household uses in food (share of food) do not appear to be influenced by the peace agreement either.

Moreover, table 5.4 depicts which categories of food have a higher probability of being consumed by treated households after the peace agreement. The results show that households increase their probability of consuming protein (through chicken) by 8.3 pp, and of vitamins through fruit by 9.3 pp.. It also shows a 7.2 pp decrease in the probability of consuming potatoes, which is considered an inferior good and an increase 6.4 pp and 10.6 pp in luxury goods like candies and cookies respectively. The only category that has a statistically significant effect is candies. These findings indicate that households do not sacrifice consumption to fund the increase in farm investment.

Table 5.3. Dietary Diversity and Consumption

| | (1) | (2) | (3) | (4) |
|-----------------|-------------------|--------------------|--------------------|-----------------------|
| | DDI | Consumption | Food Consumption | Share of Food |
| Presence * Post | 0.03 (0.03) | -0.03 (0.07) | -0.02 (0.08) | 1.82 (2.75) |
| Post | 0.44*** (0.15) | 8.32*** (0.58) | 5.88*** (0.66) | -101.26*** (23.30) |
| Constant | 0.69*** (0.00) | 12.80*** (0.02) | 12.27*** (0.02) | 62.17*** (0.43) |
| Observations | 3385 | 3385 | 3385 | 3385 |
| R^2 | 0.704 | 0.824 | 0.763 | 0.612 |
| Adjusted R^2 | 0.403 | 0.646 | 0.522 | 0.218 |

Notes: Column (1) shows the effect of the treatment interacted with the post-period on the Dietary Diversity Index. Column (2) & (3) show the effect of the treatment interacted with the pos-period on the logarithm of the total consumption and the logarithm of food consumption of the households. Columns (4) shows the effect of the treatment interacted with the post-period on the share of food ratio. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. These estimates have household and time fixed effect. The p value significance is shown like: *** 0.01, **0.05, *0.1, the errors are calculated with cluster at village level.

Table 5.4. Expenditure and Consumption Categories

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | Chicken | Sausage | Potato | Fruits | Candies | Cookies |
| Presence * Post | 0.083 (0.073) | 0.054 (0.069) | -0.072 (0.052) | 0.093 (0.061) | 0.064** (0.031) | 0.106 (0.103) |
| Post | 0.549 (0.423) | 0.997** (0.388) | 0.242 (0.479) | 0.256 (0.455) | 0.141 (0.283) | 0.724 (0.454) |
| Constant | 0.609*** (0.013) | 0.355*** (0.011) | 0.836*** (0.011) | 0.716*** (0.011) | 0.945*** (0.005) | 0.672*** (0.011) |
| Observations | 3381 | 3381 | 3381 | 3381 | 3381 | 3381 |
| R^2 | 0.623 | 0.655 | 0.670 | 0.652 | 0.564 | 0.644 |
| Adjusted R^2 | 0.240 | 0.304 | 0.333 | 0.298 | 0.120 | 0.281 |

Notes: Table shows the effect of the treatment interacted with the post-period on the DDI's categories of consumption. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. These estimates have household and time fixed effect. The p value significance is shown like: *** 0.01, **0.05, *0.1, the errors are calculated with cluster at village level.

5.2 Spillover Effect

Peace may have a buffer effect, where neighbors can also be influenced by the peace process. I include an extra parameter N_i (Neighbors) that takes the value of 1 if the individual was in a village within the same district of one of the villages that has presence of armed groups, 0 otherwise. The descriptive variables and the comparison of this group with the main treatment and control are in the appendix 8.3.1. This model does not constrain the sample as the one in the equation (2). The equation (3) resumes my empirical strategy.

$$Y_{it} = \alpha + \beta_1 P_i + \beta_2 N_i + \beta_3 T_i + \beta_4 P_i V_i + \beta_5 T_i N_i + \theta_i + \epsilon_{it} \quad (5.1)$$

Table 5.5 presents the effect of peace agreement on violence variables for the district with historic presence and their neighbors. It looks that the peace agreement also influences the neighbors, especially with a reduction of 19pp in the probability to experience kidnappings. Even though the peace agreement had positive effects for the neighbors, the zones entirely dominated by the non-state armed group decreased the murders 29pp more than their neighbors. There is no statistical difference of reduction of kidnappings between the groups. One possible explanation of this can be the different influence that the armed group had in various zones, it is expected that in places where FARC has strong historic presence, they will impose rules through rebel governance techniques like murders, but kidnapping is a channel of funding that can be applied in both places.

Moreover, table 5.6 shows the main investment and consumption decision of the households. Panel A showcases that investment is positively affected by the peace agreement in the neighbors too, creating almost a threefold growth of investment in the farm. This result is not statistically different from the effect of the peace on the guerrilla's strongholds. Moreover, farmers in the buffer zones increase 9% the land used in annual crops and they do not change the land used for short crops. This increment represents $28m^2$, which are 3% of the area dedicated to productive activities. These estimates show that farmers in the neighboring zones are increase the investment, but the change in the use of land to perennial crops is 20 pp less than those in the rebel group's zones, transitory crops decrease 9 pp less than those of the guerrilla's zone as well. Table 5.6 depicts that the peace agreement has a consistent spillover effect over the neighbors.

Panel B in table 5.6 illustrates that peace agreement does not affect DDI in any group. Moreover, this panel shows that the peace agreement does not have an effect in the total consumption, the food consumption or the resources allocated to the food in any of the groups. These findings confirm that the increase of investment is not growing at the expense of the consumption path of the households. The parallel trend assumption for these estimates is showed in the appendix 8.3.2.

Table 5.5. Violence

| | (1) Murders | (2) Kidnappings |
|------------------|------------------|--------------------|
| Presence * Post | -0.31* (0.16) | -0.22 (0.16) |
| Neighbors * Post | -0.02 (0.09) | -0.19*** (0.06) |
| Post | 0.64 (0.39) | 0.38 (0.26) |
| Constant | -0.11 (0.19) | -0.06 (0.13) |
| Observations | 5115 | 5115 |
| Difference | -0.29* (0.16) | -0.03 (0.15) |
| R^2 | 0.527 | 0.570 |
| Adjusted R^2 | 0.507 | 0.552 |

Notes: Column (1) & (2) show the effect of the two treatments on the reported murders and the kidnappings at village level. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. The p value significance is shown like: *** 0.01, **0.05, *0.1, the errors are calculated with cluster at village level.

Table 5.6. Buffer Effect - Investment and Consumption

| Panel A: Investment | (1) | (2) | (3) | (4) | (5) |
|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | Investment | Farm's Size | Permanent Crops | Transitory Crops | Short Term |
| Presence * Post | 3.71*** (1.26) | 0.00 (0.10) | 0.30** (0.14) | -0.07 (0.07) | -0.29** (0.14) |
| Neighbors * Post | 3.04*** (0.70) | -0.01 (0.05) | 0.09* (0.05) | 0.02 (0.03) | -0.09 (0.06) |
| Post | 1.39 (6.46) | 0.01 (0.53) | -0.56 (0.40) | 0.22 (0.29) | 1.01** (0.45) |
| Constant | 5.71*** (0.16) | 1.20*** (0.01) | 0.27*** (0.01) | 0.21*** (0.01) | 0.36*** (0.01) |
| Observations | 5111 | 5111 | 5111 | 5111 | 5111 |
| Difference | 0.67 (1.33) | 0.01 (0.10) | 0.21 (0.15) | -0.09 (0.07) | -0.20 (0.15) |
| R^2 | 0.609 | 0.858 | 0.750 | 0.716 | 0.644 |
| Adjusted R^2 | 0.206 | 0.710 | 0.490 | 0.422 | 0.277 |

| | (1) | (2) | (3) | (4) |
|------------------|-------------------|--------------------|--------------------|----------------------|
| | DDI | Consumption | Food Consumption | Share of Food |
| Presence * Post | 0.03 (0.03) | -0.03 (0.07) | -0.02 (0.08) | 1.79 (2.71) |
| Neighbors * Post | 0.02 (0.01) | 0.00 (0.05) | 0.00 (0.05) | -0.47 (1.49) |
| Post | 0.49*** (0.13) | 8.08*** (0.47) | 5.78*** (0.55) | -98.26*** (19.58) |
| Constant | 0.68*** (0.00) | 12.82*** (0.01) | 12.31*** (0.01) | 63.32*** (0.34) |
| Observations | 5136 | 5136 | 5136 | 5136 |
| Difference | 0.01 (0.03) | -0.03 (0.07) | -0.01 (0.07) | 2.25 (2.81) |
| R^2 | 0.705 | 0.826 | 0.762 | 0.611 |
| Adjusted R^2 | 0.403 | 0.648 | 0.519 | 0.212 |

Notes: Panel A shows the effect of the treatments in investment decision. Column (1) & (2) show the effect of both treatments interacted with the post-period on the hyperbolic sine transformation of the investment and the farm's size. Column (3) & (4) show the effect of both treatments interacted with the pos-period on the logarithm of the hyperbolic sin transformation of the area of permanent and transitory crops. Column (5) shows the effect of the treatment interacted with the pos-period on the hyperbolic sin transformation of the area of transitory plus mix crop. Panel B showcase the effect of the treatments in welfare. Column (1) shows the effect of the treatments interacted with the post-period on the Dietary Diversity Index. Column (2) & (3) show the effect of the treatments interacted with the pos-period on the logarithm of the total consumption and the logarithm of food consumption of the households. Columns (4) shows the effect of the treatments interacted with the post-period on the share of food ratio. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. The p value significance is shown as: *** 0.01, **0.05, *0.1, the errors are calculated with cluster at village level.

5.3 Heterogeneous Effect

Farmer's decisions may be influenced by their initial assets and the distance to the main markets. In this section I evaluate the heterogeneous effect of land tenure, size of the farm and proximity to markets on farm investment decisions.

I estimate the effect that land tenure has in the investment of the farm. Results in Table 5.7 show that tenure, defined as ownership of land, explains a big proportion of the investment on the farm, where farms that own the land increase almost 3.4 times the investment on the farm, however this result is not statistically significant. Land ownership does not influence the increase in the farm's size or the change from perennial to short term crops.

A possibility that the initial farm size will influence the investment due to economies of scale or through the possibility to have enough land to diversify the portfolio decision. The results in Table 5.8 show the effect of the peace agreement in the lower quartile (small) and higher quartile (big) of the distribution of farm size at baseline. Table 5.8 shows that the size of the farm does not impact the total investment or the allocation of resources in the farm. However, it has an effect in the investment of short term products in the neighboring villages with small sizes.

Finally, I evaluate if the distance to the main district affects the main outcomes. The results in Table 5.9 showcase the effect of the peace agreement in the lower quartile (close) and higher quartile (far) of the distance distribution to the main population municipality. Results show that the distance to the main population municipality does not affect the investment decision on the farm.

These findings suggest that peace does not have any heterogeneous effect on the investment. This is an important result because it looks that the peace dividend is homogeneous in the whole sample, which means that all the farmers benefit from the new investment environment.

Table 5.7. Investment by land tenure

| | (1) | (2) | (3) | (4) | (5) |
|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | Investment | Farm's Size | Permanent Crops | Transitory Crops | Short Term |
| Post | -5.78 (4.73) | -0.16 (0.40) | -0.32 (0.35) | -0.09 (0.29) | 0.47 (0.48) |
| Neighbors * Post | 3.72*** (1.10) | -0.06 (0.11) | 0.10 (0.09) | -0.02 (0.05) | -0.12 (0.09) |
| Presence * Post | 1.43 (2.34) | 0.02 (0.19) | 0.33* (0.19) | -0.09 (0.09) | -0.26* (0.13) |
| Neighbors * Post * Tenure | -0.50 (1.38) | 0.08 (0.12) | 0.00 (0.10) | 0.05 (0.06) | 0.01 (0.09) |
| Presence * Post * Tenure | 3.35 (2.71) | -0.01 (0.25) | -0.02 (0.19) | 0.01 (0.14) | -0.07 (0.17) |
| Constant | 5.94*** (0.16) | 1.26*** (0.01) | 0.28*** (0.01) | 0.22*** (0.01) | 0.38*** (0.01) |
| Observations | 4630 | 4630 | 4630 | 4630 | 4630 |

Notes: Tenure position is defined as ownership of the land. Column (1) & (2) show the effect of the two treatments interacted with the post-period and the tenure position of the households on the hyperbolic sine transformation of the investment and the farm's size. Column (3), (4) & (5) show the effect of the two treatments interacted with the post-period and the tenure position of the households on the hyperbolic sine transformation of the area of permanent, transitory and short term crops. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. The p value significance is shown like: *** 0.01, **0.05, *0.1, the error are calculated with cluster at village level.

Table 5.8. Investment by Farm Size

| | Investment | | Farm's Size | | Permanent | | Transitory | | Short Term | |
|--------------------------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | (1) Small | (2) Big | (3) Small | (4) Big | (5) Small | (6) Big | (7) Small | (8) Big | (9) Small | (10) Big |
| Post | -5.9 (4.9) | -6.7 (4.7) | -0.3 (0.4) | -0.1 (0.4) | -0.3 (0.3) | -0.4 (0.3) | -0.1 (0.3) | -0.1 (0.3) | 0.3 (0.5) | 0.4 (0.4) |
| Neighbors * Post | 3.4*** (0.8) | 2.9*** (0.7) | -0.1 (0.1) | 0.00 (0.1) | 0.1* (0.1) | 0.1** (0.04) | 0.00 (0.04) | 0.01 (0.03) | -0.2** (0.09) | -0.1 (0.05) |
| Presence * Post | 4.1*** (1.5) | 3.5** (1.4) | 0.00 (0.1) | 0.03 (0.1) | 0.4** (0.2) | 0.3** (0.1) | -0.1 (0.1) | -0.1* (0.1) | -0.4** (0.2) | -0.3** (0.1) |
| Neighbors * Post * Interaction | -0.3 (1.2) | 0.2 (1.4) | 0.1 (0.1) | 0.00 (0.1) | -0.05 (0.1) | 0.03 (0.1) | 0.01 (0.1) | 0.01 (0.1) | 0.2** (0.1) | -0.1 (0.1) |
| Presence * Post * Interaction | -0.3 (2.3) | 0.7 (1.9) | -0.02 (0.2) | -0.2 (0.2) | -0.2 (0.2) | -0.1 (0.2) | 0.05 (0.1) | 0.06 (0.2) | 0.3 (0.2) | -0.2 (0.4) |
| Constant | 5.9*** (0.2) | 5.7*** (0.2) | 1.3*** (0.01) | 1.2*** (0.01) | 0.3*** (0.01) | 0.3*** (0.01) | 0.2*** (0.01) | 0.2*** (0.01) | 0.4*** (0.01) | 0.4*** (0.01) |
| Observations | 4642 | 5125 | 4642 | 5125 | 4642 | 5125 | 4642 | 5125 | 4642 | 5125 |

Notes: Odd columns show the effect of the two treatments interacted with the post-period and a dummy that represents the lower quartile of the farm's size distribution. Even columns show the effect of the two treatments interacted with the post-period and a dummy that represents the higher quartile of the farm's size distribution. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. The p value significance is shown like: *** 0.01, **0.05, *0.1, the error are calculated with cluster at village level

Table 5.9. Distance to the District

| | Investment | | Farm's Size | | Permanent | | Transitory | | Short Term | |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | (1) Close | (2) Far | (3) Close | (4) Far | (5) Close | (6) Far | (7) Close | (8) Far | (9) Close | (10) Far |
| Post | -6.40 (4.78) | -6.47 (4.69) | -0.12 (0.37) | -0.10 (0.37) | -0.30 (0.31) | -0.32 (0.32) | -0.05 (0.29) | -0.05 (0.29) | 0.37 (0.46) | 0.40 (0.46) |
| Neighbors * Post | 3.09*** (0.89) | 2.63*** (0.74) | -0.01 (0.06) | -0.06 (0.06) | 0.13* (0.07) | 0.09 (0.05) | 0.02 (0.03) | 0.02 (0.03) | -0.12 (0.08) | -0.10 (0.07) |
| Presence * Post | 3.71** (1.76) | 3.13* (1.70) | -0.01 (0.11) | 0.05 (0.09) | 0.21 (0.15) | 0.20 (0.13) | -0.06 (0.11) | -0.05 (0.07) | -0.17 (0.18) | -0.15 (0.15) |
| Neighbors * Post * Interaction | -0.69 (1.62) | 2.08 (2.15) | 0.05 (0.12) | 0.43* (0.22) | -0.13 (0.11) | 0.07 (0.16) | -0.02 (0.07) | -0.06 (0.09) | 0.09 (0.13) | 0.01 (0.16) |
| Presence * Post * Interaction | 0.26 (3.41) | 5.28 (5.08) | 0.06 (0.23) | -0.25 (0.29) | 0.01 (0.19) | 0.27 (0.19) | -0.08 (0.20) | -0.35 (0.33) | -0.08 (0.32) | -0.48 (0.37) |
| Constant | 8.72*** (2.78) | 8.78*** (2.62) | 0.90*** (0.31) | 0.89*** (0.30) | 0.22* (0.12) | 0.21* (0.13) | 0.12 (0.18) | 0.11 (0.18) | 0.18 (0.35) | 0.18 (0.34) |
| Observations | 5012 | 5012 | 5012 | 5012 | 5012 | 5012 | 5012 | 5012 | 5012 | 5012 |

Notes: Odd columns show the effect of the two treatments interacted with the post-period and a dummy that represents the lower quartile of the distance distribution. Even columns show the effect of the two treatments interacted with the post-period and a dummy that represents the higher quartile of the distance distribution. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. The p value significance is shown like: *** 0.01, **0.05, *0.1, the error are calculated with cluster at village level

5.4 Mechanisms

5.4.1 Investment

This thesis suggests that peace has large positive effects on investment. A possible explanation of the effect is that armed groups can affect investment by decreasing the security of property rights and by decreasing the state's capacity to regulate business. Small firms in the rural zones in Colombia live in an informal framework, which means they are less likely to benefit from the regulation channel, but experience the consequences of weak property rights. Households may have seen the ceasefires and the peace agreement as a strong signal of FARC's activities decrease, leading farmers to expect secure property right. The new investment portfolio changes to the households's live in FARC strongholds suggest that this is the case because they are exchanging benefits of short term for benefits in long term, where the expectation to hold the assets for long periods is an important assumption for this new strategy.

Moreover, one important factor in the property rights influence of the non-armed group is the tenure land position of the households. Table 5.10 showcases the effect of the ceasefires in the land tenure position. Results show that the ownership of the land increases in 9 pp, which means an increase of 11% compared with baseline. Table 5.10 also depicts the effect of peace in the legal and illegal tenure. It looks that there is not effect. As it is shown in the previous sections, the size of the farms does not increase for the peace. However, results of table 5.10 suggests that a larger proportion of the farmers' land is classified as property, which means that farmers do not buy more land, but they legalize their previous land as property. These findings suggest that households perceive that their property is more secure.

Table 5.10. Land Tenure Change

| | Own Land | | Leasing Tenure | | Illegal Tenure | |
|-----------------|-------------------|------------------|-------------------|------------------|-------------------|-----------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Presence * Post | 0.09* (0.05) | 0.09** (0.04) | -0.06 (0.05) | -0.06 (0.04) | -0.01 (0.04) | -0.01 (0.03) |
| Post | 0.18 (0.20) | 0.21 (0.16) | -0.13 (0.25) | -0.14 (0.20) | 0.04 (0.12) | 0.04 (0.10) |
| Constant | 0.75*** (0.01) | 0.42** (0.19) | 0.30*** (0.01) | 0.48** (0.19) | 0.09*** (0.01) | 0.08 (0.09) |
| Observations | 4686 | 4686 | 5082 | 5082 | 5082 | 5082 |
| Household FF | Yes | No | Yes | No | Yes | No |
| Village FF | No | Yes | No | Yes | No | Yes |
| R^2 | 0.642 | 0.088 | 0.489 | 0.081 | 0.355 | 0.069 |
| Adjusted R^2 | 0.441 | 0.059 | 0.230 | 0.055 | 0.028 | 0.042 |

Notes: Legal tenure represents land that is leased or owned, illegal tenure represents land used without formal contract or owner. Column (1) & (2) show the effect of the treatments interacted with the post-period on the probability to have at least one fraction of land with "ownership" status. Column (3) & (4) show the effect of the treatments interacted with the post-period on the probability to have at least one fraction of land with "Leasing" status. Column (5) & (6) show the effect of the treatments interacted with the post-period on the probability to have at least one fraction of land with "Illegal" status. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. These estimates have household and time fixed effect. The p value significance is shown as: *** 0.01, **0.05, *0.1 the error are calculated with cluster at village level.

Chapter 6

Summary and Concluding Remarks

This thesis uses a panel of rural households to evaluate the effect of the Colombian peace agreement on decisions and household welfare of rural households. I use the variation created by the ceasefire in the peace process to compare regions with and without prior FARC presence to evaluate the effect of a peace signal in the investment and food consumption decision on the households.

My findings suggest that the ceasefire period between 2013 and 2014 was interpreted by households as a signal of a better investment environment. I find that households increased their investment on the farm almost 4 times in villages that had historic presence of the non-state armed group after the ceasefire period compared with the control group. The investment boost is not used to enlarge the farm's size, but to change the portfolio strategy of the households. Farmers increase the permanent crops by 39% and decreasing the transitory crops by 28% compared with the baseline. These changes represent a reallocation of almost 28% of the productive land used in crops. The heterogeneous result shows that peace does not have a different effect among farmers. Specifically, the findings suggest that farmers believe that the long term benefits are going to be better than the short term benefits for the unprecedented ceasefire that decreased the FARC actions by 98% (CERAC, 2016). Moreover, these outcomes suggest that the investment growth did not come at expense of the consumption. Households sustain their levels of dietary diversity, total consumption and food consumption.

Furthermore, this thesis shows that the peace also had a spatial spillover on investment. Where households that inhabit stronghold's neighbor villages decreased the kidnappings and increase the investment on the farm almost 3 times without decreasing the consumption.

The thesis's findings suggest that the investment is an important channel through armed conflict affect development. The short term reallocation of resources show that signals that advocate to a better future will affect the long term benefits of the firms. Indeed, farmers expectation to avoid conflict create an investment path that allocates more resources in longer term portfolio with higher risk.

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Appendix A: Food Diversity Index

This section of the appendix shows the categories of the food diversity index and the relation of the index with welfare and consumption variables. The table 12 discloses that the food diversity index with monthly frequency is capturing a welfare index of the households showcasing a strong relation of consumption and wealth, which means that wealthier households are consuming more diverse diet. This confirms that the index is not reflecting allocation of goods that may sustain a stable index, but a linear relation of welfare and diverse diet. The categories of Food Diversity Index are:

- Bread and products created with flour
- Milk and its processed products like yogurt and butter
- Eggs
- Beef
- Chicken
- Fish
- Sauces and jam
- Potato and tubers
- Rice, cereals, pasta and pasta
- Beans, pea and lentils
- Plantain
- Tomato, green beans, carrot, lettuce, onions, and other fresh vegetables
- Banana, orange, lemon, apple, pineapple and other fruits
- Cooking oil, butter

- Salt, sugar, and other condiments
- Coffee, chocolate and other hot beverages
- Candies and other snacks
- Canned products like tuna, sauces and beans
- Cookies
- Sodas and processed beverages

Table A1. Food Diversity Index relation

| | (1) DDI (Biweekly) | (2) DDI (Monthly) |
|--------------|-----------------------|----------------------|
| Consumption | 0.05*** (0.00) | 0.07*** (0.00) |
| Wealth | 0.00 (0.00) | 0.01*** (0.00) |
| T2 | 0.00 (0.00) | 0.03*** (0.00) |
| T3 | 0.00 (0.00) | 0.02*** (0.00) |
| Constant | -0.13** (0.06) | -0.22*** (0.06) |
| Observations | 12335 | 12335 |

Notes: Column (1) & (2) show the effect of the logarithm of consumption, the logarithm of wealth index and the two time dummies in the Food diversity index for a biweekly and monthly frequency. treatments interacted with the post-period on a selection of dummies that reflect the market decision. All the estimates include as control the logarithm of consumption, the wealth and the number of people per household at baseline interacted with the post variable. The p value significance is shown like: *** 0.01, **0.05 , *0.1.

Appendix B: Validation of Difference and Difference Assumptions

The first assumption that I must validate is that of a parallel trend. The results of the main estimates are replicated in figures B.1 with the inclusion of a previous period to prove the parallel trend assumption. The figures compare the groups with the 2010 period(pre) and with the 2016 period(post). This means that the baseline period is 2013 as the other estimates in the article. Figure B.1 shows that the estimates hold the parallel trend assumption because there is not effect in the previous period(pre). Moreover, the effect is clear in the post treatment period for the main variables.

The second assumption that must hold is the unconfounded relation between of the intervention with the outcome. This means that the outcomes that I use do not influence the probability of being treated or in this case that the reduction of violence is driven by one of the outcomes and not by the external reduction of violence. To sustain this assumption I used a stability period during the war which may lead the individuals to not expect a surprise reduction of violence. Graph 6 shows the proportion of villages that reported presence for the years 2002 to 2016. I included a discontinuity regression for the presidential government periods. As it can be seen in the graph, the period between 2006 to 2010, which is the second period of Uribe, is having a stability phase of the war that this research leverage. It is unlikely that households or the armed group had a clue about the peace agreement because the presence is decreasing only after 2010. Moreover the government of Santos was a turning point of the way that war was managed.

Figure B.1. Parallel Trend Validation 1

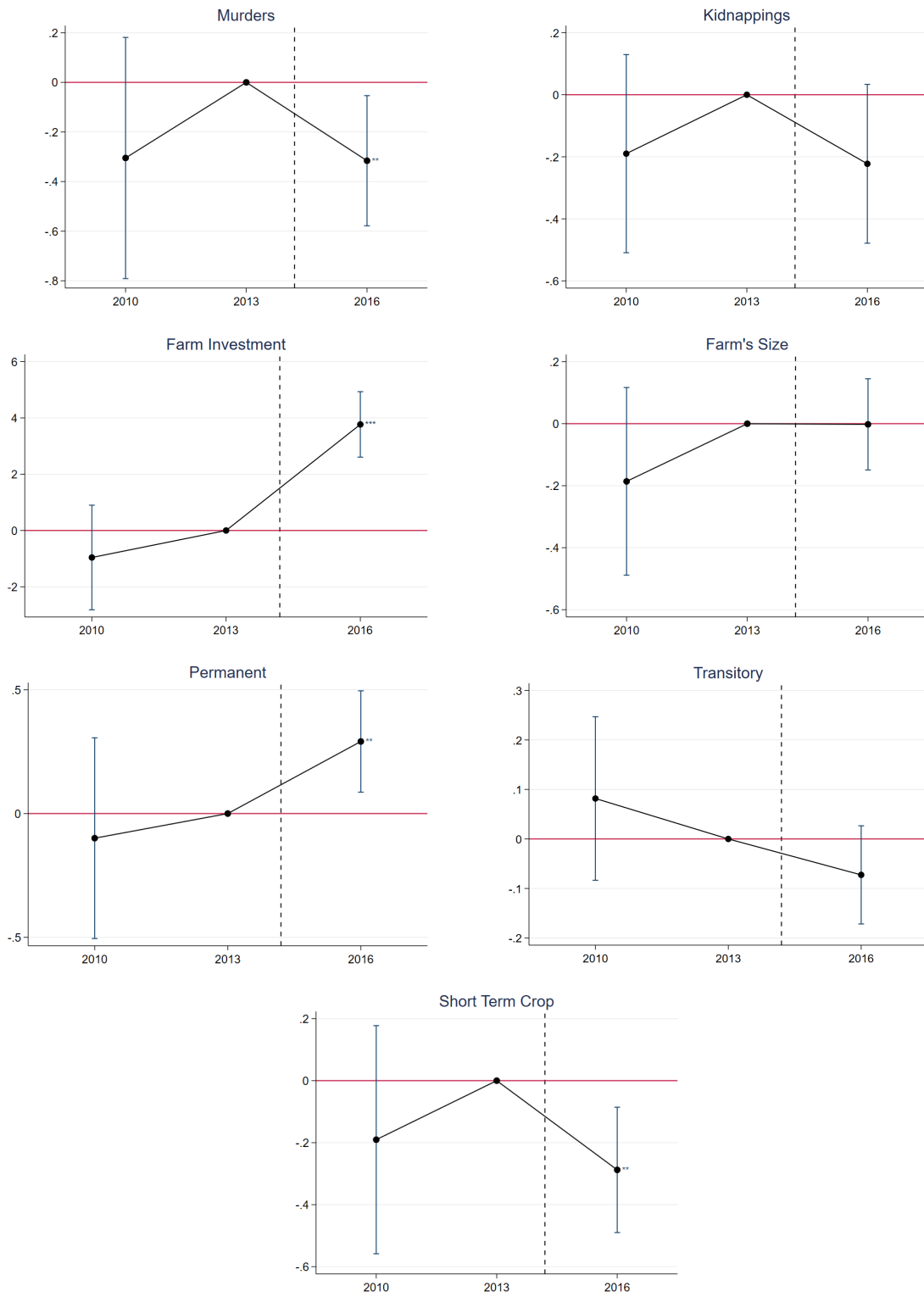
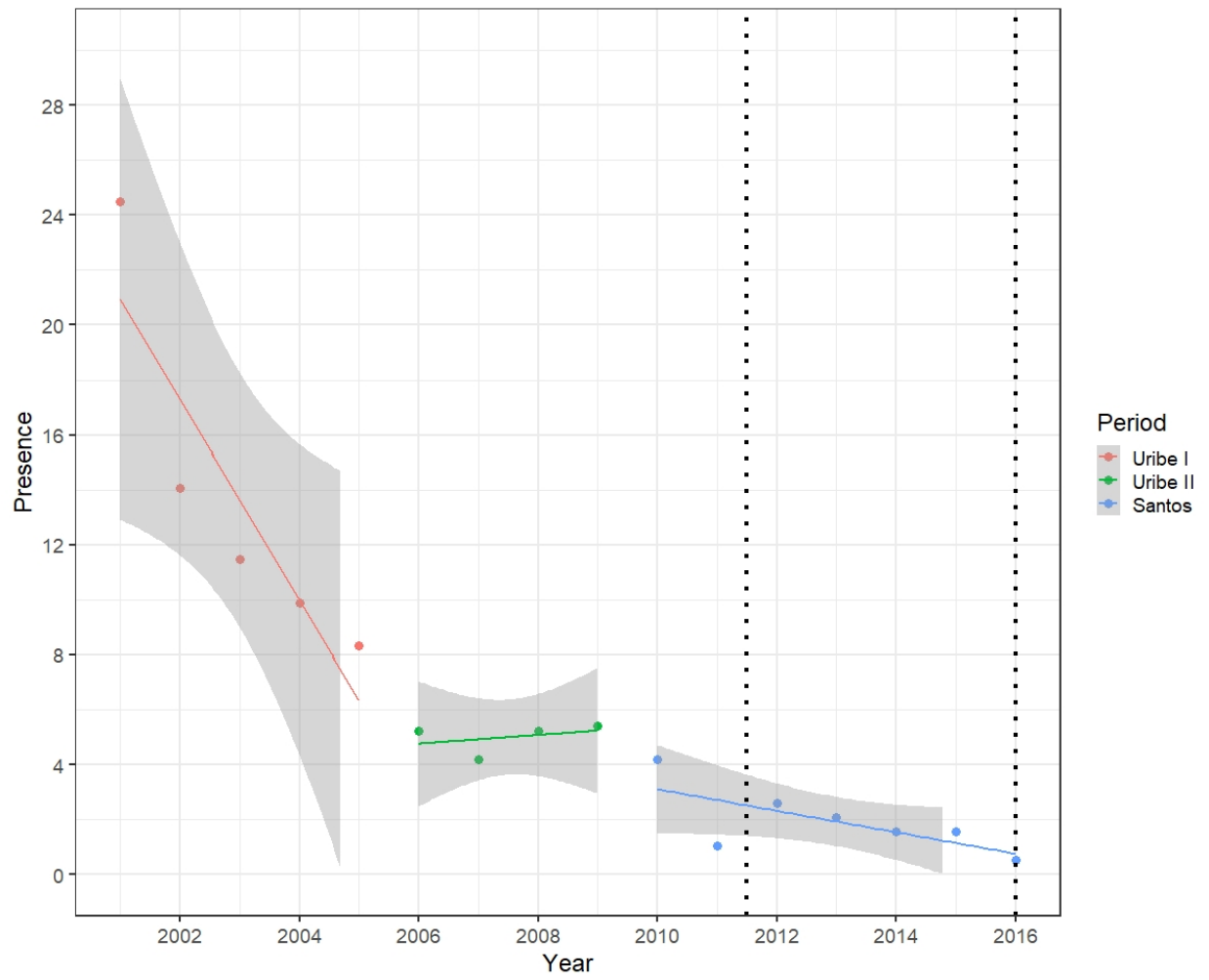


Figure B.2. Presence Trend



Appendix C: Neighbors

Descriptive Variables

The Figure C.3 shows the variation of murders and presence of the three groups. It looks that the presence has been decreasing since the negotiation of the agreement, but the violence only decreased after 2013. Moreover, the trend of the investment on the farm and the Food diversity index is having a change in the parallel trend since 2013 in neighbors and villages under the control of the non-state armed group.

The table 13 shows the balance characteristics of the main welfare features of the households, some properties of production, labor and market condition and some violence characteristics of the village. There is not significant difference among the investment made to the farm for the three groups, neither the farm's size. Nevertheless, the farms with high exposure to the armed group have more area dedicated to permanent crops, which may be explained by their location in the map, they are in areas where it is easy to sow tree based crops like fruits. Households with presence exposure are less likely to sell on Farm, sell to other districts and they work less in agricultural sector as employed or farmer. It looks there is not a big difference selling to intermediaries.

Households with presence and their neighbors are not statistically different in their total consumption. However, it looks that the food security measures are different among the groups. The observations located in the control area have an average of 0.69 in the DDI, and the households with presence and their neighbors have 3pp and 2 pp less DDI respectively. Moreover, the proportion of resources that the households use to buy food is higher in the locations with some exposure, including the neighbors.

Households with presence of the armed group are more likely to have murders and kidnappings than their neighbors and the control villages. At the baseline, sample shows the characteristics of areas with high exposure of violence: Low food diversity, less market activity, less work in the agricultural sector, all of those combined with high rates of murders, kidnappings and presence of armed groups.

Figure C.1. Violence

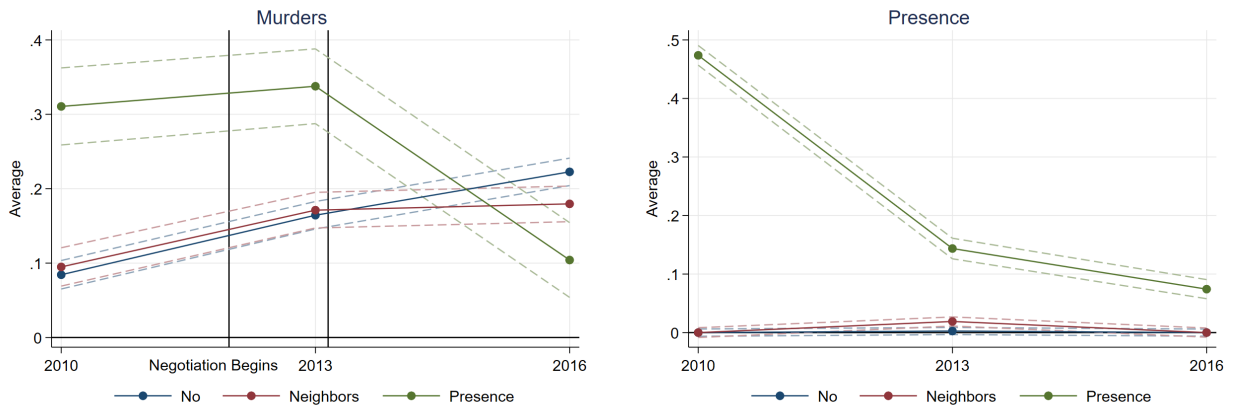


Figure C.2. Farm Investment and DDI

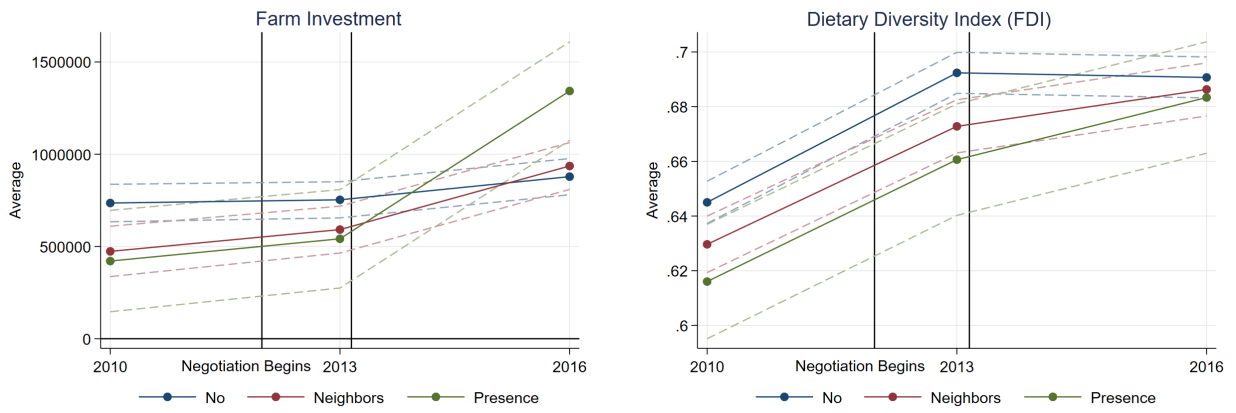


Table C1. Balance Table

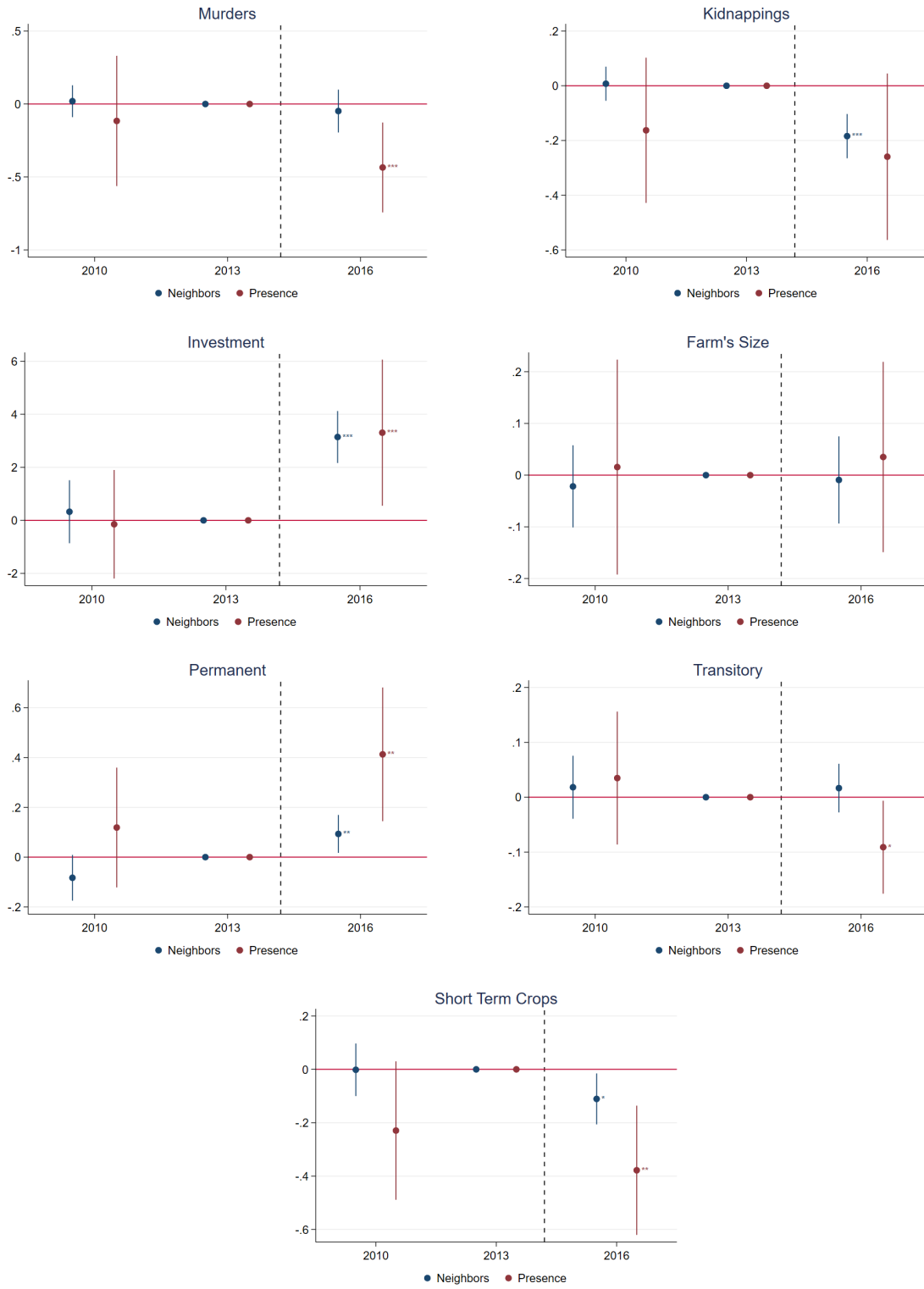
| Variables | (1) Control | (2) Neighbors v Control | (3) Presence v Control | (4) Presence v Neighbors |
|-------------------------------|------------------------------|-------------------------------|------------------------------|--------------------------------|
| Consumption (pesos) | 446,760.38 (384,451.19) | 3,334.45 (14,941.09) | -9,534.04 (28,482.40) | -12,868.49 (23,900.61) |
| Share Food | 61.82 (18.06) | 3.63*** (0.75) | 2.79** (1.33) | -0.83 (1.30) |
| Dietary Diversity Index (DDI) | 0.69 (0.15) | -0.02*** (0.01) | -0.03*** (0.01) | -0.01 (0.01) |
| Investment (pesos) | 854,122.19 (2,827,647.00) | -175,732.38 (113,923.82) | -244,612.27 (208,533.80) | -68,879.88 (190,273.38) |
| Farm's Size (Ha) | 3.15 (5.85) | -0.25 (0.27) | -0.11 (0.44) | 0.14 (0.55) |
| Permanent Crops (Ha) | 0.31 (0.91) | 0.23*** (0.05) | 0.15** (0.07) | -0.08 (0.11) |
| Transitory Crops (Ha) | 0.32 (1.03) | -0.11*** (0.04) | 0.13 (0.09) | 0.24*** (0.08) |
| Sell on Farm | 0.76 (0.43) | -0.04* (0.02) | -0.31*** (0.04) | -0.28*** (0.04) |
| Intermediary | .031588 (.174981) | -.013904* (.008058) | .006873 (.01516) | .020777 (.013087) |
| Sell Other Village | 0.05 (0.22) | 0.05*** (0.01) | 0.02 (0.02) | -0.04 (0.03) |
| Sell Other District | 0.13 (0.34) | -0.08*** (0.02) | -0.02 (0.03) | 0.07*** (0.02) |
| Work in Farm | 0.48 (0.50) | -0.12*** (0.02) | -0.08* (0.04) | 0.04 (0.04) |
| Farm Employed | 0.51 (0.50) | -0.09*** (0.02) | -0.13*** (0.04) | -0.04 (0.04) |
| Murders | 0.16 (0.37) | 0.01 (0.02) | 0.17*** (0.03) | 0.17*** (0.03) |
| Kidnappings | 0.03 (0.18) | 0.02** (0.01) | 0.19*** (0.02) | 0.17*** (0.02) |
| Presence | 0.00 (0.05) | 0.06*** (0.01) | 0.30*** (0.02) | 0.23*** (0.04) |
| Observations | 1,499 | 2,574 | 1,884 | 1,277 |

Notes: Column (1) shows the average of the control group. Columns (2) and (2) showcase the difference of the two treatment group with the control group. Column (4) shows the difference between the two treatment groups. The share of food estimation is calculated as Food Expenditure/Total Expenditure. Intermediary variable shows the proportion of sales made by a big intermediary. The variables murders, kidnappings and presence are calculated in a village level. The p value significance is shown like: *** 0.01, **0.05, *0.1 .

Parallel Trend

This section validates the parallel trend assumption of the model specification of the equation (3). Just as in the section 8.2, the first 7 variables are holding the parallel trend assumption.

Figure C.3. Parallel Trend Validation 1



Appendix D: Influence of Other Groups in Violence Exposure and Investment Decision

An important influence in the agricultural market in Colombia is the coca production. The rents of this product are driving the investment decision of the farmers for decades. This profitable product is leading the farmers to change legal products for illegal products (Prem et al., 2018). I checked the effect of this product in the decision of the farmers with the UNODC satellite data of coca fields in Colombia. The figure 7 shows that villages that I am studying do not have illegal crops. This findings suggest that the villages are not influenced by the coca production, which give confidence to think that the decision of the farmers and the market is not influenced by the disruption of this product.

Moreover, the presence of other armed groups may influence the reduction of violence and the constrain that face the households. Colombia had the influence of other armed group during the war, the ELN (Ejercito de Liberacion Nacional). The figure 8 shows the intensity index for the ELN group in 2016. It looks that this group is not having any influence during the peace period in the villages studied for this article.

The other influence group in Colombia is the organized crime in the big cities. They are mostly located in the big cities or in the areas with production of coca. The figure 9 shows the incidents that the organized crime had in Colombia. It looks that they had some effect in the control groups at the north of the country, and that may explain the little increase in murders for the control in 2016. However, those groups are not having a high influence in the control groups and the figure 4 shows that the increase is little and follow a well defined parallel trend.

Figure D.1. 2010 Coca

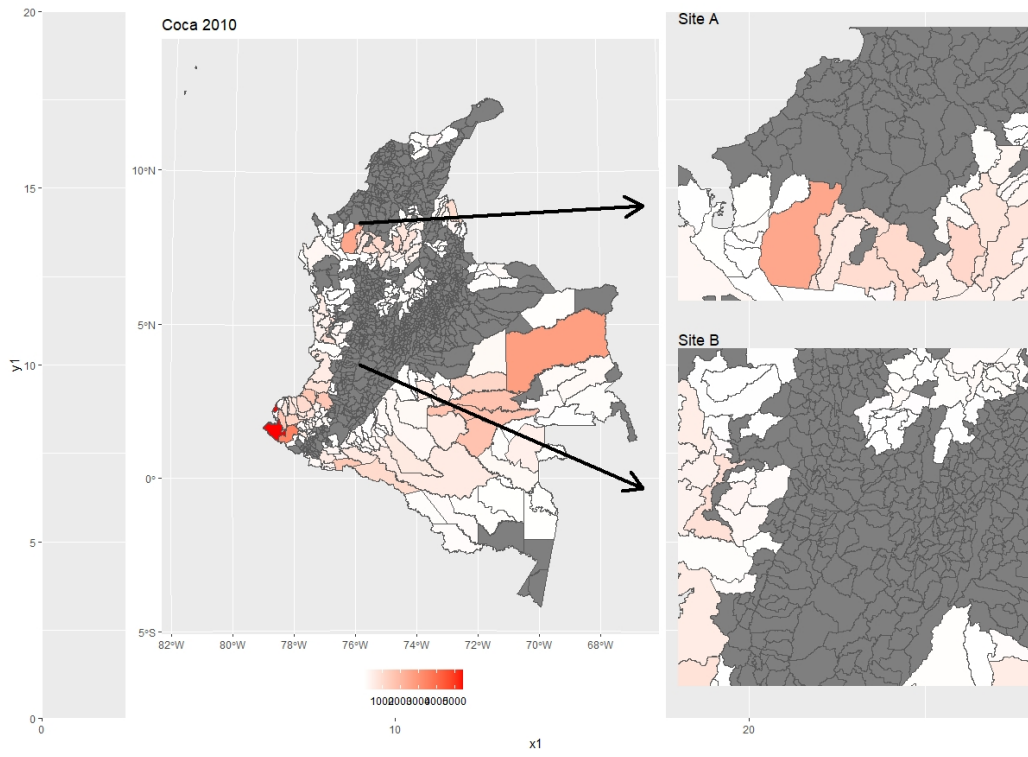


Figure D.2. 2016 ELN

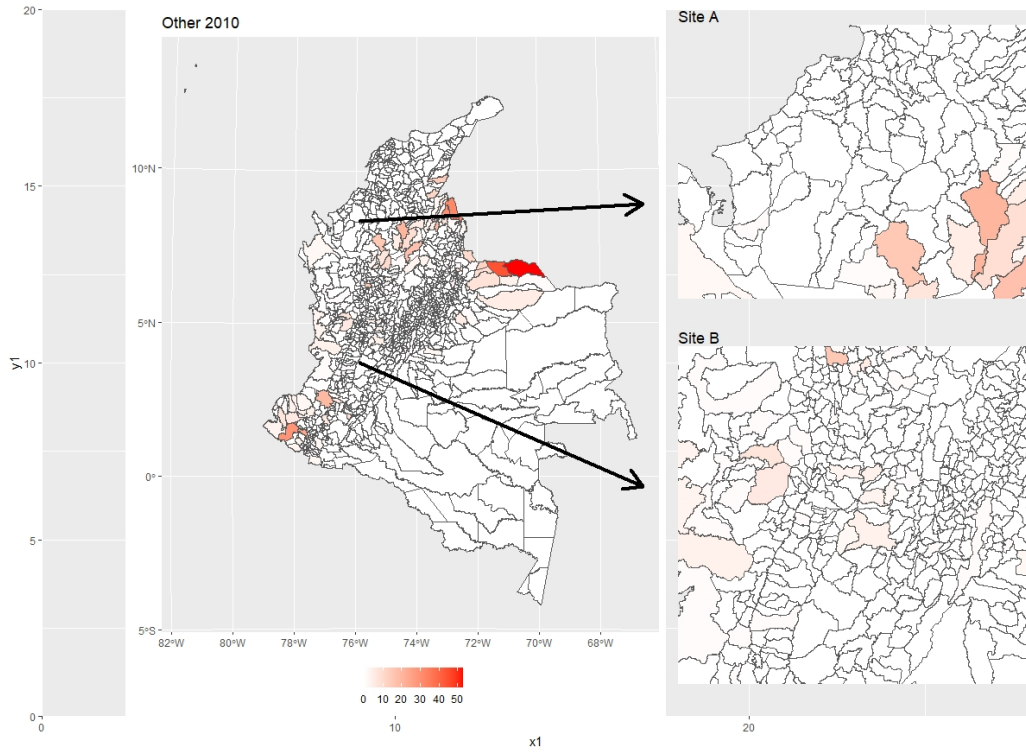
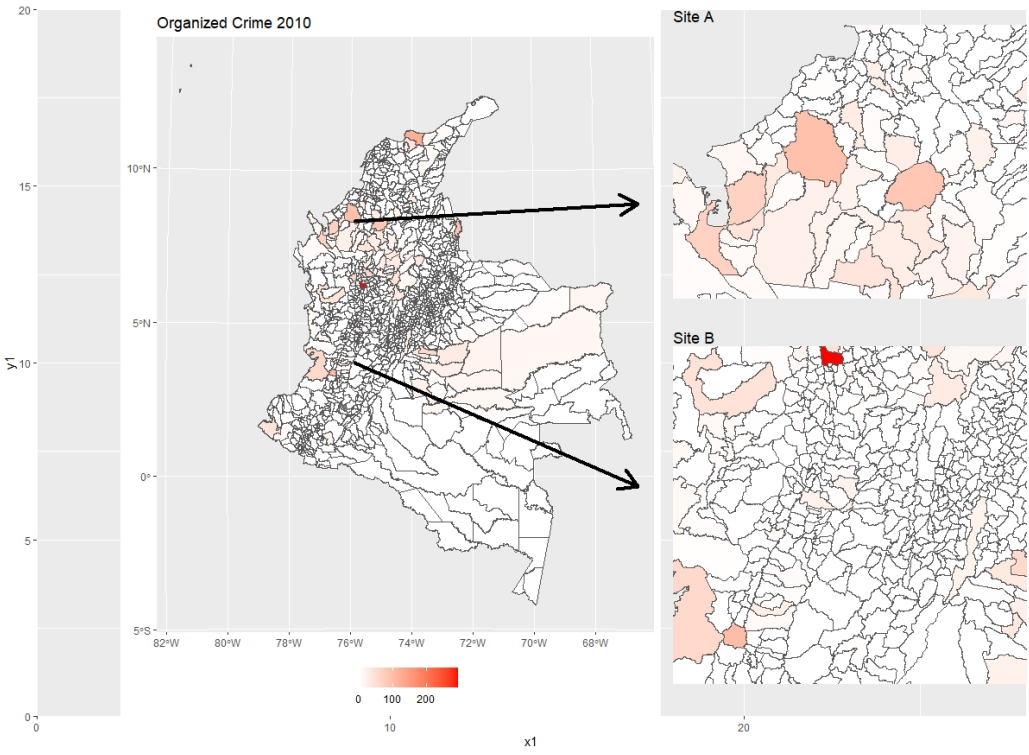


Figure D.3. 2016 Organized Crime



Appendix E: Government Support Programs

One important cornerstone of the peace agreement was the commitment of additional government support for farmers in their productive activities amid in providing reparations to the victims of violence. Given that 2016 year was the end of the negotiation, then it is unlikely that this programs has had started or impulsed different politics during that year. However, I confirm that those programs did not have any effect in the main effect of this article including them as controls of the main estimates. Table E.3 shows that the robustness check of an additional source of variation explained by this programs is not influencing the estimators.

Moreover, table E.3 includes a second panel that illustrates the evolution of the main government support programs. Where column (1) shows the effect of the ceasefires in the probability to have any support by the government. Column (2) and (3) show the effect on the main tenure support programs of Colombia. The results show that there is not a different increase in the government support driven by the peace during the last year of the agreement. These results confirm that the increase of investment happened because the expectation of the households changed and not because the government boosted the investment through agricultural programs.

Table E1. Support Agricultural Programs as controls - Investment and Consumption

| | (1) | (2) | (3) | (4) | (5) |
|------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | Investment | Farm's Size | Permanent | Transitory | Short Term Crops |
| Presence * Post | 3.67*** (1.21) | 0.00 (0.10) | 0.30** (0.14) | -0.08 (0.07) | -0.29** (0.14) |
| Neighbors * Post | 2.95*** (0.68) | 0.00 (0.05) | 0.10* (0.05) | 0.02 (0.03) | -0.10 (0.06) |
| Post * Support Program | -0.15 (0.69) | -0.02 (0.06) | -0.04 (0.05) | -0.05 (0.03) | -0.01 (0.05) |
| Post | -6.66 (4.74) | -0.07 (0.35) | -0.33 (0.31) | -0.00 (0.29) | 0.47 (0.46) |
| Constant | 5.28*** (0.42) | 1.17*** (0.04) | 0.25*** (0.03) | 0.18*** (0.02) | 0.36*** (0.03) |
| Observations | 5125 | 5125 | 5125 | 5125 | 5125 |
| R^2 | 0.609 | 0.856 | 0.744 | 0.715 | 0.638 |
| Adjusted R^2 | 0.207 | 0.709 | 0.481 | 0.423 | 0.266 |

| | (1) | (2) | (3) |
|------------------|-------------------|------------------|-------------------|
| | Support | Tenure Program 1 | Tenure Program 2 |
| Presence * Post | -0.04 (0.04) | 0.00 (0.00) | 0.00 (0.00) |
| Neighbors * Post | -0.04 (0.02) | 0.00 (0.00) | 0.00 (0.00) |
| Post | 0.02 (0.17) | 0.01 (0.01) | 0.00 (0.02) |
| Constant | 0.63*** (0.01) | 0.00** (0.00) | 0.00*** (0.00) |
| Observations | 5129 | 5129 | 5129 |
| R^2 | 0.703 | 0.600 | 0.502 |
| Adjusted R^2 | 0.398 | 0.191 | -0.008 |

Notes: Support is a dummy variable that takes the value of 1 if farmers received any support or subsidy from the government, 0 otherwise. Tenure program 1 is a dummy variable that takes the value of 1 if the farmers were beneficiaries of the program called "Titulacion de bladios", 0 otherwise. Tenure program 2 is a dummy variable that takes the value of 1 if the farmers were beneficiaries of the program called "Programa de Tierras", 0 otherwise.