Peer Effects and Recidivism: Wartime Connections and Criminality among Colombian Ex-combatants

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Abstract

To what extent do peers affect criminal behavior? In this paper, I study peer effects among ex-combatants in Colombia. Following a theoretical framework that differentiates the impact of economic conditions from that of social networks, I estimate both effects using plausibly exogenous shocks to local economic conditions and individual-level data on over 16,000 former paramilitaries in Colombia. I show that when the economic benefits of illegal sectors increase, ex-combatants favor criminal activities. More importantly, I show that an increase in wartime peers' criminality increases an ex-combatant's criminal activity. Based on these results, I explore the potential effect of tackling wartime connections as a policy to reduce recidivism after conflict.

1 Introduction

During transitions from war to peace, countries struggle to control rising levels of crime, with evidence coming from diverse settings, ranging from a crime wave following the Napoleonic Wars around 1815 to present-day gang violence after the end of El Salvador's civil war in 1992. The continuation of violence after peace transitions is often related to the failure to reintegrate ex-combatants and can pose a challenge to political and economic development. Given the evidence of increases in criminality after conflict and the threat of remobilization, the policies accompanying peace transitions increasingly focus on the reasons why former combatants may engage in criminal activities. In this paper, I present evidence concerning the way local economic shocks and wartime connections impact postconflict criminality among ex-combatants, expanding on the potential effects of peacetime policies in preventing crime and promoting reintegration.

While there is plenty of research on the continued violence after conflict, we still lack a clear understanding of the reasons why ex-combatants engage in criminal actions. Previous work has shown that, besides the classical motivations for engaging in delinquent activities, including economic incentives and psychological factors (Collier, 1994; Weinstein, 2006), ex-combatants' contact with former fighters during the aftermath of conflict might be a crucial factor determining recidivism (Themnér, 2011; Daly, 2016). Individuals are usually jobless, have mostly lost contact with their families and civilian acquaintances, and have only other fellow fighters with similar levels of criminal capital to rely on (Humphreys and Weinstein, 2007). According to this interpretation, it is possible that a peer effect drives ex-combatants to criminal activity. However, limitations in data availability have not allowed for the identification of these peer effects, and, more importantly, the estimation of their relevance, compared to other factors, in explaining postconflict criminality.

To overcome these limitations, in this paper I use individual-level panel data of postconflict criminal records of over 16,000 former paramilitary combatants in Colom-

bia from 2013 to 2016. I match this information with detailed records about individual wartime experience and connections. The structure of the data allows me differentiate the effect of economic changes that vary over time on delinquent behavior and separate them from the criminal activity of peers. I rely on a theory about peer effects in criminal behavior and derive explanations of criminality of former combatants. I argue that individual and social constraints shape the incentives and opportunities for ex-combatants to participate in illegal behavior: individual constraint refer to the opportunity cost provided by the surrounding context such as proximity to an illegal market and social constraint refer to the social network of the ex-combatant. Because the severity of these constraints may be affected by criminal activities, I study plausibly random variations to the economic local conditions, combined with the presence of partially overlapping groups of peers in the wartime network across municipalities to estimate the effect of economic shocks separately from that of the peers' activity.

The observable implications of the argument are straightforward: I find that, when the economic returns to the illegal sector increase, former combatants favor criminal activities. In particular, a standard deviation increase in the economic shock is associated with an increase of 0.38 in ex-combatant's captures. More importantly, consistent with other theoretical accounts of crime, I show that an increase in the criminal activity of peers is likely to impact an ex-combatant's criminal behavior. A one standard deviation increase in wartime connections' captures is associated with of 0.47 increase in an ex-combatant's captures. The intuition is that changes in the economic return to illegal activities taking place in certain municipalities will affect both (a) the opportunity cost of individuals living in those municipalities (individual economic effect) and (b) those individuals connected to them through a social tie who live in unaffected municipalities (social level effect). Note that (b) is true *only* if a peer effect exists. The only way that a shock that takes place elsewhere can affect an individual is through their connection to a peer who lives in a municipality that experiences the shock.

I complement the main results in several ways. First, I present consistent results with similar versions of the wartime network, severity of the economic changes, and

crime measures. Second, I show several additional placebo tests with different commodities and econometric specifications and I discuss possible alternative explanations. Third, to explore the mechanisms, I show that the results are driven by collective crimes that require the participation of several acquaintances. Additionally, I conduct a dyad analysis, instead of a group-level analysis, in order to include additional individual level controls. Finally, to validate the measures used in the main analysis, I analyze an original survey of ex-combatants that highlights the relevance of wartime connections for former paramilitaries in Colombia.

The results in this paper are directly relevant to policy debates concerning the most effective strategies for addressing the challenge of ex-combatant economic and social reintegration. In order to test the implications of the main finding, I analyze a counterfactual experiment in which I test the potential effects of a policy that tackles the wartime connections related to crime while leaving other factors, including other support networks, constant. I show that a policy aimed at breaking the wartime criminal network has the potential to significantly reduce the negative effect of adverse economic conditions and shocks.

This paper makes two main contributions. First, I use detailed individual panel data on criminal records and wartime connections to demonstrate the existence of peer effects among ex-combatants. Recent studies find evidence of the relevance of social factors in explaining recidivism (Kaplan and Nussio, 2018; Daly, Paler, and Samii, 2017); I deepen the analysis of these studies by exploiting exogenous variation and the presence of overlapping groups to carefully examine the relevance of peers and social networks. The paper also contributes to the literature on peer effects in comparative political science. The identification of peer effects within social networks is challenging; recently, political scientists have exploited exogenous variation and the use of more-detailed network data and strategies to examine the relevance of peers' behavior (Siegel, 2009; Christakis and Fowler, 2013), specially in American politics (Fowler et al., 2011; Sinclair, 2012). While many studies focus on the correlation between network characteristics and behavior, this paper aims to contribute and expand

the discussion about identifying the impact of peer behavior (Kline and Tamer, 2020; Alt et al., 2019; Larreguy and Teso, 2018).

The rest of the paper proceeds as follows: in Sections 2 and 3 I explain the theoretical motivation and context of the paper, respectively. In Section 4 I present the relevant aspects of a formal model of peer effects from which I derive the hypotheses, and then introduce the data and identification strategy. In section 5 I present the main results, and complement the analysis with a series of robustness checks. In Section 6 I explore the potential effect of policies that tackle the wartime connections to reduce recidivism after conflict. In Section 7 I conclude with a discussion of some limitations of the paper and avenues for future research.

2 Economic Shocks and Peer Effects

Mounting evidence suggests that there is a high level of violence and crime in most postconflict contexts (Call, 2012; Kurtenbach and Rettberg, 2018). Although many scholars have studied the problem of postconflict crime, there is little consensus about the motivations of former fighters for reverting to violent and illegal behavior (Stedman, 1997; Walter, 1997; Berdal and Ucko, 2009; Muggah, 2008). There is no final consensus, for example, on whether *individual economic considerations* prevail over *social circumstances*. In what follows, I expand on these two explanations from a theoretical point of view and then show the particular form they take in the Colombian case.

2.1 Economic Shock and Postconflict Crime

How variations in economic conditions impact civil conflict (Dube and Vargas, 2013) and crime (Dix-Carneiro, Soares, and Ulyssea, 2017) has been widely studied. The theoretical motivation for this effect can be traced back to classical economic studies of crime in which agents engage in criminal activities after performing a calculation of the cost and benefits that includes the opportunity costs of legal sector employ-

ment (Becker, 1968; Dal Bó and Dal Bó, 2011).[1]

The effect of a commodity shock will depend on many factors, including whether the commodity is legal or illegal, capital or labor intensive, or seasonal or not.[2] There is evidence that changes in the economic return to the production and distribution of illegal commodities is associated with crime and violence (Sviatschi, 2018; Dell, 2015; Millán-Quijano, 2015; Mejia and Restrepo, 2013). When illegal profits increase, rates of criminality rise, for example because competitors seek larger market shares or because the number of people involved in the illegal market increases given that market's increasing economic returns.

Profits from illegal markets can fuel criminality in general and recidivism of ex-combatants in particular. To study variations in the ex-combatant's opportunity-cost, I analyze a municipal-level shock to illegal gold production. This commodity is at the core of the individual constraints that bind individual criminal behavior, particularly in the developing context of Colombia, characterized by low state capacity and limited labor market opportunities. Ex-combatants possess knowledge of the functioning of illegal operations and the know-how required to make a profit from engaging in these activities (Valencia and Riano, 2017; Ortiz-Riomalo and Rettberg, 2018).

To simplify my argument, I hypothesize that when the production of a labor-intensive illegal commodity is high and prices rise, ex-combatants' participation in criminal activities increase.

2.2 Peer Effects and Postconflict Crime

Several scholars in sociology and criminology underscore the effect of social networks in crime decisions (Warr, 2002; Papachristos, 2014). According to this expla-

[1] For a review of crime and economic incentives, see Draca and Machin (2015). A recent meta-analysis on the literature on economic shocks and violence by Blair, Christensen, and Rudkin (2020) compares different possible mechanisms, and the recent study by Rettberg et al. (2018) discusses the applications to Colombia.

[2] Economic shocks could affect crime by changing local labor market conditions such as employment rates and earnings (Fougère, Kramarz, and Pouget, 2009; Lin, 2008). Other potential mechanisms include the rapacity effect of a shock to capital intensive goods (like appropriation of oil revenues) and an increase in public good provision (Levitt, 1995; Di Tella and Schargrodsky, 2004).

nation, individuals participate in criminal activities as a result of the interaction with other delinquents. This approach suggests that delinquents have friends who have participated in crime and that social ties are a means of influence to commit crime (Sarnecki, 2001). In the same vein, following the seminal work of Glaeser, Sacerdote, and Scheinkman (1996), recent theoretical approaches in economics relate crime to social networks. Several papers find that, in fact, crime and delinquency are related to positions in social networks.[3]

All these studies suggest that properties of peer associations should be taken into account in order to better understand social pressure on delinquent behavior in the aftermath of conflict and to inform delinquency-reducing policies targeted at ex-combatants. The reason to focus on wartime peers is twofold. First, recent studies show that different aspects of the social connections of an ex-combatant are important in explaining recidivism (Kaplan and Nussio, 2018; Daly, Paler, and Samii, 2017; Themnér, 2015, 2011). Second, wartime bonds lay the foundation for one of the most important social networks of ex-combatants following demobilization and during reintegration. Militancy often requires that combatants break links with family and friends, which in most cases implies a complete separation of military and civil life that is not always easy to bridge after conflict (Themnér and Karlén, 2020; Wood, 2008). The bounds created during a conflict are an important source of information (Parkinson, 2013; Staniland, 2014) and many ex-combatants actually retain their identity long after a conflict has ended (Daly, 2016). Consequently, although reintegration paths may differ, ex-combatants have in common at least one set of "weak ties": their former fellow combatants. Combatants reinforce bonds formed during wartime through socialization for long periods of time in small units while being exposed to constant threats.

Former ex-combatants remain an important source of information after a conflict has ended and units demobilized. Even though these connections are not as 'strong'

[3] See, for example, Ballester, Calvó-Armengol, and Zenou (2006); Patacchini and Zenou (2008); Mastrobuoni and Patacchini (2012); Liu et al. (2012).

as family and friends, they are relevant in one key domain. Granovetter (1977, 2018) famously shows that weak ties are superior to strong ties in terms of providing support in getting a job.[4] Moreover, Patacchini and Zenou (2008) show that weak ties are positively related with crime decisions. Criminals transmit valuable information about criminal opportunities to potential accomplices. In other words, networks of criminals amplify delinquent behavior. As information about criminal opportunities are transmitted through social networks, an increase in the level of activity of peers in turn drives an increase in individual participation in criminal activities.

To simplify the second part of my argument, I hypothesize that ex-combatants will be affected by the level of criminal activity of their wartime peers. In particular, I argue that the overall criminal activity of the wartime connections will directly affect the decision of an ex-combatant to participate in criminal activities.

3 Context

Civil conflict has affected every region if Colombia. Left-wing guerrillas, right-wing militias, and groups involved in drug trafficking have proliferated since the 1980s and the consequences of their actions still resonate across the country (Romero, 2003). The paramilitary groups were born as a reaction by the landowning elite, drug barons, and the political class to the growth of rebel groups (Medina Gallego, 1990; López and Martínez, 2010), and were the main group responsible for war atrocities during a conflict that left over 220,000 dead and displaced more that 4.7 million, according to the Historical Memory Group (Comisión Nacional de Memoria Histórica) (CNMH, 2013).

After negotiations with the government of Álvaro Uribe, the self-defense paramilitary organization Autodefensas Unidas de Colombia (AUC) collectively demobilized

[4] According to this argument, neighborhood-based close networks are limited when it comes to providing information about possible jobs. Recently, Alt et al. (2019) empirically develop this argument to show how unemployment shocks can transmit via social connections. I conduct an analysis similar to that of (Alt et al., 2019), who looks at the effect of an economic shock on individuals not directly affected by it, in appendix Table 10.

between 2006 and 2007.[5] The militia organizations that composed the AUC showed considerable divergence in their postconflict trajectories (Daly, 2016). With the war between the government and other organizations continuing, almost half of the former factions remilitarized. It has been documented that the former paramilitary fighters formed the backbone of criminal organizations that are still operating (Human Right Watch, 2010; Fundacion Ideas para la Paz, 2017).[6]

Although many factors could account for the overall dynamics of the reintegration and recidivism of an ex-combatant, this study seeks to identify the role of local economic conditions and peer effects. Since commodity price shocks and wartime connections are important channels through which postconflict criminality responds to economic conditions and peer effects, I provide background information on these factors in the following subsections.

3.1 Illegal Commodities and Postconflict Crime in Colombia

Studies have shown the effect of commodity prize shocks on conflict and criminality in Colombia [7]. Rettberg, Leiteritz, and Nasi (2014) dedicate a recent book to the exploration of the effect of shocks to different commodities on conflict. According to their argument, gold did not play a major role during the conflict, compared to coca, coffee and oil, but it has become one of the main sources of criminal activity since the post-paramilitary demobilization. In the words of the Colombian National Police chief, "Gold will have even more devastating effects than drug trafficking for the coun-

[5] Two points are worth mentioning: one, individual demobilizations continued until 2012, as not all units demobilized in 2007; and two, the process was criticized for the *inflated* number of demobilized combatants. Multiple accounts of former paramilitary leaders and former government officials argue that the actual number of paramilitary combatants was considerably lower than the initial number of over 30,000 members. In the data section I discuss the implications of these two considerations.

[6] Human Right Watch (2010) reports on early recidivism on the part of paramilitary members and Fundacion Ideas para la Paz (2017) reports on how groups like Aguilas Negras and Autodefensas Gaitanistas de Colombia, criminal organizations created by former AUC units, have become a major threat to security and development in the country since the demobilization.

[7] In a recent meta-analysis of studies of economic shock and conflict by Blair, Christensen, and Rudkin (2020), the majority of studies of this type of interaction mentioned by the authors consider the context of Colombia.

try" (cited in Rettberg, Leiteritz, and Nasi (2014)).[8] The involvement of illegal armed groups can be explained by their interest in controlling and distributing the wealth that accrues from the resource at hand. There are multiple opportunities for illegal groups to take advantage of mining activity: they can appropriate the value generated along the chain of gold production and even regulate the value chain in the territories where they are present.[9] For these activities, agents with experience in routes, the use of weapons, and engaging in violence are particularly valuable. In addition, agents with knowledge of trusted people to carry out these activities across different regions are of paramount importance.[10] Moreover, there are numerous documented cases of arrests related to illegal mining that spread though various municipalities where organizations consisting in part of former paramilitary members are known to operate. Section A reports on instances of illegal gold-mining activities taking place in different municipalities and describes multiple cases in which ex-combatants were involved as a proof of concept of the mechanisms of the argument in the paper.

Illegal gold mining is a widespread activity in Colombia: based on the 2010 Mining Census, more than 62% of gold mines do not have a legal permit. The economic activity related to illegal gold mining is particularly vulnerable to predation; armed groups provide security along trafficking routes and in many cases exploit the mines. As such, illegal gold mining is an important source of revenue for organized criminal bands that control deposits and transit (Valencia and Riano, 2017). Significantly, disputes over control of the illegal activity spreads beyond the locations of the mines. The actors involved are often located along trafficking routes and have developed the criminal capacity for extortion in several locations.[11]

To further show the relationship between economic shocks and crime, Section A.2

[8] The same comparison was made by the Colombian Attorney General, according to Rubiano (2017).

[9] Ortiz-Riomalo and Rettberg (2018) provides evidence that nonstate armed agents have mediated in the development of the illegal gold mining industry, "especially in regions far from the main smelting and marketing centers. In this way, they gain access to the process of declaration, settlement and distribution of profits generated."

[10] Using evidence from different contexts, von Lampe and Johansen (2004) present a typology of how various types of crime entail high levels of trust between partners.

[11] See Section A of the appendix for additional details of production and distribution chains across the country.

in the appendix shows the relationship between price shocks to gold and overall levels of crime in Colombia (not only ex-combatant crime) for the period studied in this paper. The analysis shows that variations in the price of gold are related to criminality in gold-producing municipalities and the activities of organized criminal bands.

3.2 Wartime Connections and Postconflict Crime among Colombian Ex-combatants

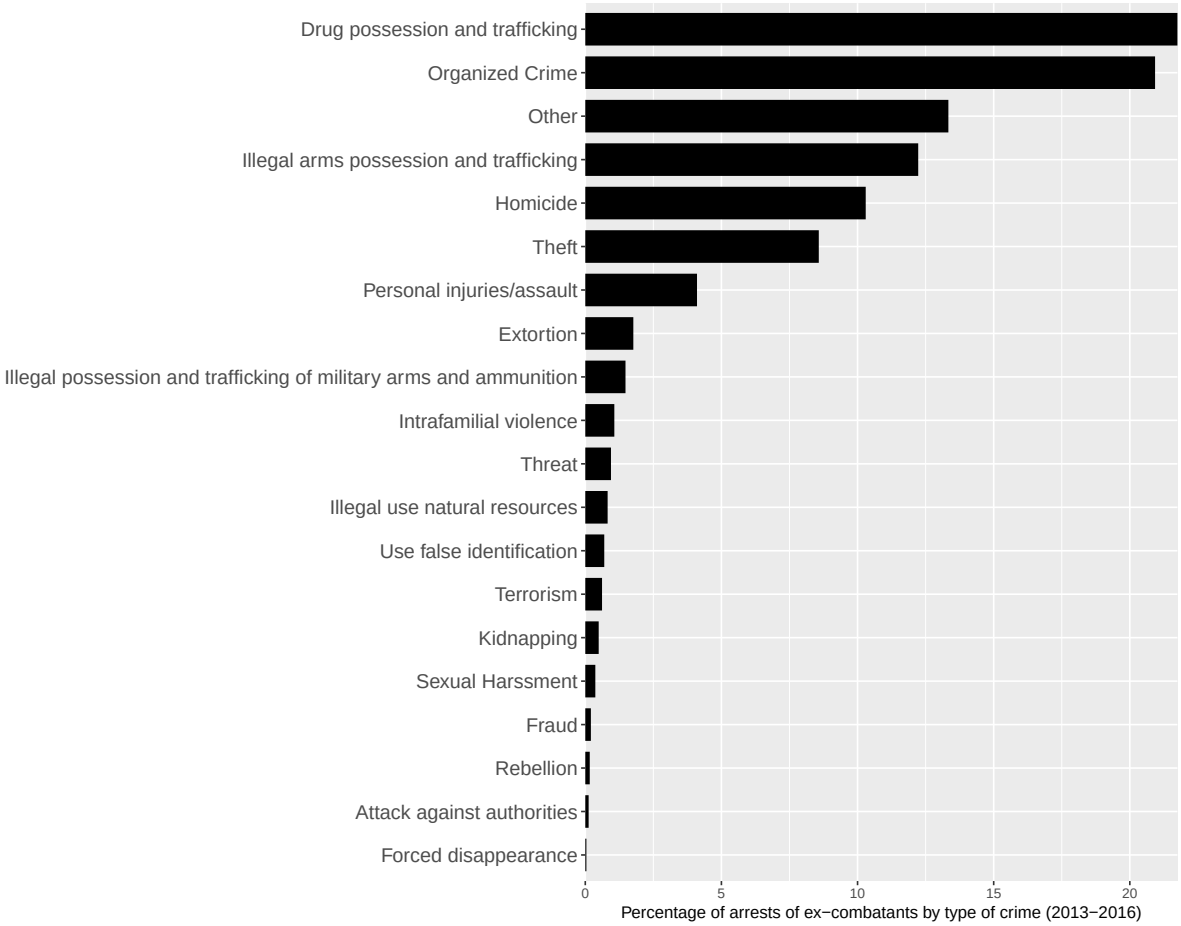
A considerable number of ex-combatants in Colombia resumed criminal activities undertaken during the conflict after demobilization, many as a result of their ongoing contact with former commanders (Daly, Paler, and Samii, 2017) and many as a result of weak family ties and the presence of illegal markets (Kaplan and Nussio, 2018).[12] Based on the number of arrests, around 15% of former paramilitary members participated in illegal activities in the years after demobilization, with their participation in crimes being spread across more than 900 municipalities across the country. Figure 1 in the appendix shows the location and spread of arrests of ex-combatants in the country. In contrast to other populations, former paramilitary members participate more frequently in collective crimes.[13]

Three facts are worth mentioning about the collective nature of ex-combatant criminality. First, Figure 1 shows the frequency of arrest across types of crimes. The most common types of crimes are related to drug trafficking, organized crime, possession of arms, and homicide. These activities need the cooperation of several individuals to take place, because they cannot be carried out alone. Success in these activities depends on the collective participation of co-offenders (or knowing someone with connections and access to illegal markets). In fact, the National Police of Colombia uses the category of 'gang-related' crime to refer to these crimes and to distinguish them from other 'individual' crimes.

[12] The last two studies analyze together data on different guerrillas (FARC, ELN, EPL) and paramilitary (AUC) organizations.

[13] Table 7 in Section A.2 presents a comparison of national levels of crime with ex-combatants' level and type of crime.

Figure 1: Types of crimes of ex-combatants, 2013–2016



Second, we can determine whether ex-combatants were arrested together. To that end, we can explore the density of arrests across different periods to see whether there is evidence of overdispersion (Glaeser, Sacerdote, and Scheinkman, 1996) or even bimodality (Gaviria, 2000) in the crime distribution, meaning that several offenders must have acted together. If we see a multimodal geographical distribution, this reflects the fact that most places have few arrests (as expected) and a significant number of places have *many* arrests, which suggests that multiple participants were involved in criminal activities together. Figure 2 in the Appendix shows the densities of arrests rates across Colombian municipalities for different years and, following (Gaviria, 2000), it provides suggestive evidence of collective participation in crime.

Finally, as preparation for this paper, I conducted a national survey of ex-

combatants in Colombia to capture some patterns of their social connections. The idea was to capture the type of connections that are more relevant during conflict and how those relations vary after demobilization. I present the results separated by each type of armed group, because the sample includes members who participated in a collective demobilization (Paramilitary) and individuals the demobilized individually (Guerrilla). The description of the survey strategy and results are provided in Section B of the Appendix. Figure 8 shows that combatants spent more time with members of their same unit and their same rank than with commanders or members of other positions. After demobilization, the connection with ex-combatants is stronger with peers in the same unit and position than with other ex-combatants and lower than with family and close friends. This aspect is important considering the evidence of weak ties for job opportunities and crime explained in the theory section. Former paramilitary members have higher levels of contact with wartime peers than members of any other organization.

Therefore, the increasing presence of both criminal bands and illegal markets and the participation of ex-combatants in both, combined with the recent peace process that disarmed thousands of former fighters, makes the study of the implications of wartime legacies on recidivism and criminality in Colombia particularly relevant.

4 Empirical Strategy

The identification of peer effects within social networks is challenging for several reasons. There are two main problems, as explained in Figures 2 and 3. First, the investigation of the effect of a ex-combatant i's criminal behavior on the criminal behavior of a ex-combatant j to whom i is connected may be affected by a 'reflection problem' (Manski, 1993). This refers to the possibility that a correlation in the criminal behavior of two ex-combatants, i and j, is because either i's criminal effort is affecting j's criminal effort or vice versa. A second problem is that of 'common shocks'. Specifically, unobserved common shocks might affect the behavior of ex-combatants

who are connected, and might be the underlying reason for the observed correlation in their behavior. It is possible to incorrectly attribute a change in i's behavior to k's behavior, when in fact both are being affected by the same shock in location X.

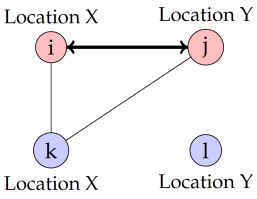


Figure 2: Reflection problem

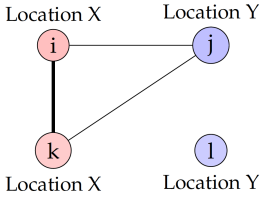


Figure 3: Common shock

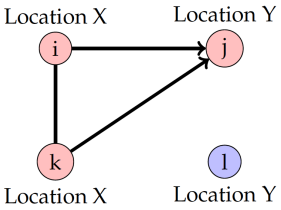


Figure 4: Peer effect

I address these empirical challenges by taking advantage of the panel structure of the data and the presence of overlapping wartime groups across municipalities to calculate the effect of the economic shock on one municipality as it transmits to connected peers in other municipalities, including group (wartime), time (year), and location (municipality) fixed effects. The idea behind the strategy is that it estimates how the effect on some units of analysis, for example i and k, transmits to other units of analysis, j (and not to l), through their connection in the wartime network. To put it differently, I estimate to what extent an economic shock that does not affect the municipality of an ex-combatant may still have an effect on his criminal record through his wartime connections.

To further explain the identification strategy, I rely on the formal models that have been developed to describe the relationship between social networks and crime. In what follows, I present a simplified version of such a model based on a synthesis of previous models by Calvó-Armengol, Patacchini, and Zenou (2009), Ballester, Calvó-Armengol, and Zenou (2006), and Calvó-Armengol and Zenou (2004).[14] The model departs from the idea that the decision to put effort into criminal activities is affected by local economic conditions (e.g., presence of legal and illegal markets) and by social networks (e.g., criminal activity of peers, social connections involved in crime).

[14] The general version of this kind of model, network games with quadratic payoffs, is explained in Jackson (2010), pp. 290–292. For a review of applications of this model to crime, see Lindquist and Zenou (2019).

Therefore, the model not only reflects the main elements discussed in this paper, but also enables the empirical separation of the effect of economic conditions from peer effects.

4.1 Model of Networks and Crime

Individuals are connected to each other through a social network represented by an adjacency matrix g, where $g_{ij} = 1$ if i and j are linked to each other and $g_{ij} = 0$ otherwise.[15] In Figure 4 agents i, j, and k belong to the same wartime network while l belongs to another network.

In each period t, individuals indexed by i who are members of group g are choosing a level of criminal effort $y_{it} \geq 0$ and obtain an utility $u_{it}(\mathbf{y})$ that depends on the group's criminal profile $\mathbf{y} = (y_1, y_2, ..., y_n)$ in the following way:

$$u_{it}(\mathbf{y}) = \underbrace{a_{it}y_{it} - \frac{1}{2}y_{it}^2}_{\text{Benefits - Cost}} + \underbrace{\beta\Big(\sum_{j \neq i} g_{ij}^w y_{it} y_{jt}\Big)}_{\text{Social Component}}.$$

The first two elements represent the benefits and costs of criminal effort y_{it}, where $a_{it} > 0$ denotes differences in individual's economic benefits for criminal activity, and the cost of committing crime is given by $\frac{1}{2}y_{it}^2$, which increases with own effort.

The social component is included in the utility function by adding $\sum_{j \neq i} g_{ij}^w y_{it} y_{jt}$. The social component reflects the influence that the action or outcome (e.g., criminal activity) of other members of group g has on the utility of i. The social influence of i on j is captured by g_{ij}^w. The overall effect of the weighted sum of bilateral influences is captured by β. The idea behind this social component is that individuals derive more utility from committing crime when their connections commit more crime, which means that crime decisions are *complements*. Therefore, the parameter that we would like to estimate in the empirical section is β, which reflects the effect of the criminal records of the group, holding the other variables fixed.

[15] By definition, $g_{ij} = 0$ means that individual i is not connected to j and therefore does not have an influence on i. We can let $g_{ii} = 0$ and use an undirected network such that if $g_{ij} = 1$ then $g_{ji} = 1$.

In equilibrium, each individual maximizes their own utility by choosing a level of criminal effort. The first-order condition for each individual i is

$$y_{it} = a_{it} + \beta \sum_{j \neq i} g_{ij}^{w} y_{jt}. \tag{1}$$

Thus, the level of crime that an individual will show in equilibrium is determined by his own economic characteristics, a_{it}, and by individual i's weighted sum of his group's criminal efforts, $\sum_{j \neq i} g_{ij}^{w} y_{jt}$. Therefore, the first-order condition can also be divided into individual-level and social-level elements. On the one hand, suppose that the personal cost-benefit element, a_{it}, is subject to variation in measured and unmeasured factors:

$$a_{it} = x_{it}\eta + \alpha_g + \tau_t + \epsilon_{igt},$$

where x_{it} are the observed variables that explain variation in the individual cost-benefit ratio, α_g and τ_t denote the full set of group and year effects, and ϵ_{igt} represents the unobserved heterogeneity. On the other hand, in the second element of the best response, the social component, suppose that the scaled weights g_{ij}^{w} follow

$$g_{ij}^{w} = \begin{cases} 0 & \text{if } g_{ij} = 0, \\ \frac{1}{\sum_{j \neq i} g_{ij}} & \text{if } g_{ij} = 1. \end{cases}$$

Thus, $\sum_{j \neq i} g_{ij}^{w} y_{jt}$ in the best response is the average of the criminal record of the agents that influence individual i in g. This parametrization, known as the *linear-in-means*, determines that the criminal effort of i depends linearly on the mean of the criminal records of the other members of the group, $E[y_{it}]$. As a consequence, what we can study is the effect of the 'average level of criminality of the group.' For example, an individual with one connection who commits two crimes is affected to the same degree as an individual with two connections who each commit two crimes.

Following Kline and Tamer (2020), the elements that affect an individual's equilibrium best response in Equation 1 can be represented in its corresponding empirical

equation:

$$y_{it} = x_{it}\eta + E_{gt}[y_{it}]\beta + \alpha_g + \tau_t + \epsilon_{igt}. \tag{2}$$

Because the outcomes, y_{it}, are simultaneously determined in Equation 2, the previous equation cannot simply be estimated in a regression. The aim of the following sections is to capture the effect of local economic conditions, η, separately from the effect of the peers' criminal activity, β. To that end, the following sections describe the structure of the data and the identification strategy.

4.2 Data

Data for this project come from three different sources. The first data set—gold mining data—provides the tools to create the treatment variable. I interact the time-series variation in the international price of gold with information on illegal gold production at the municipality level. The second data set—conflict experience—provides individual-level information, which serves as the basis for the construction of the network of wartime connections. The third data set—criminality—provides individual-year-level information of captures of ex-combatants after demobilization.

Gold mining data

The geographic variation in illegal gold productions is drawn from the mining census published by the Colombian Ministry of Mines and Energy in 2010. The census contains records of the number of illegally mined gold deposits in each municipality prior to 2009. Municipalities are the lowest level of disaggregation in the census. Furthermore, since the geographical measure of gold production is defined before the period of analysis of this paper and the expansion of Colombia's illegal gold mining industry, the records do not reflect potentially endogenous production efforts correlated with the main outcomes over the period of analysis. The census was carried out in more than 600 municipalities that reflect the places where, due to geographical

characteristics, the government identified as potentially producers. The census counts in each municipality the number of mines without permits and the variable changes continuously from 0 to 254. There is considerable production in the Caribbean and Andean region (see Figure 6). In addition, in order to compare the estimates of gold production and the production of other commodities, I use data on municipal oil production measured by the number of pipelines and coffee and coca production measured by the number of hectares. Information for these variables, and other geographical characteristics, comes from the municipal panel from the Centro de Estudios sobre Desarollo Economico (CEDE) of the Universidad de los Andes.

The other identifying source of variation comes from changes in the international price of gold from 2013 to 2016. The data on the international price of gold and other commodities were obtained from the World Bank Global Economic Monitor Commodities Database. Importantly, Colombia is not an international price maker in the gold market, so variations in the price of gold experienced during the period studied can been arguably considered exogenous to local production Dube and Vargas (2013).

Conflict experience

I use two different sources to create the wartime network measure. First, a census of ex-combatants conducted by the Colombian Agency of Reintegration (Agencia Colombiana para la Reincorporación y la Normalización, ARN) as part of the reintegration process. The survey contains information concerning the population of paramilitary members who initially demobilized. The survey includes information about the subunit inside the larger structure of the paramilitary organization to which each ex-combatant belonged during the conflict, which allows me to identify which individual belonged to which subunit.[16] The paramilitary organization AUC had 41 units at the time of demobilization. Second, to capture the position each ex-combatant held during the conflict, I use information from a survey conducted by ARN and the International Organization for Migration (OIM) about conflict experience. The survey

[16] The list of units is in Figure 3 in the appendix.

includes questions about the position inside the organization of 16,761 paramilitary ex-combatants. The positions included in the survey vary from commander to foot soldier. The survey, known as Base Line (Línea Base) was implemented for several months beginning in 2007 and is one of the most comprehensive data sets about ex-combatant experience known to date.[17]

Using both sources of information, I construct the links between all the individuals in my sample. Two individuals are considered to be linked if they shared the same position and served in the same subunit for at least one year during the conflict. This way of capturing wartime connections is based on interviews and ex-combatants' recollections about the most important connections during the conflict. The representation of the network resembles the 'military squads network' in basic network classifications (Christakis and Fowler, 2009) in which the groups is described ass having a transitive relationship in which all those involved know each other. I provide additional justification for this selection with qualitative and survey evidence in appendix Section B, and consider variations of the wartime connection definition in the empirical analysis.[18]

There are a total of 559 groups/networks in the sample. The average group has approximately 30 members. The smallest group is comprised of 1 individual and the largest has 1110 individuals. The median group has a size of 4, and there are only 12 groups with more than 300 people. Additionally, it is important to highlight that ex-combatants are spread all over the country. In other words, ex-combatants have several wartime peers living outside their own municipality.[19]

Criminality

In order to examine whether ex-combatants exposed to changes in returns to illegal activities are more likely to engage in crime, I use confidential and anonymized

[17] Appendix Figure 3 shows the recognized units, the positions identified by the agency, and the number of members in each group.

[18] See Section B for a description of an original survey with ex-combatants about wartime connections.

[19] As mentioned before, the analysis includes different versions of the network definition, including only subunit membership and time spent together during the conflict.

information from the National Police of Colombia on the universe of ex-combatants captured in the period 2013 to 2016 . I use an indicator of whether an ex-combatant was captured for a crime during the period of study along with the type, location, and date of the last crime this person committed. There are two categories of captures reported in the data: captures as a result of an investigation (label *Capture* in the analysis) and captures in flagrante (label *Red-handed capture* in the analysis). Figure 1 displays the distribution of crimes among ex-combatants across Colombia and Figure 1 shows the type of crimes for which ex-combatants were arrested according to the articles of Colombia's penal code.

I do not rely on perceptions, opinions, or self-reported participation in criminal activities, and instead use a behavioral indicator. This is the best available data it is used to measure individual-level criminal behavior, and it is used in all other studies about postconflict criminality. However, there are some concerns that are worth discussing. One is that captures reflect law enforcement capacity and the results may reflect the contagion of 'law enforcement capacity' instead of contagion of crime. To minimize this concern, the main analysis focuses on in flagrante captures, because these captures are less dependent on police investigation and may be carried out by citizens.[20] I discuss the other possible concerns associated with this measurement in light of the results in a separate section.

4.3 Identification

Recall that the identification problem arises from the presence of y_{it} on both sides of Equation 2. Following (Manski, 1993, p. 534) and provided that $\beta \neq 1$, we can define the social equilibrium by considering the expectation on both sides of Equation 2:

$$E_{gt}[y_{it}] = E_{gt}[x_{it}]\frac{\eta}{1-\beta} + \frac{\alpha_g}{1-\beta} + \frac{\tau_t}{1-\beta}. \tag{3}$$

[20] Article 32 of the Political Constitution of Colombia establishes that an offender who is caught in flagrante delicto, that is, while committing a crime, can be apprehended either by the authorities or by a private citizen.

Suppose that this equilibrium holds for the observed data in each period t. Then, substituting Equation 3 back into the individual-level model in Equation 2, we have

$$y_{it} = E_{gt}[x_{it}]\theta + x_{it}\eta + \alpha_g^* + \tau_t^* + \epsilon_{igt}, \tag{4}$$

where $\theta = \beta\eta/(1-\beta)$. The first element of Equation 4 estimates the mean of the economic change for members of the group. The second element estimates the variation in the economic return for each individual, while α_g^* and τ_t^* are the rescaled group and time effects.

If we can (1) identify coefficients on $E_{gt}[x_{igt}]$ and x_{igt} and (2) partial out the group and time effects, then we can back out β, which is the social interaction parameter of interest:

$$\hat{\beta} = \frac{\hat{\theta}}{\hat{\theta} + \hat{\eta}}. \tag{5}$$

The conditions that are sufficient to identify β are the following: first, to identify coefficients on $E_{gt}[x_{it}]$ and x_{it}, we need that $E_{gt}[x_{it}]$ and x_{it} not be confounded with respect to ϵ_{igt}. We also need that $E_{gt}[x_{igt}]$ and x_{igt} not be perfectly collinear. We obtain this with the variation in x_{igt}, which is equivalent to the effect of each shock, *within* the groups indexed by g.

In other words, β will capture the effect on criminality of the criminal activity of peers who were affected by the exogenous economic variation by transforming the coefficients of the individual- and group-level estimations.

The treatment variable for the individual-level effect, x_{igt}, is the price of the commodity interacted with the intensity of its production in the municipality of residence of i in year t. In the case of gold, the shock is the interaction of the international price of gold with the number of illegal gold mines in the municipality. The outcome of interest, y_{it}, measures the number of red-handed captures by individual i in year t:

$$y_{it} = \underbrace{E_{gt}[(Price_t \times Intensity_{ig})]}_{\text{Mean Group Schok}_{gt}}\theta + \underbrace{(Price_t \times Intensity_{ig})}_{\text{Price Shock}_{it}}\eta + \alpha_g^* + \tau_t^* + \epsilon_{igt}, \tag{6}$$

To partial out the group and time effects, I take advantage of the panel data and include group (α_g^*) and time(τ_t^*) fixed effects. For reasons of robustness with fixed effects models, I use ordinary least squares to estimate the parameters, and then the delta method for inference on $\hat{\beta}$. That is, to estimate the peer effects, β, I compute the estimates and standard errors for the composite parameters estimated in the main specification in Equation 6. I cluster standard errors at the group level and provide additional results with individual and municipality clustered standard errors.

In addition to estimating the parameters of the model, I conduct several robustness checks to address potential concerns. First, in all estimations I include municipality fixed effects. By including these fixed effects, I control for invariant differences between gold- and non-gold-producing municipalities. Second, I include time trends to control for changes in aggregate time trends across years. Third, I include region time trends and municipality-specific time trends for a set of baseline characteristics.[21] These interactions are included to control for potential differential changes across types of municipalities. Finally, I include a set of individual-level characteristics.[22]

5 Results

In this section, I present the main results. First, I provide evidence that ex-combatant criminal records are significantly affected not only by their local economic conditions, but also by their wartime peers' average criminal activity. I complement these main results in two ways. First, I consider the effect for different levels of the strength of the wartime connection. I look at the size and precision of the peer effects for connections that range from one to five years during the conflict. Second, I examine the elements driving the peer effects by showing results for collective and individual crimes separately. I show that peer effects are mostly driven by the effect

[21] Colombia is divided into five regions. I include municipality-specific baseline time trends for poverty index, total population, distance to local market, and distance to Bogotá.

[22] Individual characteristics are gender, race, and parents' level of education.

on collective crimes.

Table 1: Effect of gold-price shock and effect of peers criminality—Red-handed captures

	Red-handed captures				
	(1)	(2)	(3)	(4)	(5)
Panel A: Economic shock and average shock for the group					
Economic shock ($\hat{\eta}$)	0.382***	0.382***	0.391***	0.414***	0.432***
	(0.104)	(0.104)	(0.104)	(0.109)	(0.109)
Average shock ($\hat{\theta}$)	0.339***	0.340***	0.342***	0.343***	0.394***
	(0.119)	(0.119)	(0.120)	(0.125)	(0.139)
Panel B: Criminal peer effects					
Peer effect ($\hat{\beta}$)	0.470***	0.471***	0.467***	0.453***	0.477***
	(0.126)	(0.126)	(0.126)	(0.129)	(0.125)
Mean of outcome	0.0243	0.0243	0.0243	0.0242	0.0233
S.D. of outcome	0.1702	0.1702	0.1702	0.1701	0.1666
Observations	36,318	36,318	36,318	35,178	29,877
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time trends		✓	✓	✓	✓
Region×Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

The dependent variable includes only red-handed arrests for the 2013-2016 period. Panel A shows the result of estimating Equation 6, where the first row represent the effect of the shock for individual i and the second row represents the average shock for the group g. The economic shock is defined as the interaction of the natural logarithm of the international price of gold and illegal gold production, in standard deviations. Panel B shows the estimation explained in Equation 5, representing the effect of wartime peers' arrests on $i's$ criminality. Standard errors in parentheses clustered at the group-wartime level. Municipality characteristics include pretreatment levels of poverty, population, and distance to Bogotá. Individual controls include age, gender (female), mother's level of education, and race (indigenous and afro). *** is significant at the 1% level, ** is significant at the 5% level, and * is significant at the 10% level.

5.1 Economic and Peer Effects

Panel A of Table 1 shows the estimation of the parameters in Equation 6 and Panel B shows the estimation of the peer effects following the transformation in Equation 5. The economic shock has been standardized across all estimations. All columns including group, time, and municipality fixed effects. Results show that higher economic returns for illegal activities are positively associated with an increase in criminality. The

coefficient of the individual economic changes in Column 1, reflecting variation in local economic returns to illegal markets, shows that a one standard deviation increase in the treatment is associated with an increase of 0.38 red-handed captures. This result is consistent with the theoretical expectations and other studies about commodity shocks and crime.

The most important result is the robust, positive, and significant effect of peers criminal records on the likelihood that an ex-combatant will be captured. Column 1 of Panel B shows the coefficient associated with the peer effects from the theoretical model. There is a significant effect of wartime peers' criminality on individual criminal activity. A one standard deviation increase in the average criminal activity of an ex-combatant's group increases 0.47 his criminal records. This result captures the effect of an increase in the average criminality of the wartime group as a result of the economic changes. $\hat{\beta}$ describes the effect of the peers' criminal activity on the outcome of an individual i. To get a sense of how this effect translate, if we consider an individual (*collaborator* in the 'Bloque Central Bolívar') who is in the average gold producing municipality, the increase in the criminal activities of his peers is associated with an increase of his criminal record equivalent to around 55 percentage points.

The results of the peer effects are consistent across different specifications in Table 1. The magnitude of the coefficients barely change compared to the baseline estimation. Economic changes and peer effects remain similar when I include time trends, region- and municipality-specific time trends, and individual covariates. Column 3 includes the interaction of region and year; Column 4 includes the interaction of municipality characteristics with year, which accounts for potential biases coming from differential trends in places that may have been more affected by violence; and Column 5 includes individual covariates.

I replicate the analysis with all types of captures, not only red-handed. Table 2 shows the estimations of Equation 6 taking general captures as the outcome. In this case, the effect of the changes in local economic returns for illegal activities and peer effect are both positive and significant, albeit a little smaller.

In sum, a clear pattern emerges in which return to criminal activities is consistent with the theoretical expectations that illegal markets and peers' activity play an important role.

5.2 Robustness

In this section, I address some additional potential concerns regarding the main identification strategy. I study different econometric specifications, selection problems, and measurements.

First, as a robustness check, in Table 3 in the appendix I replicate the analysis, clustering standard errors at the individual rather than the group level to account for the fact that connections in the same municipality may experience similar shocks. The estimations are equivalent to the main results for red-handed and non-red-handed captures, with and without the additional tests in Table 1. Second, to take into account the fact that some groups are very large and may be explaining the peer effect results, in Table 8 in the appendix I exclude groups with more than 500, 250, and 100 members from the analysis, respectively, and obtain consistent results for the economic and peer effects. Finally, I consider different measures of the treatment. The preferred specification is based on the intensity of illegal gold production in the municipality. To see if there are peer effects across all municipalities, we should expect the results to hold for individuals residing in places with low to no production, but with connections in gold-producing municipalities. Table 10 in the appendix shows that, with some variations, the results are consistent for individuals residing in municipalities with different levels of gold production. In all cases, crime is positively related with the economic variation to wartime peers.

In sum, the criminality patterns are consistent with the discussion presented in Sections 3 and 4. Local economic conditions and peers' activity affect recidivism after conflict. The results are also consistent with the anecdotal evidence and news reports about involvement of ex-combatants in criminal networks.

5.3 Strong and Weak Wartime Ties

Results should vary if we consider a definition of wartime network that affects the strength of the connection between peers. To address this possibility, I consider variations in the effects for arguably stronger and weaker links. The stronger ties refer to the time ex-combatants spent together during the conflict: people who spent a long period of time together during the war may show differential peer effects than if they had spent a short period of time together. Figure 6 shows the effects of pairs for different types of connections in wartime. The results are similar to those discussed above and also show that as people spent more time together, the peer effect increases slightly. The results are to be taken with some caution: time spent together is self reported in months (which explains the concentration of observations every six months in the data). Importantly, more time spent together during the conflict could also imply that ex-combatants switched units and rose rank during the war. While mobility was low, we should expect that more time in conflict is related with more time spent with peers.[23]

Furthermore, we can also consider a definition of the network that incorporates weaker ties. In Figure 5 in the appendix I show that the peer effects are consistent if we define a weaker wartime connection in which two people belong to the same network because they belong to the same unit—regardless of position. While the coefficient of peer effect is positive, its magnitude shrinks compared to the other results with stronger ties.

Overall, although the results found by using a different definition of the wartime network show some slight change, the magnitude and relevance of the coefficients confirm the intuition behind each network: stronger ties are associated with a larger peer effect and weaker ties are related with a smaller peer effect. The effect that the criminal activity of an ex-combatant has on the criminal records of his wartime connections increases as the time spent in the same unit and rank during the war in-

[23] Additional information from an original survey administered by the author in Section B of the appendix shows that ex-combatants spent more time with other fighters in their unit and of the same position than with any other combatant during the war.

Figure 5: Peer effect of strong ties: Time together in conflict

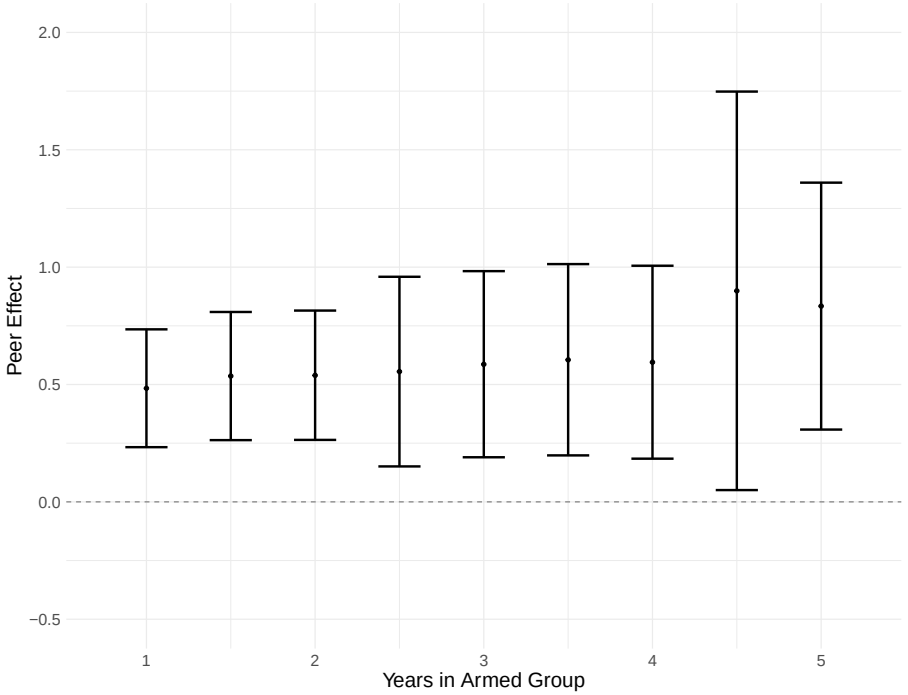


Figure 6: Estimation of peer effects following Equations 6 and 5, considering groups in which all members were in the armed group between 1 and 5 years (showing 6-month cutpoints).

creases.

5.4 Collective and Individual Crimes

In this section I study the effect of economic changes and peers' activity, separating the type of crime for which ex-combatants are captured. Table 2 shows the estimations of economic returns in Panel A and the peer effects in Panel B for *individual* and *collective* crimes. In constructing this classification I follow Khanna et al. (2019), which relies on the Colombian National Police's categorization of gang-related crimes. The list with the classification is in Table 4 of the appendix. Collective crimes include homicide, extortion, and organized crime/conspiracy, among others. Individual crimes include simple assault, sexual harassment, and use of false identification, among others.

The results show an increase in criminality as a result of the economic changes for collective crimes. The coefficient is bigger than that reported in Tables 1 and 2. Col-

Table 2: Economic shock and peer effects—Collective crimes only

	Red-handed captures for collective crimes				
	(1)	(2)	(3)	(4)	(5)
Panel A: Economic shock and average shock for the group					
Economic shock ($\hat{\eta}$)	0.333***	0.334***	0.327***	0.317***	0.309***
	(0.0948)	(0.0949)	(0.0921)	(0.0936)	(0.0919)
Average shock ($\hat{\theta}$)	0.260**	0.261**	0.270***	0.285***	0.338***
	(0.103)	(0.103)	(0.104)	(0.108)	(0.123)
Panel B: Criminal peer effects					
Peer effect ($\hat{\beta}$)	0.438***	0.439***	0.452***	0.474***	0.523***
	(0.139)	(0.139)	(0.137)	(0.140)	(0.138)
Mean of outcome	0.0174	0.0174	0.0174	0.0174	0.0165
S.D. of outcome	0.1462	0.1462	0.1462	0.1463	0.1424
Observations	36,318	36,318	36,318	35,178	29,877
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time Trends		✓	✓	✓	✓
Region × Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

The dependent variable include only red-handed arrests for collective crimes in the 2013–2016 period. Panel A shows the result of estimating Equation 6, where the first row represents the effect of the shock for individual i and the second row represents the average shock for the group g. The economic shock is defined as the interaction of the natural logarithm of the international price of gold and illegal gold production, in standard deviations. Panel B shows the estimation explained in Equation 5, representing the effect of wartime peers' arrests on $i's$ criminality. Standard errors in parentheses clustered at the group-wartime level. Municipality characteristics include pretreatment levels of poverty, population, and distance to Bogotá. Individual controls include age, gender (female), mother's level of education, and race (indigenous and afro). *** is significant at the 1% level, ** is significant at the 5% level, and * is significant at the 10% level.

umn 1 shows that a one standard deviation increase in the average criminality of the group is associated with 0.438 more collective crimes. Columns 2 through 5 replicate the additional specifications to address some of the potential concerns regarding the main identification strategy. The results are consistent across all of these tests. Additionally, Table 5 in the appendix shows that all captures, not only red-handed, increase as a result of the economic shock. In this case, peer effects are also positive, and comparable with other results, but are not significant. Finally, as a placebo test, Table 6 in the appendix shows that the economic shock does not have a significant effect on captures related only to individual crimes.

Taken together, these results show that variations in the economic return of the illegal gold mining industry in Colombia had a significant impact on the criminal records of ex-combatants in gold-producing municipalities compared to districts with little or no gold production, and that the criminality of wartime connections had a major impact on a ex-combatant's own criminal record. The results are concentrated among collective crimes, which are the types of crimes that are most likely to be susceptible to changes in prices and illegal returns and, more importantly, to changes in the criminal activity of peers.

These results complement the main results by showing that most of the peer effect is explained by activities that by their nature require the participation of various acquaintances. The results are also consistent with other qualitative evidence presented in the paper.

5.5 Additional Tests

I subject the main estimates to additional tests. I summarize these tests briefly here and provide greater detail on each of them in the online appendix.

Placebo tests for treatment and outcome. First, I consider the effect of a change in the yields of other legal commodities (oil and coffee) that have been used to analyze the relationship between the labor market and conflict. We should not expect an increase in criminal activity as a result of changes in the yields of these legal prod-

ucts. Second, I look at the effect of treatment on noncriminal activities. I show that annual participation in educational and sports activities does not change as a result of changes in the price of gold. In this way it is shown that the results are not an artifact of general changes of ex-combatant behavior, because we should not expect network effect for these particular outcomes. All these analyses can be found in the online appendix.

Mobility. Third, I show that the results are robust when I examine individuals who moved to a different municipality. This result is important, because it rules out the possibility that the effects are driven by local enforcement in gold-producing areas.

Measurement. Fourth, it is worth mentioning the discussion about measurement in the light of the results. Previous research on criminal peers has predominately relied on respondent's assessments of their own criminal records and their assessments of their peers' criminality. However, this approach has been criticized: it is vulnerable to measurement error due to projection by respondents of their own behavior and by limitations in remembering or observing the activities of peers, thus increasing the crucial correlation between own and peer criminality (Meldrum, Young, and Weerman, 2009).

On the other hand, one may worry that captures reflect law enforcement capacity and the results reflect the contagion of 'law enforcement capacity' instead of contagion of crime. For the peer effect to result from an increase in police activity that is not related to contagion of criminal activity, there should be a reason why individuals who are committing crimes independently and live in different municipalities are more likely to be captured than other individuals committing crimes. If they have the same level of criminal activity, but that activity is independent from what their peers are doing, this should also be true for other ex-combatants who live in the same municipality (and not only those connected to other criminals). However, we don't observe this: ex-combatants living in municipalities not affected by the shock are more likely to be arrested 'only' when they are connected to other ex-combatants that participated in criminal activities. For example, when we consider the example in Figure 4, we see

an increase in the value of the outcome for $j's$, not for l's, as a consequence of $i's$ or $k's$ actions.

Dyad Analysis. Finally, I conduct a dyad analysis, in which instead of considering the group-to-individual ($g - i$) effect, I rearrange the data to estimate the individual-to-individual ($i - j$) effect. Instead of looking at the effect of the average criminality of the network, this estimation focus in the one-to-one relations and allows me to include additional fixed effects. While the theoretical expectations refer to the group-level effect, these results are important because they clearly show the link between criminal activity among peers living in different municipalities while controlling for additional individual-level characteristics. In the dyad analysis, individuals i and j are connected if they belonged to same subunit and position during the conflict. For reasons of robustness, I exclude dyads with individuals in the same municipality and include i-level fixed effects. In particular, I use three sets of ex-combatant fixed effects that vary by year to restrict attention to the economic shock for individuals within the same education, socioeconomic stratum, and region groupings. I estimate the following OLS regression:

$$Y_{it} = \beta \text{ Wartime peer economic shock}_{jt} + \mu_{ei} + \gamma_{si} + \delta_{ri} + \epsilon_{it}, \tag{7}$$

where *Wartime peer economic shock*$_{jt}$ is the economic shock to i's connections, and μ_{ei}, γ_{si}, and δ_{ri} are ex-combatant-level socioeconomic stratum, education, and region fixed effects.

The results are presented in Table 11. Criminality increases with the economic shock of wartime peers. The analysis includes several additional robustness checks: Columns 1 and 2 show the effect of the economic shock for all observations, including red-handed and non-red-handed captures. Columns 3 and 4 show the results for individuals living in municipalities with levels of gold production that are less than the mean, and Column 5 and 6 show the results for groups of less than 100 members. The coefficients are significant, though considerably smaller than those of the main

analysis. This is to be expected, given that the interpretation in the dyad analysis refers to the effect of a single pair, while the interpretation in the group-level analysis refers to the criminality of the entire wartime network.

Overall, the dyad analysis results are in the same direction as the group level analysis. The substantial effects of peers' crimes that go through wartime ties thus suggests that the network of ex-combatants, arguably weaker after the conflict, could affect recidivism, particularly in the presence of illegal markets.

6 Implications: Counterfactual Experiment

The previous section showed that postconflict crime is subject not only to changes in local economic conditions, but also to peer effects. These results have some important implications. What would be the effect, for example, of a policy that tackles the wartime networks? To address this question, we can think about the effect of the economic shock to gold mining, with and without the presence of peer effects. To answer these questions I perform a counterfactual analysis below in which I look at the predicted values of captures estimated in the main analysis, following Equation 6, when we reduce the peer effect to different values. Specifically, I look at the effect of (1) a gold-price shock under the actual conditions and (2) a gold shock with wartime connections randomly reduced by half.

Figure 7 shows the difference in the predicted values of Equation 6 when we reduce β, the peer effect, by 50%. The blue line represents the predicted values of captures derived from the main specification. The red line represents counterfactual predictions, that is, the predicted values when we look at the difference between the predictions in Equation 6 and the predictions when we set β to 50%. The difference between the two lines measures the difference that an intervention reducing β by 50% would have on capture rates. Red-handed captures decrease around 15% when we reduce the effect of the peer effect by 50%. This is a notable implication of the present study: the reduction in crime is due to the reduction of peer effects, even when the

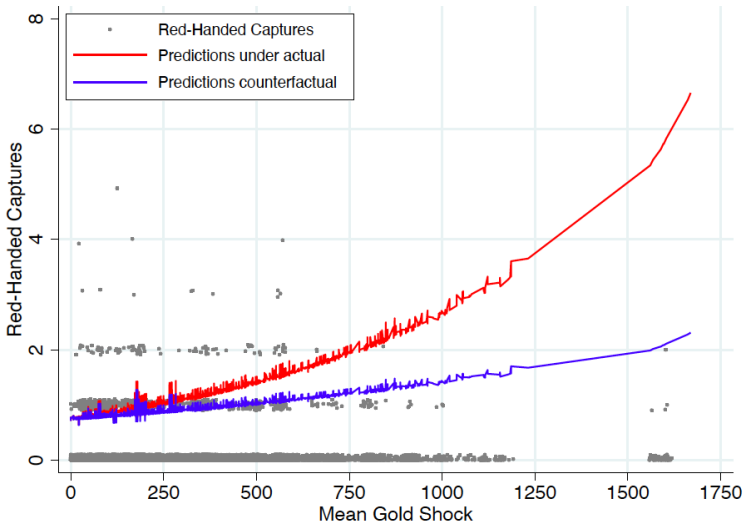


Figure 7: Predicted values of red-handed captures under actual and counterfactual conditions

economic factors are the same under the two conditions.

What does it mean to reduce criminal connections by 50%? The potential intervention aims to reduce the economic dependency on wartime peers while keeping other contacts, such as political or emotional ones. Recent evidence on social-contact interventions (Mousa, 2020; Lowe, 2020; Scacco and Warren, 2018) points to their being a promising avenue for this kind of policy, through which participants may reduce their prejudice toward out-groups and more importantly create new connections. A social-contact intervention that promotes integration of ex-combatants with other members of their inmediate community has the potential to open up new possibilities of economic connections for the former.

However, this analysis should not be taken as suggesting that all types of combatant connections should be broken. The expectation with such an intervention is that ex-combatants keep their friendship, political, and social wartime networks unchanged. An individual can have different networks for different purposes; the results of the experiment point to economic connections, specifically new ones outside the former military structure, as potentially being able to promote reintegration.

7 Conclusions

This paper studies the social logic of recidivism among former members of illegal armed groups. I argue that the networks that combatants develop during conflict facilitate delinquent behavior after demobilization. Given the time spent in military life, ex-combatants may rely on wartime connections for many different activities. These connections are not necessarily the primary ties that they hold as civilians,being mostly weak ties that help them to find out about economic, job, and crime opportunities. Therefore, ex-combatants are likely to be affected by the behavior of these connections.

I show that changes in the economic returns for criminal activity increase the participation of not only the ex-combatants directly affected by the local economic changes, but also of those of their peers during conflict. Contrary to previous studies of Colombian ex-combatants, I consider the local and external conditions that could affect their decision to participate in crime. In doing so, I study only one group, the paramilitary members, and how their reintegration process was interconnected with the illegal gold-mining industry.

This study highlights the relevance of weak ties for criminal behavior in general and for ex-combatants in particular. However, it is important to note that networks can also play a positive role in the reintegration process. Support networks and political networks, for example, could potentially facilitate reincorporation into civilian life. The fact that some wartime networks, as shown in this paper, affect recidivism, suggests that the composition, type, and strength of networks should be carefully addressed in postconflict initiatives.

Future research could explore the mechanisms that explain why wartime connections are related to participation in criminal activities. Potential explanations include peer pressure, social status, and responsibility diffusion. All these channels can potentially be studied with a survey that captures the relevance of these factors and further evidence of the effects of wartime connections after peace agreements.

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Appendix Tables & Figures

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Figure A 1: Ex-combatants Captures

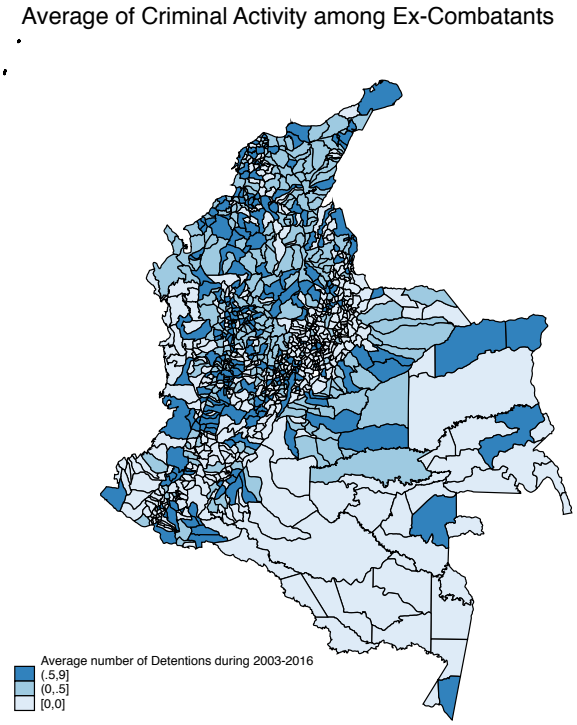


Figure A 2: Densities of Arrests Rates across Colombian Municipalities

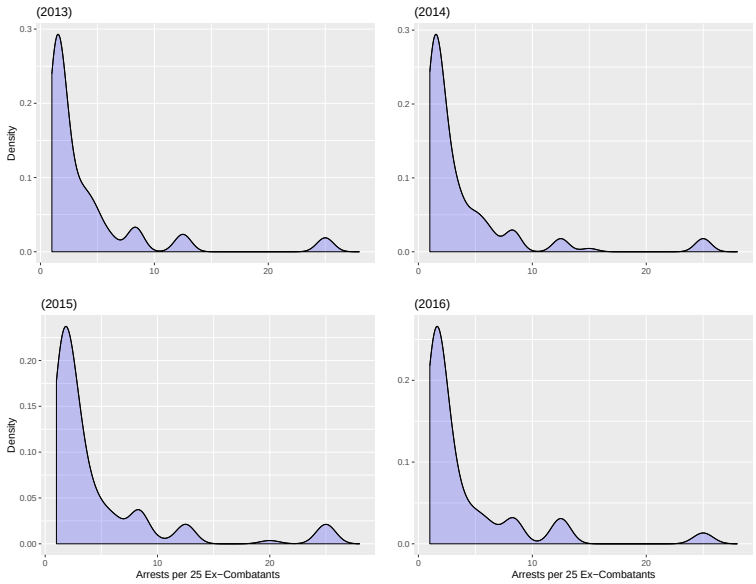
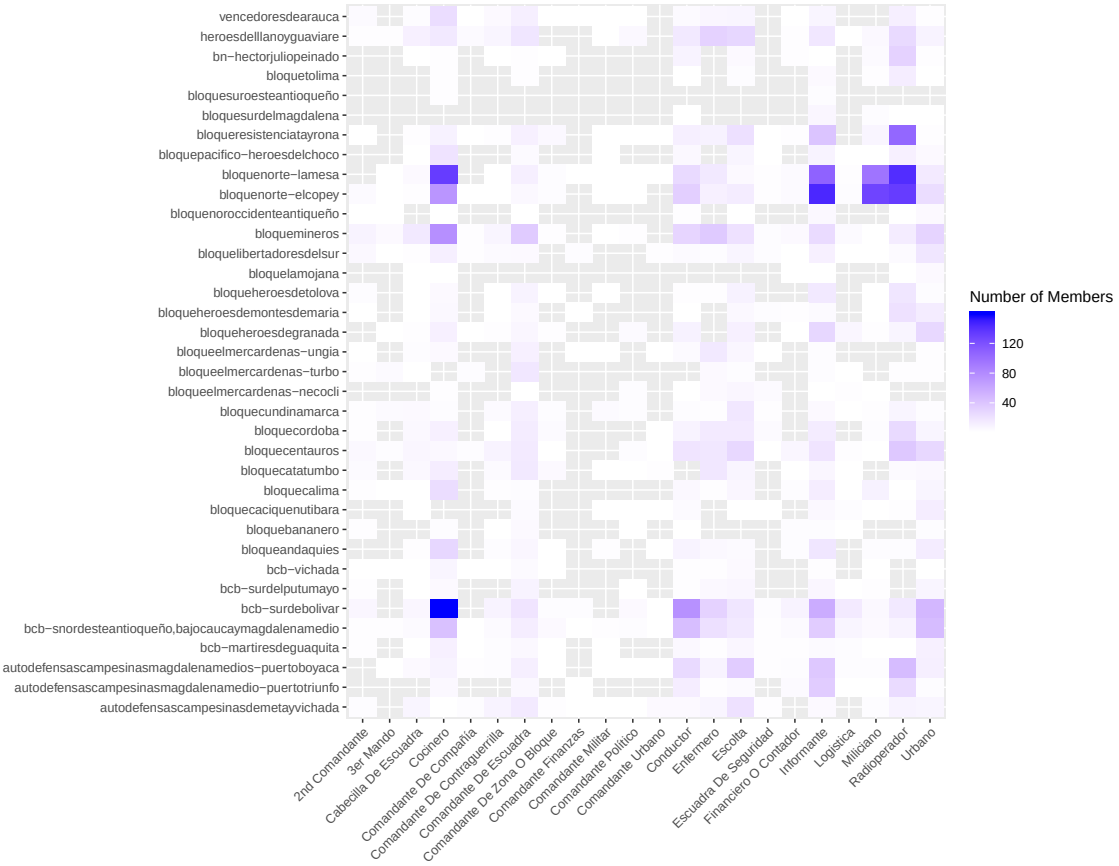


Figure A 3: Units, Positions, and Number of Members in Wartime Groups



The figure shows the units that composed the AUC and the positions inside the units as self-identified by the former combatants and classified by the ARN. The figure exclude the position “Patrullero" (foot soldier), for visualization purposes since it encompasses the few large groups of over 1,000 members.

Table A 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
Panel Variables			
Number of arrests	48,787	0.037	0 .211
Number of flagrant arrests	48,787	0.024	0.171
Municipal Variables			
Length of oil pipe lines, km	1092	0.246	0.590
Number of Illegal gold mines	542	35.184	62.644
Annual Variables			
Log global oil price, USD per barrel	4	4.082	0 .381
Log global gold price, USD per ounce	4	7.151	0.165
Ex-combatant Variables			
Age	16,761	37.408	7.532
Children	16,761	1.209	1.302
Relatives	16,761	2.820	1.630
Socio-Economic stratum	16,761	1.343	0.631
Age joined Armed group	16,761	24.231	7.667
Months in Armed group	16,761	39.558	33.537
Years of Education	16,761	9.218	3.66

Table A 2: Effect of Gold Shock and Effect of Peers Criminality - All Captures

	Captures				
	(1)	(2)	(3)	(4)	(5)
Panel A: Economic shock and average shock for the group					
Economic shock ($\hat{\eta}$)	0.377***	0.378***	0.357***	0.383***	0.415***
	(0.127)	(0.127)	(0.128)	(0.129)	(0.129)
Average shock ($\hat{\theta}$)	0.226*	0.227*	0.220*	0.229*	0.281*
	(0.127)	(0.127)	(0.127)	(0.130)	(0.149)
Panel B: Criminal peer effects					
Peer effect ($\hat{\beta}$)	0.375**	0.375**	0.382**	0.374**	0.404**
	(0.183)	(0.183)	(0.189)	(0.181)	(0.176)
Mean of outcome	0.0368	0.0368	0.0368	0.0366	0.0355
S.D of Outcome	0.2072	0.2072	0.2072	0.2069	0.2024
Observations	36,318	36,318	36,318	35,178	29,877
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time trends		✓	✓	✓	✓
Region × Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

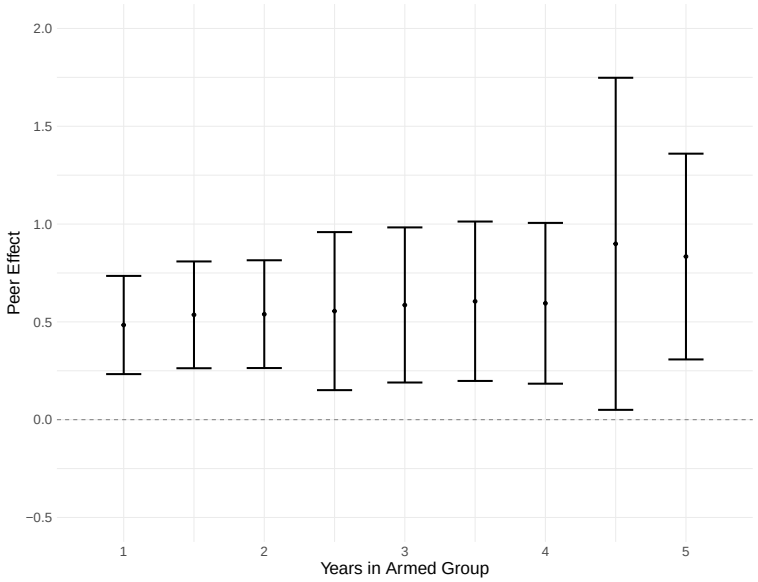
The dependent variable include all ex-combatant captures for the 2013-2016 period. Panel A shows the result of estimating Equation 6, where the first row represent the effect of the shock for individual i and the second row represents the average shock for the group g. Panel B show the estimation explained in Equation 5. Standard errors in parentheses clustered at the group-wartime level. Municipality characteristics include pre-treatment levels of poverty, population, and distance to Bogotá. Individual controls include: age, gender (female), mother education, and race (indigenous and afro). *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the 10% level.

Table A 3: Main effect clustered at individual level

	Red-handed Captures				
	(1)	(2)	(3)	(4)	(5)
Panel A: Economic shock and average shock for the group					
Economic shock ($\hat{\eta}$)	0.382***	0.382***	0.391***	0.414***	0.432***
	(0.113)	(0.113)	(0.117)	(0.119)	(0.121)
Average shock ($\hat{\theta}$)	0.339**	0.340**	0.342**	0.343**	0.394**
	(0.139)	(0.139)	(0.142)	(0.145)	(0.159)
Panel B: Criminal peer effects					
Peer effect ($\hat{\beta}$)	0.470***	0.471***	0.467***	0.453***	0.477***
	(0.147)	(0.147)	(0.149)	(0.149)	(0.144)
Mean of outcome	0.0243	0.0243	0.0368	0.0242	0.0233
S.D of Outcome	0.1702	0.1702	0.2072	0.1701	0.1666
Observations	36,318	36,318	36,318	35,178	29,877
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time trends		✓	✓	✓	✓
Region $\times$ Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

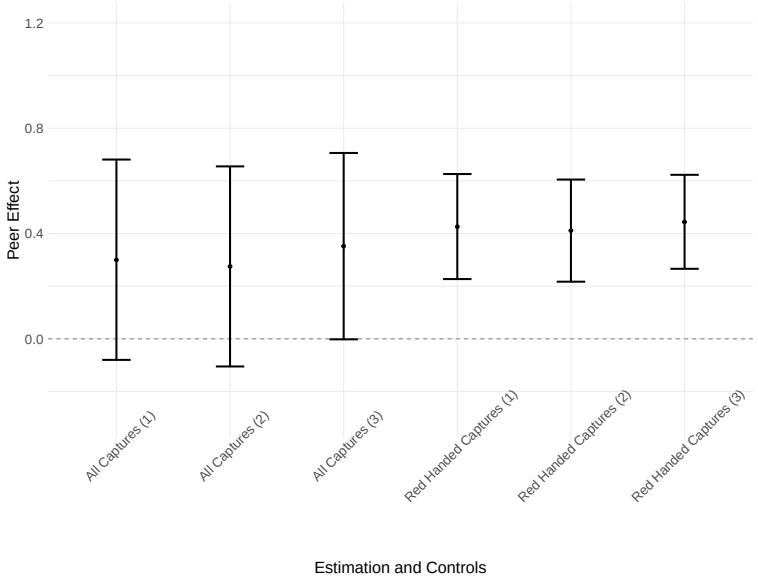
The dependent variable include red-handed arrests for the 2013-2016 period. Panel A shows the result of estimating Equation 6, where the first row represent the effect of the shock for individual i and the second row represents the average shock for the group g. Panel B show the estimation explained in Equation 5. Standard errors in parentheses clustered at the individual level. Municipality characteristics include pre-treatment levels of poverty, population, and distance to Bogotá. Individual controls include: age, gender, mother education, and race. *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the 10% level.

Figure A 4: Peer Effect of Strong Ties: Years together in conflict



Estimation of peer effects considering only groups in which all members where in the armed group between one and five years.

Figure A 5: Peer Effect of Weak Ties: Same unit



Estimation of peer effects with weak ties (Unit in conflict only). Peer effects reflect the estimation of peer effect including different controls: (1) includes group, municipal and time fixed effects, (2) adds Region*year fixed effects and municipality conditions*year fixed effect, and (3) adds individual controls.

Figure A 6: Geographical Distribution of Oil and Illegal Gold Production

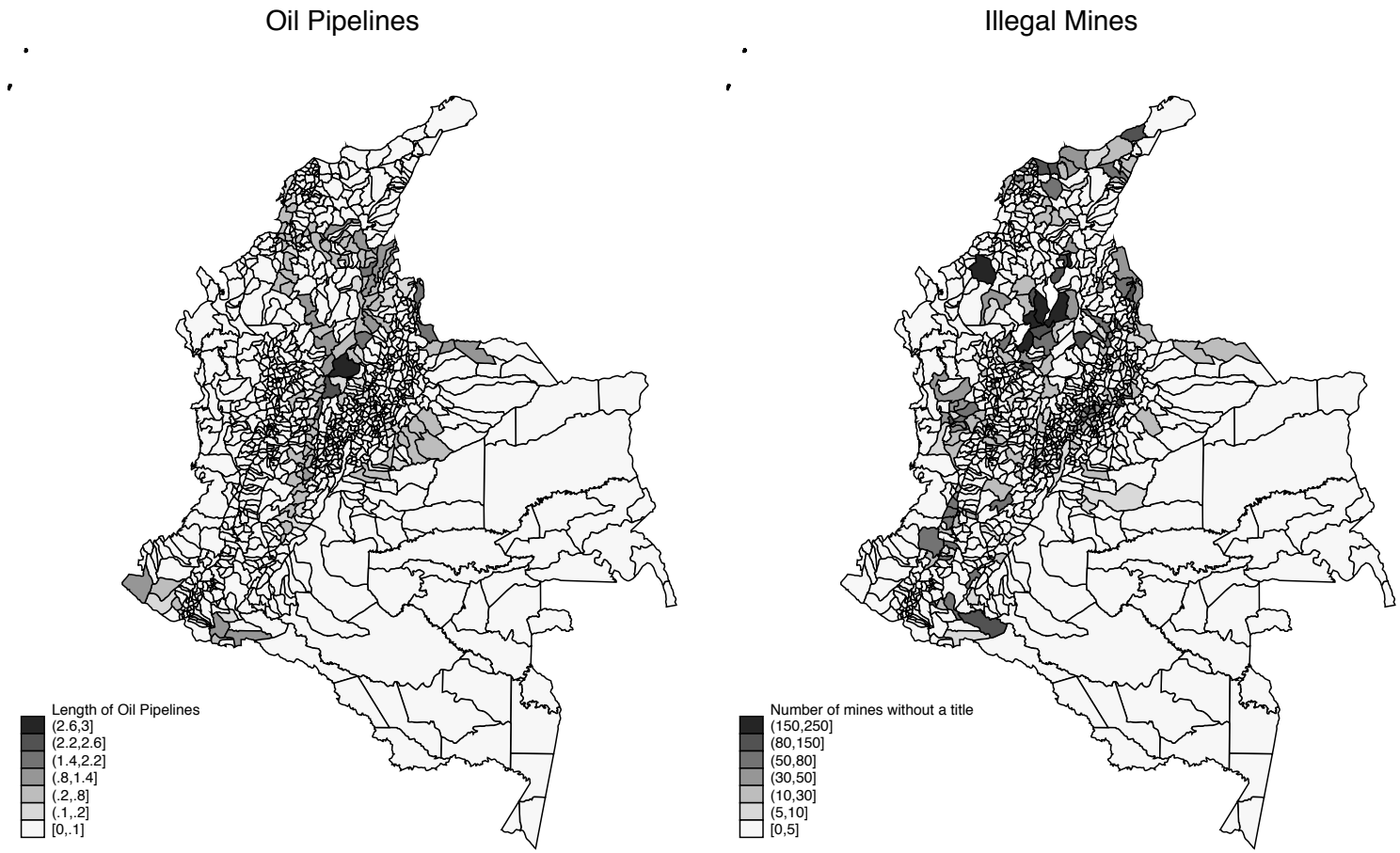


Table A 4: Crime Classification

Crime	Type	Participation	Gang Flag
Drug Trafficking, possession and distribution	Drug	Collective	Yes[1]
Organized Crime / Conspiracy	Violent	Collective	Yes
Illegal arms possession and trafficking or production	Violent	Collective	Yes
Homicide	Violent	Collective	Yes
Theft	Property	Collective	Yes
Attack or assault	Violent	Collective	No
Extortion	Violent	Collective	Yes
Illegal possession and trafficking of military arms and ammunition	Violent	Collective	Yes
Domestic violence	Violent	Individual	No
Threat / Intimidation	Violent	Collective	Yes
Illegal use of resources	Property	Collective	Yes
Use of false identification	Property	Individual	No
Terrorism	Violent	Collective	Yes
Kidnapping	Violent	Collective	Yes
Sexual harassment	Violent	Individual	No
Fraud	Property	Collective	No
Rebellion	Violent	Collective	Yes
Attack against authority	Violent	Collective	Yes
Forced disappearance	Violent	Collective	Yes
Household food assistance	Property	Individual	No
Property assault	Property	Collective	Yes
Animal abuse	Violent	Individual	No
Negligent injuries car accident	Property	Individual	No

List of group of crimes and their type, defining participation between individual and collective, and point out the crimes that have a high probability to get a police reported fllag of a known gang affiliation at the moment of capture based on (Khanna et al., 2019).

Table A 5: Economic Shock and Peer Effects for Collective Crimes Only - All captures

	All Captures - Collective Crimes				
	(1)	(2)	(3)	(4)	(5)
Panel A: Economic shock and average shock for the group					
Economic shock	0.351***	0.351***	0.307***	0.292***	0.305***
	(0.110)	(0.110)	(0.109)	(0.109)	(0.104)
Average shock	0.0999	0.100	0.0995	0.128	0.190
	(0.121)	(0.121)	(0.121)	(0.122)	(0.141)
Panel B: Criminal peer effects					
Peer effect	0.222	0.222	0.245	0.305	0.384*
	(0.238)	(0.238)	(0.258)	(0.244)	(0.224)
Mean of outcome	0.0280	0.0280	0.0280	0.0279	0.0268
S.D of outcome	0.1826	0.1826	0.1826	0.1825	0.1772
Observations	36,318	36,318	36,318	35,178	29,877
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time trends		✓	✓	✓	✓
Region × Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

The dependent variable include all ex-combatant collective crimes for the 2013-2016 period. Panel A shows the result of estimating Equation 6, where the first row represent the effect of the shock for individual i and the second row represents the average shock for the group g. The economic shock is defined as the interaction of the natural logarithm of the international price of gold and illegal gold production. Panel B shows the estimation explained in Equation 5, representing the effect of wartime peers' arrests on $i's$ criminality. Standard errors in parentheses clustered at the group-wartime level. Municipality characteristics include pre-treatment levels of poverty, population, and distance to Bogotá. Individual controls include: age, gender (female), mother education, and race (indigenous and afro). *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the 10% level.

Table A 6: Economic Shock and Individual Crimes

	Red-handed Captures - Individual Crimes				
Economic shock	0.00961	0.00968	0.00230	0.0228	0.0375
	(0.0214)	(0.0214)	(0.0264)	(0.0321)	(0.0353)
Average shock	0.0556**	0.0557**	0.0528**	0.0434	0.0411
	(0.0250)	(0.0250)	(0.0257)	(0.0290)	(0.0295)
Mean of outcome	0.0010	0.0010	0.0010	0.0010	0.0010
S.D of outcome	0.0323	0.0323	0.0323	0.0320	0.0317
Observations	36,318	36,318	36,318	35,178	29,877
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time trends		✓	✓	✓	✓
Region $\times$ Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

Thr dependent variable include red-handed captures for individual crimes for the 2013-2016 period. Panel A shows the result of estimating Equation 6, where the first row represent the effect of the shock for individual i and the second row represents the average shock for the group g. The economic shock is defined as the interaction of the natural logarithm of the international price of gold and illegal gold production. Panel B shows the estimation explained in Equation 5, representing the effect of wartime peers' arrests on $i's$ criminality. Standard errors in parentheses clustered at the group-wartime level. Municipality characteristics include pre-treatment levels of poverty, population, and distance to Bogotá. Individual controls include: age, gender (female), mother education, and race (indigenous and afro). *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the 10% level.

A Additional Details of Illegal Mining and Crime in Colombia

Here I expand on section 3 of the context about illegal gold mining in Colombia. First, I argue that variations in the price of gold are related with an increase in violence. Second, I refer to several cases documented by journalists and qualitative studies on captures related to illegal mining in Colombia that function as a proof of concept of the argument presented in the paper.

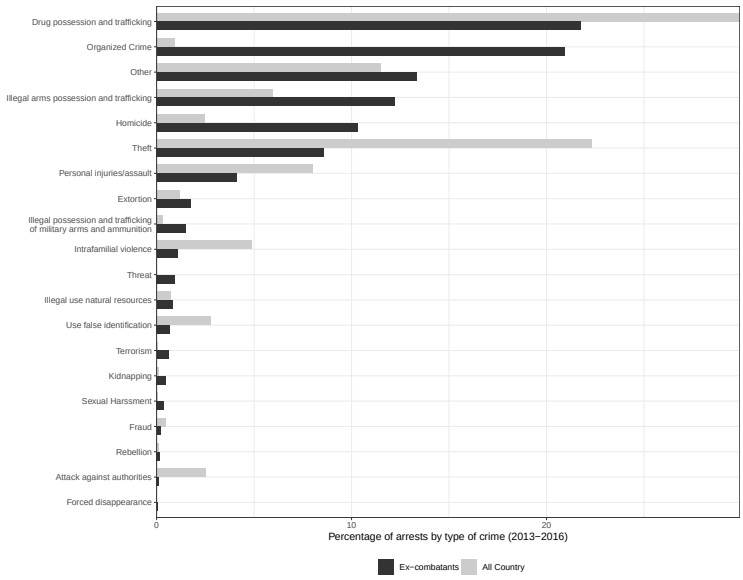
Illegal mining is a significant source of revenue for poor and marginalized people, and have significant effects of development indicators at the local level (Ibáñez and Laverde, 2014; Romero and Saavedra, 2016). Idrobo, Mejía, and Tribin (2014) show that variations in the international price of gold caused a statistically significant increase in the homicide rate and the number of victims of massacre in municipalities with illegal gold mines. Their time frame is before the one studied in this paper, but the same conditions and mechanisms remain. To complement this analysis, I explore i) the differences between ex-combatant criminality overall criminality; ii) the effect of the economic shock on national levels of criminality as measured by captures; iii) and the relationship between general captures with other measures of crime and violence.

A.1 Ex-combatants Criminality and National Level Crime

Figure 7 compares ex-combatant's typo of crimes with national levels. The graph shows the percentage of each type of crime for the ex-combatant population - as in Figure 1 - and the corresponding national-level percentage for each type of crime. For example, if we consider homicide, the fifth category in the graph, we see that 10% of the captures of ex-combatant in this period were related to that crime, and around 2.5% of captures at the national level were related to homicide. One of the most important difference between the percentages by type of crime refers to organize crime ('*concierto para delinquir*'): while this crime alone captures 20% of ex-combatant cap-

tures, it represents less than 2.5% of the national captures. This goes in line with the social logic of crime, in which ex-combatant would be involved with more collective crimes.

Figure A 7: Ex-combatant Crime and National Crime



Percentage of crime type over all types.

A.2 Economic Shocks and National Level Captures

To look at the effect of the gold shock on overall levels of criminality, and not only, former paramilitary, I estimate the following model:

$$y_{jt} = \alpha_j + \gamma_t + X_{jt} + \beta(\text{Gold}_j \times \text{GP}_t) + \epsilon_{jt}] \tag{8}$$

where y_{it} are crime outcomes including captures by the national policy and captures of criminal bands (known in Colombia as *BACRIM*, for *Bandas Criminales*) in municipality j, and year t; α_j are municipality fixed effects; γ_t are year fixed effects; and X_{jt} are time-varying municipality controls that include log of population, to account for the scale effect since the dependent variable is measured as the number of captures. $Gold_j$ is the number of illegal gold mines in the municipality j before 2013;

GP_t is the natural log of the international price of gold in year t. In the equation, β captures the differential effect of the gold price on crime in municipalities producing more gold.

In all specification, I cluster the standard errors at the region level to control for potential correlation over time across municipalities within a region. Table 7 shows the effect of the gold shock on captures for the 2013-2016 period. the coefficients in columns (1) and (2) show the effect of the gold shock on captures, and columns (3) and (4) for criminal bands (BACRIM). The gold shock is positively correlated with captures and criminal bands captures, although the estimates are of economic significance but small statistical significance. This fairly stringent test provides some evidence that the the gold shock may affect crime and complements the results by Idrobo, Mejía, and Tribin (2014), that show that the gold shock was particularly relevant in explaining levels of homicide and attacks in gold producing areas, for a different period.

Table A 7: Economic Shock at the National Level

	(1) National Captures	(2) National Captures	(3) BACRIM Captures	(4) BACRIM Captures
Municipal gold shock	4.727**	1.916	0.210**	0.145
	(2.063)	(2.385)	(0.101)	(0.113)
Mean of outcome	1.9572	1.9572	0.0213	0.0213
S.D of outcome	1.9928	1.9928	0.0715	0.0715
Observations	1,164	1,164	603	603
Municipality FE	✓	✓	✓	✓
Year FE		✓		✓
Sample period	2013-2016	2013-2016	2013-2015	2013-2015

Dependent variable in columns 1 and 2 include all national level captures from 2013 to 2016. Estimation based on Equation 8. Dependent variable in columns 3 and 4 include captures of criminal bands until 2015 (data constrained). Standard errors in parentheses clustered at the municipality level. *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the 10% level.

A.3 Crime Chain Across Municipalities

A key part of the argument is the systematic spread of crime across different locations. To complement the results presented in the main analysis, here I report some

of activities related to illegal gold mining than involve the participation of multiple actors in different locations. The report is based on new articles of captures of members of criminal organizations, many of which were created from former paramilitary units.

The gold value chain has several stages including the production, stockpiling, buying and selling, and finally marketing (Ortiz-Riomalo and Rettberg, 2018). In each of these stages, the participation of several actors in necessary. In the production phase, for example, the machinery needed for gold extraction uses motor fuel oil that must be adquiere and transported to the place of extraction. On many occasions, the input is obtained through local gas stations that request exaggerated amounts of motor fuel oil from other municipalities, and they have to pass an approval from the local government. The police director explains that the process is complicated because the motor fuel oil is not illegal. What is illegal is the whole process that has to be carried out through intimidation and corruption in different places, in order to transport it (Rubiano, 2017).

Something similar happens with machinery. According to the investigations of the General Prosecutor's Office and the Police, the machines used for the exploitation of mines are generally built from parts of the used machines that can be obtained in black markets in urban centers including Bogotá and Medellín. For the Prosecutor, the 'capacity' of the machines to travel across the country without being detected is surprising - *you even get parts for machines that arrive from other countries, like Brazil* (Rubiano, 2017). Again, the process shows how illegal mining requires the participation of various agents in different places.

Finally, and very important, marketing involves the purchasing process by different suppliers in different parts of the country. The deposits of Antioquia, Córdoba and Choó (north-east of the country: area of Map 6 where illegal mining production is concentrated), have proven commercial links with payments to suppliers in places as far away as indigenous reservations in Guainía (south-west of the country, non-gold producing locations) (Semana-Sostenible, 2019).

A.4 Former Paramilitary Criminal Organizations

Many reports indicate that arrests in different places are carried out by organizations that develop in different parts of the country and that they arose from units of the paramilitary organization AUC. The report by Fundacion Ideas para la Paz (2017) shows the areas on influence of the criminal organizations recognized by the government as 'Criminal Bands' that have their origins in former AUC sub-units. National and local newspapers, as I show below, usually report the capture of members of these organizations. The reports often include activities in several municipalities and the link to illegal gold mining. For example, different reports document the capture of several members of the criminal organization '*Clan del Golfo*', created from former AUC paramilitary unit *Bloque Central*, for illegal mining among other crimes, in several municipalities in Córdoba and Antioquia (Canal Monteria, 2019). Even today, the organization has operations in much of the national territory. The captures of members of the *Clan del Golfo* include organized crime, extortion, drug trafficking, and homicide (Monteia Radio 38, 2020), and they center of operations are in Antioquia and Cordoba, where the 'Gold Tsar', that funded illegal groups since 2012 was recently captured (Monteria Radio 38, 2019).

Another report shows a series of arrests in different municipalities of Magdalena for extortion by members of a group that arose from another AUC unit: the *Bloque Norte* (Semana-Region, 2015). The group was consolidated in the study period (as of 2013), and operates in different parts of department of Magdalena and La Guajira in the north part of the country (Caracol Noticias, 2002). According to news reports, their activities include organized crime, homicide, theft, and extortion, mostly to tourist organizations. These activities and form of operation of criminal organizations continues as for today in the same region (Diario Magdalena, 2020).

Finally, a group known as *Los Puntilleros*, that operates mostly in the western part of country, has its origin in the former AUC unit of *Heores del Llano y Guaviare*. The group controls a large range of criminal activities in the area. Their expansion and growth process took place through an intense work of agreements and alliances in

which the organization incorporated former members of the AUC (InSight Crime, 2020). The group of *Los Puntilleros* actually make up a complex criminal network that have territorial interference in several locations, control the population and regulate various activities, both illegal and legal (Diario Extra Llano, 2020).

The reports mostly confirm the argument in the document according to which the criminal operations took place in different locations, in many cases directly linked to the main source of revenue for criminal organization in that period, illegal gold mining, and related to criminal structures that emerged from former units of the AUC.

Table A 8: Analysis excluding larger groups

	Red-handed Captures			
	(1)	(2)	(3)	(3)
	> 1,000 Members	> 500 Members	> 250 Members	> 100 Members
Panel A: Economic shock and average shock for the group				
Economic Shock	0.395***	0.302*	0.198	0.0103
	(0.120)	(0.161)	(0.187)	(0.211)
Average Shock	0.408**	0.451*	0.531**	0.676**
	(0.175)	(0.233)	(0.247)	(0.333)
Panel B: Criminal peer effects				
Peer Effect	0.509***	0.599***	0.728***	0.985***
	(0.148)	(0.204)	(0.236)	(0.307)
Mean of Outcome	0.0229	0.0223	0.0217	0.0191
S.D of Outcome	0.1652	0.1643	0.1625	0.1501
Observations	28,265	18,706	14,326	7,903
Municipality, Year, and Group FE	✓	✓	✓	✓
Time Trends	✓	✓	✓	✓
Region × Year	✓	✓	✓	✓
Municipality Characteristics TT	✓	✓	✓	✓

Panel A shows the result of estimating Equation 6, where the first row represent the effect of the shock for individual i and the second row represents the average shock for the group g. The economic shock is defined as the interaction of the natural logarithm of the international price of gold and illegal gold intensity prior to study period. Panel B show the estimation explained in Equation 5, representing the effect of wartime peers' arrests on $i's$ criminality. Standard errors in parentheses clustered at the group-wartime level. Municipality characteristics include pre-treatment levels of poverty, population, and distance to Bogotá. Individual controls include: age, gender, mother education, and race. *** is significant at the 1% level, ** is significant at the 5% level and * is significant at the 10% level.

Table A 9: The effect of the economic shock on mobility

	Moved to gold municipality				
	(1)	(2)	(3)	(4)	(5)
Average shock	0.0370***	0.0370***	0.0341***	0.0341***	0.0337***
	(0.00960)	(0.00960)	(0.0107)	(0.0107)	(0.0112)
Mean of outcome	0.0371	0.0371	0.0370	0.0370	0.0353
S.D of outcome	0.2101	0.2101	0.2100	0.2100	0.2031
Observations	64,812	64,812	63,201	63,201	54,371
Municipality, year, and group FE	✓	✓	✓	✓	✓
Time trends		✓	✓	✓	✓
Region × Year			✓	✓	✓
Municipality characteristics TT				✓	✓
Individual covariates					✓

The table shows the effect of the mean of the gold shock of the group on the mobility of ex-combatants.

Table A 10: The effect of the economic shock for different levels of gold production

	Production Below Mean	Production Below 25 Percentile	No gold Production
	(1)	(2)	(3)
		Red-Handed Captures	
Average shock	0.410***	0.275**	0.0227
	(0.114)	(0.133)	(0.352)
Mean of outcome	0.0355	0.0347	0.0259
S.D of outcome	0.2044	0.2020	0.1678
Observations	26,708	22,967	4,823
Municipality, year, and group FE	✓	✓	✓
Time trends	✓	✓	✓
Region × Year	✓	✓	✓
Municipality characteristics TT	✓	✓	✓

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The table shows the effect of the mean of the gold shock of the group on the mobility of ex-combatants.

Table A 11: Dyad analysis: Estimates of wartime peers economic shock on ex-combatant's criminality

	All Observations		Gold Production Below sample mean		>100 Members in group	
	Captures	Red-Handed	Captures	Red-Handed	Captures	Red-Handed
Wartime peer economic shock	0.0005***	0.0005***	−0.00003	0.0003***	0.002***	0.002***
	(0.0001)	(0.00005)	(0.0001)	(0.0001)	(0.0005)	(0.0004)
Observations	11,809,884	11,809,884	6,469,073	6,469,073	264,131	264,131
Ex-combatant level Fixed Effects:						
Education	✓	✓	✓	✓	✓	✓
Economic stratum	✓	✓	✓	✓	✓	✓
Region	✓	✓	✓	✓	✓	✓

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All specifications are estimated using OLS, and include the fixed effects described in Equation 7.

B Survey on the Social Connections of Former Combatants

In this section I provide additional information about the social connections of former combatants based on an original survey with members of armed organizations in Colombia. I expand on the relevance of social connections of former combatants, by showing what connections were more important during the conflict, and by explaining what factors are related to criminality. [2]

B.1 Sample

I use administrative data from an original survey along with data from the Colombian Agency of Reintegration, and police records. The survey was conducted by various regional teams coordinated by the Universidad Externado de Colombia between July and September of 2019, resulting in a sample of 448 ex-combatants that were contacted by the ACR in municipalities with over 100 ex-combatants registered with the agency. The final sample contains ex-combatants living in twenty-six different municipalities. It includes 163 former members self identified with the paramilitary group AUC, 125 former members of the guerrilla group FARC, 37 former members of the guerrilla group ELN, and 9 individuals from other illegal armed groups.[3]

Even with several threats of sampling bias, the sampling procedures still permits the construction of a relatively representative sample compared to other samples of hard-to-reach population. I compare the aggregate data of the sample with aggregate data of the complete population of ex-combatants in the reintegration program. The sample has a significantly larger amount of former combatants of the FARC in several municipalities, but other covariates are very similar.

During the survey, enumerators started with an informal conversation about con-

[2] The survey was approved by the Colombian Reintegration Agency, an internal review board, and experimental components of the survey were pre-registered.

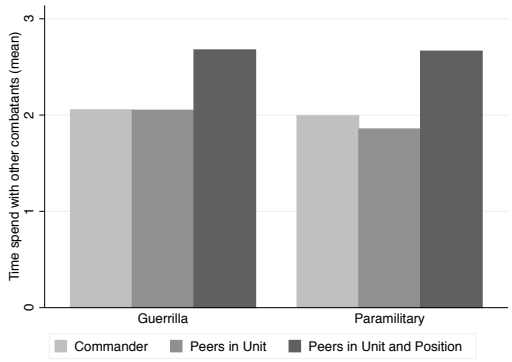
[3] The group of origin, as many other variables, came directly from the ACR and I currently don't have all the administrative information on all of the respondents.

nections during the conflict, then asked basic demographics, survey questions about wartime, and some questions about perceptions of crime and reintegration.

B.2 Ex-combatants' Social Connections

The survey contains questions about the intensity of the interaction with other combatants during and after the conflict. Figure 8 shows the extent to which individuals shared their time with members of their same unit and position, member of the same unit but not the same position and commanders of their unit, both before and after the conflict. Based on the conversations and the survey, combatants spent more time with members of their same unit and their same position, than with commanders or members of other positions. This is true for the members of all armed groups. Both Paramilitary and Guerrilla members used to spend more time with other combatants in their same position inside their unit. More than 70% of respondents said the spent a lot of time with members of the same unit and position during the conflict. This finding provides some supports to the selection of this type of link, given that it is the most extensive connection for ex-combatants.

Figure A 8: Connections During the Conflict

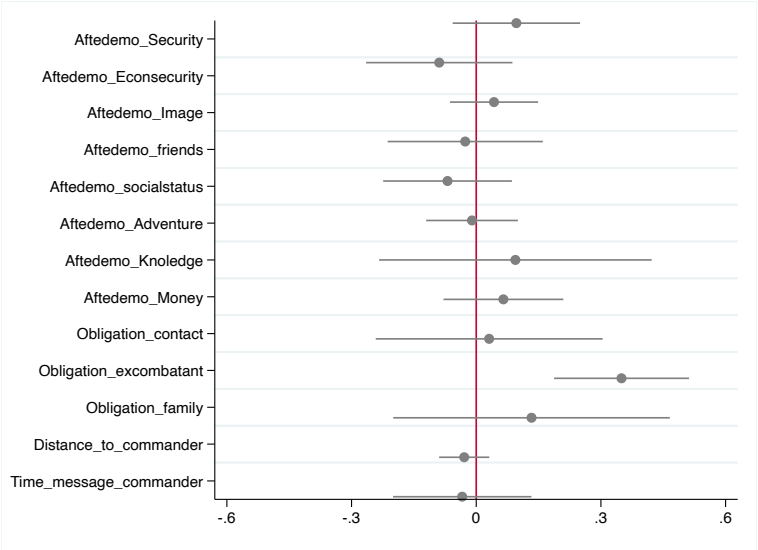


Note: Time spent with other combatants in a 0("Never") to 4("A lot") scale.

Finally, to complement the conjecture that connections to former peers is relevant only for a set of ex-combatants, I regress a set of variables related to perception of the post-conflict period (after demobilization feelings of security, economic condi-

tions; feeling of obligation towards family, former combatant,) and a measure of crime acceptance based on the answers to a lists experiment (to avoid directly asking about crime acceptance). The results are presented in Figure 9, and are done for the paramilitary-only sample. We see a positive and significant relationship in the coefficient of 'feeling obligations towards and ex-combatant.'

Figure A 9: Crime Acceptance and Post-conflict



Note: Each coefficient is the results of a regression of the crime acceptance on the corresponding variable, including location and enumerator fixed effects with robust standard errors.