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**“The formality in property rights: determinant in the military strategy of
armed actors”**

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SUMMARY

The causes of internal conflicts are not easy to identify, and in order to understand its dynamics it is important to determine the factors that influence its persistence. The appropriation of economic resources has been identified as a cause of the conflict; however, asset appropriation may not be the main motivation for armed groups. On the contrary, it may be seen as a means of financing, which influences the conflict's persistence. In Colombia, land appropriation has been a recurrent strategy for illegal armed groups in order to increase their territorial control and the institutional weakness when defining property rights may facilitate illegal appropriation of these assets. The hypothesis presented in this work is that the informality of property rights positively influences the armed groups' decision of attacking and, therefore, influences the conflict's intensity. In order to prove this hypothesis, an econometric model is proposed, which explains the conflict's intensity through economic, social and institutional indicators at a municipal level. The results suggest that with a greater formality in property rights, the conflict's intensity decreases.

Key Words: Institutions, armed conflict, property rights, possession and use of land

Classification JEL: D02, D74, O17, P14, P37, Q15.

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I. INTRODUCTION

“Peasants were far from understanding why the paramilitary had such a great interest in their houses. More than a decade later –and also through guns and displacement- they realized that their lands were more attractive than they seemed and that the ‘buyers’ had perverse reasons to take them away” (The Law of the Mount, Revista Semana consulted at: http://www.semana.com/wf_InfoSeccion.aspx?IdSec=25)

The causes for conflict are not easy to identify. There is currently a debate on the objective and subjective causes for civil conflicts (Collier and Hoeffler, 2001; Grossman, 1999) and the papers that have established the causality between conflict and economic resources appropriation lead to opposite conclusions. Asset appropriation is, however, a common characteristic of internal conflicts and an effective strategy for increasing financing means for the conflict’s participants (de Soysa, 2002; Korf, 2005). Asset appropriation may not be the main purpose of armed groups, but it may constitute a means of subsistence for the actors involved and, therefore, for the preservation of the conflict.

In countries like Colombia, where the conflict is predominantly rural, land constitutes an important element of its dynamic. In these cases, establishing the causality between rural problems related to the establishment of private property and the episodes of violence is not easy, as conflicts over land property may be both cause and consequence of violence (Pons-Vignon and Solignac, 2004). In both cases land access may establish the conflict’s dynamic and may be a factor that determines the duration of the same: the expulsion of individuals becomes a strategy of war to strengthen the territorial power and land appropriation becomes a source of economic resources used to finance armed groups (Ibáñez and Querubín, 2004). In Colombia, for example, land owners, compared to the rest of the population, have been subject to greater violence from armed groups (Kirchhoff and Ibáñez, 2001) and in African countries like Ghana, Rwanda and Uganda, institutional weakness in the definition of property rights in rural areas has influenced the evolution of the conflict (Goldstein and Udry, 2005; André and Platteau, 1997; Deininger, Ayalew and Yamano, 2006).

Institutional weakness in the definition of property rights and the little clarity on the legality of the different types of titles¹ may facilitate the illegal appropriation of land. Well established property rights, sign of State presence, may make asset appropriation by armed

¹ In Colombia, for example, the different types of possessions contemplated by Law are: owners, holders, possessors and occupants, from which only the first group exercise a property right over the land.

groups difficult and may have implications on the conflict in the long term². In Colombia, property rights are developed under a weak institutional framework: the appropriation of abandoned lands by peasants, the lack of institutional clarity on the title formalization proceedings of these land lots and the high costs related to the registration and authentication of rural properties, generated a low title formalization of land lots and non-formalized property rights (Binswanger, Deininger and Feder, 1998).

The work also represents a contribution to the literature on informality. Literature on the “informal economy”, understood as a sector isolated from state regulation (Flórez, 2002), has concentrated on the functioning of the labor market. However, tax exemption may create perverse incentives not to register land lots, which may influence other markets and as proposed in this paper, the intensity of the armed conflict.

The relation between the conflict episodes and the informality of property rights has been theoretically raised, but only in a few cases has empirical evidence been shown (Alston, Libecap and Mueller, 2000; Deininger, 2003). The objective of this investigation is to analyze the relation between property rights over land and the episodes of violence in Colombia. The hypothesis proposed is that institutional weakness prompts insurgent groups towards taking armed actions and, therefore, intensifies the conflict. It is to say that the regions with greater property rights informality show greater violence indexes caused by the conflict’s dynamic: weak property rights facilitate resource appropriation, which influences the armed groups’ military strategy. Establishing the armed actors’ final objective exceeds this paper’s purpose. However, the intention is to build a model that may illustrate the decision function of the armed actors in Colombia. The relationship raised by the paper is related to Oquist’s weak State hypothesis: conflicts and violence episodes are not random, and occur with a greater frequency in places where the State is absent or where its institutions are weak (Oquist, 1980). If the results show the relation between the two variables analyzed, the importance of state presence from a broad scope is evidenced: property rights, institutions, and not only police presence, in rural areas in order to help mitigate the armed conflict in Colombia.

² In the Amazon border of Brazil, for example, the institutional contradictions in the definition of property rights originated invasions and violent confrontations between owners and illegal occupants (Alston, Libecap and Mueller, 2000). On the other hand, in Uganda the increase in land property related conflicts has been a reply to the failure of the property rights systems (Deininger et al., 2006).

Seeking to prove the hypothesis, an econometric model is proposed which explains the intensity of the conflict through economic, social and institutional indicators at a municipal level. Due to the lack of data for all the explanatory variables two econometric alternatives are developed: a cross section type model is developed, in the first place, through average variables and, in the second place, through maximum variables for the dependents, in order to observe the relation in the periods in which violence manifestations are present.

The results suggest that with greater formality in property rights, the conflict's intensity (measured by the total attacks, massacre rate and the number of displaced individuals) decreases. Although endogeneity may exist in the variable that measures the definition of property rights, in the sense that greater conflict intensity may negatively influence the effectiveness of property rights, through regressions with instrumental variables the problem is corrected and the negative relation is maintained.

The document is made up of five sections. The first one is this introduction. The second section presents a bibliographic review on the Colombian conflict framed within the institutions theory and in the literature on civil conflicts. The third section analyzes the model proposed to prove the hypothesis, as well as the explanatory variables to measure the conflict's intensity. The fourth section concentrates on the data description and the econometric results are discussed. The conclusions are presented in the fifth section.

II. LITERATURE REVIEW

The objective of this section is to describe the relation that has existed, and that currently exists, between access to land and the armed conflict in Colombia. Institutions literature³ offers the theoretical framework to understand the importance of norms (formal and informal) in society and the role of the State in the compliance of said norms. On the other hand, literature on the theory of conflict, offers the necessary tools to understand the possible causes for the Colombian conflict and the variables that may influence its dynamic. The first part of the review concentrates on a brief historic review of the armed conflict in Colombia under the institutions theory and the second part analyzes the possible causes and factors of the Colombian conflict's persistence from the theories on conflict.

³ Literature that incorporates the role of institutions to the economic theory and economic history. From this point of view, history is important to understand the present and future of a society and the continuity of the institutions in a society explains the connection between the past and the present (North, 1990).

II. A. History of the Colombian Conflict and the Institutions Theory

Institutions represent the rules of the game in a society and mold the individuals' behavior through the definition and limitation of the group of possible decisions (North, 1990). Property rights are an economic institution that determines the assignment of available resources and establishes who shall be the owners of the benefits of said resources, as well as its distribution (Acemoglu, Johnson and Robinson, 2004; Grossman and Kim, 1995; Grossman, 2001). When there is a clear legal structure that establishes the norms that govern individuals' behavior, the uncertainty decreases, which implies lower transaction and production costs, and stimulates investment.

The literature and empirical evidence have demonstrated the relation between property rights and investment as well as the aggregate level of economic growth. These well-defined property rights may have a positive impact on economic growth through investment incentives, and on credit market access and land productivity through a fairer distribution (Deininger, 2003)⁴. Galiani and Schargrotsky (2007) found that after legally formalizing the title to some land lots in Buenos Aires, investment in housing infrastructure increased the average size of the home decreased and school coverage for children increased. However, contrary to that stated by De Soto (2000) access to credit did not improve with the title formalization of land lots. Although the title formalization of land lots allows the use of land as an alternative asset, which may facilitate access to formal credits that in turn may be reverted (De Soto, 2000); in the case of Buenos Aires, the authors found a different explanation. The deficiency of the credit market generates very strong restrictions. In the case of Argentina, counting with physical assets was not enough to access credit, as it was also important to have a stable job with competitive salaries (Galiani and Schargrotsky, 2007).

On the other hand, badly defined property rights generate uncertainty on future returns on the capital and labor invested, which generates failures in the land market when limiting transactions and making access to credit more difficult, characteristics that have a negative impact on long term growth (Deininger, 2003). Additionally, the more powerful groups may take advantage of the deficiencies of property rights seeking to extract

⁴ In Ghana the greater security on land possession increased investment of homes in their properties and, in China, homes with private land show greater levels of investment in labor and fertilizers (Deininger and Feder, 1998).

economic rents from other's lands and from the peasants who work them, without holding property titles; the activities of economic rent extraction increase wealth concentration, delay growth and the level of rural poverty, and in the Colombian case have contributed to the conflict (Binswanger et al., 1995)⁵.

The relation between badly defined institutions and violence episodes is observed when said institutions generate a low growth environment, high levels of inequality and social unrest. In this case the probability of having armed conflicts increases, given that the State is not capable of satisfying the living conditions that the society demands and individuals may resort to acts of violence to guarantee that which the State does not provide. Additionally, in a scenario of state weakness, the rise of illegal armed groups may be facilitated. The probability of having episodes of violence may depend therefore on the way in which the society's institutions are defined. Both the formal and informal institutions influence this probability. On the one hand, for example, (formal) state institutions may control the insurgent groups' actions, and on the other hand, the (informal) social institutions may influence the individuals' behavior and decisions (North, 1990; Oquist, 1980).

In Colombia, although social contradictions were evidenced since colonial times, the first sprouts of violence would only appear until 1850. Before this date, although social contradictions were evident, they did not move on to violent conflicts due to the well-defined social domination structure (Oquist, 1980). The sporadic episodes of institutional weakness of the State (formal institutions) hid behind a solid social structure, and most importantly, accepted by individuals (informal institutions), which maintained social order. In the early 18th century the Colonial State was weakened, due in part to the institutional fragility which allowed the Hispano-American oligarchy confront the Spanish Colony and fight for independence. Notwithstanding, the social structure continued to dominate, which avoided that the first years of independence were framed within periods of greater violence.

During the first years of the 19th century the conditions changed, not only with regards to the role of the State (formal institutions) but due to the new social conditions of individuals (informal institutions). The first samples of violence caused by agricultural

⁵ Knack and Keefer (2002) found a positive relation between the average annual growth of per capita GDP and the property rights index, for the period between 1970 and 1990, for a sample of 24 countries.

conflicts surfaced during this period: contrary to what happened during colonial times, as of the 19th century the social domination structure was not well-defined. Colonists, landowners and the State had different and irreconcilable objectives, where the only common objective was access to land (LeGrand, 1988).

In the mid 19th century, the rising of the exporting economy, the State's objective was the title formalization of land, seeking to create incentives for land investment and increase in agricultural productivity. Although this period was characterized by relative calm, the scenario changed when the social domination structure began to collapse together with the state crisis. The party struggles began to mature, fueled by agricultural conflicts and the struggles with guerilla groups that formed in the rural areas, as a consequence of the ideological conflicts between the Liberal and Conservative parties. Social conflicts were multifaceted in the early 20th century and, in addition to the state collapse in the 1940s, they gave rise to the period of greater violence in the history of Colombia: the Violence (Oquist, 1980).

The State's partial collapse worsened in time and intensified the agrarian conflicts, as well as the fighting between liberal and conservative guerrillas that developed at a regional level. Colonists and leaseholders were expelled from their lands and properties, regardless of their ideological preferences. The competition for natural resources turned into a priority for the guerrilla groups, and the struggles between the political parties turned into fights over territorial control of specific areas. The initial motivations based on political ideologies, were reflected in different social conflicts, and the State's weakness could not stop the first sprouts of violence, intensified the social crisis and allowed the formal organization of opposition groups (Oquist, 1980).

In the 80s, coca production opened new economic opportunities for illegal armed groups and modified the conflict's dynamic. The drug and drug trafficking economy has financed armed groups, both guerrilla and paramilitary, and has intensified the forceful displacement as a strategy to increase the territorial influence and avoid the support of the enemy groups by the civil population (Reyes, 1994). The guerrillas, on the other hand, have also looked for territorial control by means of extortions and violent acts against the civil population. Lastly, the purchase of urban and rural real estate has become a recurrent mechanism for money laundering by drug traffickers (Kalmanovitz and López, 2006),

which has worsened land concentration. Grossman and Mejía (2005) built a model of the armed conflict where the economy's two agents (State and insurgent groups) dispute the land available for illegal crops, and an external agent through a punishment and subsidy supports the state war against drug production. This paper finds an equilibrium of the model by means of the maximization of each agent's benefits, and shows how drug crops have directed the dynamic of the armed conflict in Colombia.

The institutional context has been an important determinant in the development of the Colombian conflict. During the 40's and 50's it represented a determinant factor in the development of political party conflicts as well as social and agricultural conflicts that had survived since the 19th century. The social contradictions managed to mature due to the institutional collapse as well as the social structure collapse by mid 20th century. In this case, contrary to the colonial period or to the second half of the 19th century, the social structure was not solid and there were multiple social contradictions due to the social exclusion and the high level of inequality. Beginning in the 80s, the institutional weakness in the rural areas has facilitated the territorial expansion of armed groups and formal institutions have been replaced by alternative institutions in the hands of guerrilla and paramilitaries, and lately captured by illegal armed groups. Throughout Colombian history, from mid 19th century to today, property rights have been weak and have influenced the Colombian conflict's dynamic.

II. B. Analysis of the armed groups' decisions and of the persistence of the Colombian conflict

The direct attacks towards the civil population and land expropriation have been a recurrent military strategy of armed group seeking to increase their territorial hegemony, weaken their enemies and take over valuable assets (Reyes, 1988). State inefficiency and the social structure (formal and informal institutions) have been important determinants of the dynamic of these attacks and of the Colombian conflict. On the other hand, although the conflict's persistence may depend on opportunities for obtaining economic rents, the easiness of taking control over these resources depends in turn on the institutions, specifically, the State's territorial control. The weak definition of property rights facilitates the illegal appropriation of land, and conflicts between armed groups, peasants and landowners generate violence in rural areas. Land appropriation increases the territorial

influence of insurgent groups, and generates displacement of victims, which increase land concentration in the hands of armed groups.

Violence episodes become present when there are motives and opportunities to extract economic rents. Motives are social factors and circumstances that make individuals want to rebel (objective causes of the conflict); the opportunities are the economic conditions that make the conflict feasible (subjective causes of the conflict) (Collier and Hoeffler, 2001). Collier and Hoeffler (2001) investigate the causes of civil wars, in the period between 1969 and 1999. The two possible explanations for rebellions are subjective causes, greed, and objective causes, such as inequality and the lack of political rights, among others. Collier's point of view focuses on the conflict's economic factors and leaves aside the social and political factors associated to the same. However, the State and the political vulnerability of socially excluded groups have an important role in the conflict, not only as causes but as factors that influence the sustainability of violent actions of armed groups. Goodhand (2001) states that the discussion between objective and subjective causes of civil wars, instead of focusing on only one of the theories, should focus on establishing the relation between the two explanations. From Goodhand's point of view, the conflict's analysis should begin with the relation between the objective and subjective causes, as they not only explain the causes of the conflict but that which sustains it. Although the economic factor influences financing of armed groups, stating that the conflict is only explained by these sets aside the role of the social and political injustice perceptions held by armed groups. Under Collier's model, the role of the State and of the political and social variables is marginal and subordinated to the importance of the "booty" of war, but it may be precisely due to the lack of property rights, which facilitate the appropriation of economic rents during the conflict. Well-defined institutions not only avoid social unrest and the rise of "objective causes" of the conflict, but also complicate the enrichment from the war, reason for which the "subjective causes" that are those that influence the war's sustainability, are hardly attainable. Beyond establishing if the conflict depends on objective or subjective causes, the analysis must be based on the relation existing between the two, and in the way in which they influence the armed groups' decisions, which may determine the persistence of the armed conflict.

This work moves away from the one-dimensional view of the conflict, and of the objective and subjective causes. Civil conflicts are multi-dimensional phenomena: social motives related to the definition of institutions may be in some cases the spark for violence. Recent literature on Political Science has taken an intermediate approach to explain the origin of civil conflicts. The origin of civil wars should not be framed in the dichotomy of objective and subjective causes (grievance and greed), but should be analyzed within a context where the interaction between political and private agents is considered (Kalyvas, 2003). Although in some cases a spark that frames the conflict as ethnic, political or religious, among others, could exist, the expressions of violence and the persistence of the conflict depend of more complex reasons. Furthermore, the same conflict may develop I diverse ways according to the characteristics of the region and of its population. Local conflicts many times may seem to loose its original motivation, and the opportunities of extracting economic rents become a factor of duration of the conflict (Korf, 2005)⁶.

In Colombia, problems relating to land and property rights have been a determinant factor of the conflict's evolution, and the attempts of agrarian reforms have not been successful. The institutional weakness has been reflected on the inexistence and lack of clarity in the definition of the ruled of the game, especially concerning property rights, which has intensified social disequilibria, which in turn have generated episodes of violence (Machado, 1998). Additionally, they have facilitated the hegemony of the illegal armed groups and the rising of illegal crops.

The Colombian armed conflict has been framed by a military strategy of the armed groups which is related to the struggled for lands and territorial expansion. Territorial expansion has military objectives relating to the control of key areas, and territories rich in natural resources, among them illegal crops, which have deepened the conflict's magnitude since the 80s. The armed groups in turn extended their operations towards areas that represent strategic advantages, be it for economic benefits or for geographic advantages of some territories (Echandía, 1999). Therefore, the definition of property rights in Colombia has been a main character in the dynamic of the Colombian conflict and this paper intends to demonstrate that it represents a determinant in the strategic process of armed actors.

⁶ In Colombia, during the 50s, the struggle between liberal and conservative guerrillas had little ideological background and plenty of economic motivations (Roldán, 2003).

III. ECONOMETRIC STRATEGY

This section's objective is to develop a model that allows determining the way in which weakly established property rights have contributed to the intensification of the conflict. The paper intends to establish the importance of defining property rights in Colombian rural areas and their role in the illegal armed groups' decision making.

Some models of conflicts and civil wars analyze the armed groups' strategies and the individuals' reaction to their attacks under scenarios determined by regional and state characteristics. Kalyvas' (2006) model, for example, has the purpose of establishing the dynamic of violence as of a repeating game between illegal organizations and the civil population. Armed groups seek to increase their territorial power and the decision to attack a certain community depends on the benefits and costs of implementing violence against it. Benefits are determined by economic, political and strategic benefits that derive from the territorial "conquest" and from a greater control of the territory they already govern. The costs function is determined, among other factors, by the probability that the civil population decides to turn them in or support the enemy. The utility function of armed groups is, therefore, linked to the civil population's decisions.

This model may be useful for the Colombian case as the consolidation of territorial hegemony has been one of the main motivations of the attacks against the civil population by the Colombian armed groups. In the case of the Colombian conflict, armed groups strategically choose the civil population they will attack in order to reach their objectives. In some cases, forceful displacement of the civil population is the armed groups' objective in order to take control over their lands. In this way, for example, landowners have been victims selected by illegal armed groups (Kirchhoff and Ibáñez, 2001). Likewise, individuals who participate in peasant or social organizations tend to be victims of violence with a greater probability, given that the destruction of social networks (informal institutions) facilitates the permanence of armed groups and of the imposition of their power.

Appropriation of resources, especially land, in one of the most notable characteristics of the Colombian conflict. Seeking to include this aspect into the economic model, it is possible to start off with the production and appreciation models proposed by

Grossman and Kim (1995) and Hirshleifer (1995)⁷. These models consider the interaction between two agents, that starting with an initial position chooses the allocation of resources between production, defense and appropriation activities. Each of the activities depends on the technology function and of the agents' initial position. In cases where property rights are not well established, properties become resources subject to appropriation, and the imposition of one of the agents over the same depends on the technology and initial positions. Hirshleifer (1995) finds that an anarchy equilibrium that implies social order may be possible if perfect symmetry exists between the two agents, meaning, if neither of the two agents is much more effective in the conflict than the other. Anarchy does not imply social disorder in the case that both agents (for example, civil population and insurgent groups) have the same military capacity and count with the same initial positions so that there are no incentives to attack their neighbor. On the contrary, if one of the agents has better weapons and better resources, or is more efficient, the final equilibrium will be the imposition and hegemony over the others. The agents' decisions are based on the maximization of their utility function, which depends on the production value (initial resources and production technology) and of the level of welfare that depends on the measures in which, on the one hand, it may appropriate of resources of others and, on the other, appropriate their resources and production. Grossman and Kim (1995) find that the absence or weakness of property rights allows for lands to be in the common pool and the equilibrium determined depends on the initial positions and on the technology of each agent. In the Colombian case, the asymmetry in the military power by part of the armed actors, the informality of property rights, the little protection by part of the State and the need for land appropriation as part of the military strategy, have facilitated land expropriation and influenced the conflict's dynamic. These models offer the theoretic framework in order to establish the relation between the property right weakness, the actors' military capacity and resources appropriation.

Seeking to analyze the effect of property rights formality on the intensity of the conflict, some authors have developed probabilistic models to explore the causality between conflict and the specific characteristics of the regions. Deininger (2003), Deininger

⁷ Other papers that have analyzed in depth resources allocation between production and appropriation are: Anderton et al. (1999), Grossman (1994) and Skaperdas (1992).

et al. (2006) and Alston et al. (2000) determine the probability of conflicts taking into consideration the characteristics of the homes, municipalities and land lots, and they are able to determine the causality between the conflict and the property rights problems. Alston et al. (2000) identify the problem of endogeneity in property rights, and propose a methodology in two steps to solve it. First, they propose using observations with a one period lag for the variable that measures the definition in property rights, although there may still persist simultaneity errors between the number of conflicts and the past observations, which may be corrected controlling for the fix effects if the data allow it. Due to the restriction in the data, the authors estimate in a first stage the variable of property rights from the instruments that measure municipal⁸ characteristics that influence the cost of establishing property rights in a given municipality. In the second stage the variable estimated in the regression is used against conflict intensity. In these models, as in the model of Kalyvas (2006), a maximization of the benefit function for the armed group is proposed as well as a function for the conflict's victims' reaction. In both cases it is found that the areas with less defined property rights have an increased probability of violence episodes.

The papers previously mentioned are of great importance as they provide the theoretic basis for the selection of explanatory variables of the model proposed for the Colombian case. In Colombia, the armed conflict is not explained by the interaction between the illegal groups and the civil population, therefore, the models must adapt to the Colombian conflict conditions. Violence in Colombia during the last decades is explained by the confrontations between armed groups (guerrilla and paramilitaries) and, between armed groups and the State (Kalmanovitz and López, 2006); and, although the civil population plays a role in the Colombian conflict, the same is not predominant, reason for which an alternative model is proposed.

III. A. The Conceptual Model

The conceptual model is based on the first part of Deininger's (2003) model, which explains the decision to attack and the selection of the community to be attacked by the

⁸ The instruments are: a dichotomy variable for municipalities under federal mandate, distance of the municipality from the department's capital, and the total area of projects that received credit from the evaluated policy.

armed groups. The decision to attack and the intensity of violence is determined by the economic profit that the armed actors may obtain by attacking a municipality (determined by geographical variables: incidence of illegal crops, oil areas or pipelines, livestock areas, mining areas, among others), due to the profit related to political power and the institutional conditions that facilitate or not the establishment of armed groups and the imposition of their control in certain areas. The violence intensity in the municipality i depends on economic conditions, state presence and the existence of social problems in previous periods (i.e. objective causes of war).

Deininger's model assumes that armed groups choose communities, municipalities in this case, with an economic base sufficient enough to achieve the extraction of economic rents. Armed groups impose a tax t over the amount of assets available in the municipality, which determines the level of economic rent of the conflict; this being, therefore, a decision variable for armed groups. In the Colombian case, the fraction of the tax may be 100 percent; be it because the armed actors charge taxes to the community or because they achieve total expropriation of assets, particularly land. In both cases, effectiveness to appropriate assets depends on the weakness of property rights and of the "technology" used by the armed groups. The costs of attacks are determined, according to Deininger, by the amount of civilians, n , that are recruited by the armed groups, who are paid a wage w_R that depends on human capital and production technology possessed by the same.

For the Colombian case, the costs for armed actors to exercise hegemony in a territory are related to the technology used in said process, which is related to a production function: $F(L)$ ⁹ where L is the production factor, labor. The production function determines the capacity to extract economic rents, which allow the financial sustainability necessary to reach the armed groups' objectives. Notwithstanding their origin as leftist guerrillas and right-wing paramilitaries, both groups have become the main producers and exporters of drugs in Colombia (Grossman and Mejía, 2005). The objective function of increasing the territorial hegemony is associated with the maximization of a benefit function determined by an income and a cost function.

⁹ This assumption is not far from reality: in Colombia, the conflict and production technology in the production area are labor intensive. The conflict in Colombia is a "war of guerrillas" where the main good for production is manual labor and not military capital.

Armed groups may be modeled as a firm that looks to maximize the probability of success, meaning, the probability of taking control over a territory. A greater probability of success of insurgent actions determines the conflict's intensity. The conflict's technology has as a production factor the number of workers (L), meaning of insurgents in the armed group. The armed groups' decision variable is the optimal quantity of the production factor to be employed to maximize benefits. The production function of armed groups has the following form:

$$(1) \quad I = F(L)$$

where I is the conflict's intensity, determined by the probability of success. Armed groups decide how much labor they will employ, in order to maximize the benefit function subject to a technological restriction. The benefit function is determined by:

$$\pi = \text{Total Income} - \text{Total Costs}$$

Income is determined by:

$$(2) \quad Y_i = Y_i(\bar{A}_i, G_i, S_i, I_i)$$

where \bar{A}_i , represents the average level of wealth for municipality i measured by land and its quality, transfers at a municipality level and tax collection, tG_i represents the State's presence, measured by the amount of public goods and the way in which property rights over land are defined, S_i measures the persistence of social and political problems in municipality i , and I_i measures the intensity of violence, determined by the production function. The first three variables are exogenous to the model, while the level of violence intensity in municipality i is endogenous and is determined through the benefit maximization. With greater violence intensity, armed groups may extract a greater economic rent. However, intensity yields are decreasing as it may get to the point where use of violence may destroy the natural resources available, and therefore the derivate's sign is undetermined: $\frac{\partial Y}{\partial I} >< 0$. Total costs on the other hand, are determined by:

$$(3) \quad C_i = C_i(\bar{A}_i, G_i, S_i, w_L, I_i)$$

where \bar{A}_i , G_i , S_i and I_i are defined as in equation (2). The workers' wages w_L are determined as in Deininger's (2003) model and depend on the opportunity cost of belonging to an armed group, of human capital and of the technology held by individuals.

The first four variables, as for the income function are exogenous, while the intensity of violence is endogenous. In this case, the greater production of violence entails the use of more goods for production, which implies greater costs, meaning: $\frac{\partial C}{\partial I} > 0$.

The armed group then decides the intensity of the conflict according to the incomes extracted, the costs entailed and its technology. Therefore, the intensity of the conflict is: $I^* = 0$ when $Y < C$, and, $I^* > 0$ when $Y > C$. The problem faced by armed groups is the following:

$$(4) \quad \underset{L}{Max} \quad Y_i(\bar{A}_i, G_i, S_i, I_i) - C_i(\bar{A}_i, G_i, S_i, w_L, I_i)$$

$$s.a. \quad I_i = F(L)$$

The conflict's intensity depends on the production function and of L^* which results from the benefit maximization and depends on exogenous variables that determine the income and costs function, such that:

$$(5) \quad I_i = f(\bar{A}_i, G_i, S_i, w_L)$$

where I_i measures the level of intensity of the conflict in municipality i , and the rest of the variables are defined in the way described in the previous paragraphs. The exogenous variables influence both the income and the costs function, in the case of municipality

wealth the relation is positive in both cases: $\frac{\partial Y}{\partial A} > 0$ y $\frac{\partial C}{\partial A} > 0$. With a greater wealth,

greater income, but in order to extract more resources more goods for production must be employed which increases costs. Armed groups need economic financing and the wealthy areas represent greater opportunities of economic extraction, therefore it is to be expected that armed groups invest greater efforts in the areas that represent a greater opportunity to

extract economic benefits: $\frac{\partial I}{\partial A} > 0$.

The variables that measure state presence may, on the one hand, increase the armed group's income: $\frac{\partial Y}{\partial G} > 0$ and, on the other, increase costs: $\frac{\partial C}{\partial G} > 0$. In the first place, the massive offer of public goods increases the amount of appropriable resources and positively influences the income function of armed actors and consequently influences the conflict's intensity. Second, the offer of goods such as security and justice expenditure increases the

probability of “punishment” and the costs associated to the same, thus, decreases the conflict’s intensity. Third, the offer of goods such as education, health care and employment opportunities increase the opportunity costs for belonging to insurgent groups and decreases the conflict’s intensity. Lastly, and this is the relation proposed in the hypothesis, defined property rights may dissuade military actions by armed groups and have a negative impact on the conflict’s intensity. The impact of state presence over the conflict’s intensity depends on the nature of the public good.

The social and political variables of the municipality influence, as well, the conflict’s intensity. The social and political problems may be generated and generate failures in the state system, which facilitates the presences and territorial imposition of armed actors. With a greater social unrest, the costs for insurgent groups decrease: $\frac{\partial C}{\partial S} < 0$, which positively influences the conflict’s intensity. The relation to be established between the variables that measure grievance, meaning the objective variables of the conflict, is that with a greater social unrest, there is greater conflict intensity: $\frac{\partial I}{\partial S} > 0$.

Finally, it is necessary to analyze the interaction between wealth of municipalities and state presence. The wealth of a municipality *per se* does not explain the greater conflict intensity given that the good quality lands and high levels of municipal investment could stimulate greater investment towards property security by landowners (not necessarily legal owners), which would make the presence of armed groups more difficult. This interpretation makes sense under the theoretic framework set by the models of Grossman and Kim (1995), and Hirshleifer (1995): with well established property rights, lands are not a “common resources” which may be appropriated by armed actors and, when the “owners” invest in security, the winner of the booty is established by the military capacity of each agent. In this sense, it is important to establish the sign of: $\frac{\partial^2 I}{\partial \bar{A} \partial G}$. When G_i is defined by the presence of better-defined property rights, the entrance of armed groups becomes more difficult and thus $\frac{\partial^2 I}{\partial \bar{A} \partial G} < 0$.

III. B. DEFINITION OF VARIABLES AND DATA DESCRIPTION

Seeking to prove these empirical relations, the following econometric estimation is defined:

$$(6) \quad I_i = \alpha + \beta X_i + \delta X_i * V_i + \gamma V_i + \varphi Z_i + \varepsilon_i$$

The estimation's objective is to explain the intensity of the conflict taking into consideration municipal characteristics. The conflict's intensity I_i , measured by different types of attacks by armed groups: total attacks, massacres¹⁰ and displacements, and, is explained through municipal variables that represent each one of the vectors established in the previous paragraph. The three measures of violence are not perfect substitutes however, and each represents a different military strategy for armed actors. The explanatory variables are: a vector of municipal characteristics related to the wealth of municipality X_i that measure how attractive the municipality is for armed actors, a vector $X_i * V_i$ that measures interactions between the municipality's wealth and state presence, a vector V_i that measures the characteristics of the variables related to state presence and, lastly, vector Z_i of the municipality's social characteristics.

Vector X_i includes: the size of rural land lots, per capita transfers, tax collection and the distance to the department's¹¹ capital¹². Per capita transfers and the tax collection are measures of the municipality's economic capacity and may increase the armed groups' expected benefits. On the other hand geographic variables such as the presence of illegal crops, oil areas or agricultural or livestock production areas are included in the estimations by means of department controls. The presence of illegal crops may increase the probability of actions by part of the armed groups given that the drug economy increases the "value of the war booty and the clandestine rewards that are received by members of the security forces" (Reyes, 1994; Pg. 66). However, the causality between conflict and illegal crops is difficult to establish given that it cannot be determined what happens first: the presence of illegal crops which increases the "war booty" or the armed actors that intervene in the

¹⁰ Homicide of people in a state of defenselessness, produced by an armed attack or similar cause, of three or more human beings (Defense of the People, consulted in: http://members.fortunecity.com/anncol3/okt/991017_Defensoria_masacres.html)

¹¹ Municipalities are the smallest administrative units in Colombia and departments are similar to States in the United States.

¹² Although the size of the land lots and the distance to the department's capital do not explicitly measure municipal wealth, they are characteristics that may make the entrance of armed actors to the municipality more or less attractive.

illegal crops due to its economic yield and its clandestine legality. Sánchez and Díaz (2004) find that the activity of armed groups explains in a large percentage the production of illegal crops, and conclude that the expansion of the conflict is one of the explanations of coca leaf crops¹³. The discussion on the causality between presence of illegal crops and the intensity of the conflict is an issue of great relevance in the Colombian context, however, exceeds the purpose of this paper.

Vector $X_i * V_i$ measures the interactions between: first, characteristics of the land lots with an informality level of property rights; second, characteristics of the land lots with a level of expenditure in security and justice; and third, characteristics of the land lots with a level of informality and expenditure in security and justice. Interactions are fundamental to the model, given that wealthier municipalities may coincide with those that have a better definition of property rights, in which case the measure of wealth would not necessarily increase the conflict's intensity.

The variables related to state presence are taken into account independently from their interaction with the characteristics of the land lots, in vector V_i . The characteristics such as the informality of property rights and public investment per capita¹⁴ are taken into consideration in this vector.

The social problems related to poverty and well-being conditions, in addition to the social capital heap in the municipality, are measured in vector Z_i . In order to measure the impact of social variables over the intensity of the conflict the Unsatisfied Basic Needs (NBI) index and the number of organizations¹⁵, at a municipal level¹⁶ are used. The population's social conditions influence the decision function of illegal groups, given that the entrance of armed actors may be less costly in a community with greater poverty and precarious life conditions. Likewise, when there are no legal economic opportunities it

¹³ The endogeneity problem may be solved using as instrumental variable of the presence of coca crops, the municipality's altitude. However, the first stage results show that the altitude is not significant in order to explain the presence of illegal crops. Additionally, qualitative evidence supports this relation. In Cerotal, Pasto the victims of the conflict state that: *they told us we had to plant the poppy, they taught us how to do it (...) They made calculations of the yield of potato and of poppy and they showed us that the poppy was more profitable (...) People were told: 'he who will have the least, will have 12 million, that convinced us (...) They only required it to finance the war'* (Jesús, H., 57 years old) (Case Studies Poverty Mission, World Bank).

¹⁴ Municipality investment, in healthcare, education, housing, water, roads and total.

¹⁵ The number of organizations corresponds to economic, civil and social organizations.

¹⁶ Land concentration measures were also considered. However, none of the estimations were significant, nor changed the sign or significance of the other variables.

may be easy to recruit civilians into the illegal armed groups. Regarding the characteristics of the land lots, a greater level of land concentration may be related to political inequality (Acemoglu, Bautista, Querubín and Robinson, 2007), which may influence the living conditions in the municipality. In addition to the community's social conditions, the social capital heap is a determinant of the model. With well defined social networks, individuals are better organized, they have more information and may be better prepared to confront possible negative shocks due to war as the probability of civil resistance increases. Additionally, the presence of social organizations increases the level of social cohesion and integration, and therefore decreases the risks of an individual preferring to enter the armed groups' lines. Notwithstanding, this variable's sign is difficult to establish a priori given that the conflict may arise precisely in these areas, and the attack on the civil population is a way to dismantle said networks.

Although it could be argued that the variable for property rights informality may present endogeneity problems, given the objective function of armed groups this problem is not present. Despite the fact that the conflict's intensity may deteriorate the State's actions and presence, which may influence the determination of property rights, in this case the relation is not found in this sense. The informality of property rights affect the benefit function of armed agents and therefore L^* and the intensity of the conflict. However, when armed agents make a decision of attacking they do not influence state presence, as at the time of the attack these variables are exogenous, which determine the armed agents' decisions but not the other way around. The armed actors decide to enter a community based on the income and costs function that determine the expected benefits of the attacks. Informality influences the objective function of armed groups, as well as the explanatory variables, at the moment in which the actors face the decision of entering a community. The objective function that determines the intensity of violence depends therefore on the municipality's conditions, which are exogenous. Although the strengthening of armed groups in a community may influence the state presence variables and social conditions, when the actors make the decision these variables are exogenous and there are no endogeneity problems. However, to rigorously prove this interpretation the formality percentage in 1985 is used as an instrumental variable.

The dependent variable is measured by the total number of attacks by armed groups¹⁷, the total massacres and the number of displaced individuals. All this data is analyzed at a municipal level, annual data for the total number of attacks is available between 1993 and 2004, and for the massacres between 1995 and 2002, both series originating from the National Planning Department; annual data on displacement is available from 1995 to 2006, originating from the Only System of Registration (SUR)¹⁸. Although three variables are a measure of the conflict's intensity, they are not perfect substitutes of the intensity of violence as it is not expected that the econometric results be the same for the three cases given that the armed groups' objectives may differ according to the military strategy they decide to employ. Displacement, for example, is not only related to the armed groups' decision but also to the victims of the conflict. It is likely that when being victims of the armed conflict, independently of the type of possession over the land, individuals decide to migrate based on other factors that influence their expected utility¹⁹. In the case of the attacks, there may be specific objectives in the municipality, and in the case of the massacres the motivation may be the massive consolidation of the determine municipality. In the second case the violence may be motivated in greater part by the municipality's level of wealth, or by conflicts for territorial hegemony between insurgent groups and not by specific objectives within the municipality.

Given that several variables only have information for one year, there are no annual variations for the whole group of explanatory variables; therefore, data panel models cannot be conducted with the whole group of variables specified in the section above. Seeking to empirically explore the hypothesis, two econometric strategies are used: on the one hand, averages of the dependent and explanatory variables are used. This methodology is similar to a data panel model controlling for the variables omitted that change in time, but that remain constant²⁰ between municipalities, meaning, fixed effects at a municipal level. On the other hand, the maximum dependent variable and the average of the explanatory variables are used. This methodology allows observing the impact of explanatory variables when the attacks take place (in the cases of the maximum observation) seeking to identify

¹⁷Attacks by paramilitaries, CNGS, ELN, EPL, ERG, ERP, FARC, M-19, PEPES and other unknown actors.

¹⁸ Social Action Network (Red de Acción Social). Valid thru: February 3, 2007.

¹⁹ In Ibáñez and Querubín (2004) a model on the probability of individuals migrating is developed.

²⁰ Princeton University. "Data and Statistical Services" consulted in:
http://dss.princeton.edu/online_help/analysis/panel.htm

the determinants of the conflict's intensity at the time in which the presence of the armed group is observed. Given that the attacks do not occur in a constant manner, only observing the averages could underestimate the intensity of the conflict.

A formality *proxy* is built seeking to measure the definition of property rights. The variable is built taking the data on the area of the land lots at a municipal level from IGAC for 1999 to 2003²¹. The IGAC data are based on information from cadastre, therefore the area of the registered land lots in this database correspond to formal land lots with defined property rights. To establish a percentage of formality in property rights, the area of formal land lots is compared with the total area of the municipality²². The *proxy* proposed for the definition of property rights measures the percentage of formal land lots in municipality *i*, as defined below²³:

$$Formality_i = (Area\ of\ formal\ land\ lots_i) / (Area\ of\ the\ municipality_i)$$

The measure is an approximation of the informality in Colombia and is based on cadastral data. The econometric analysis excludes the data for the large cities²⁴ in order to eliminate exclusively urban areas from the sample.

The results of the model are relevant as, if the variables that measure state presence (motives and objective causes), are the most significant (contrary to Collier and Hoeffler's (2001) results), it would be demonstrated that State policies are an important determinant within the conflict dynamic. Furthermore, if especially the variables related to property rights turn out to be significant, it is evidenced that informality in the land market is still a problem related to the conflict and highlights the effort that the Colombian State must make in order to resolve and formalize access to small farmers' lands.

²¹ With the exception of Antioquia for which property data of the Statistics Yearbook of Antioquia is used.

²² The municipality area to be compared is that which should have established property titles, namely, the municipal area without taking into account: indigenous reserves, forest areas and natural parks, and State lands. The area registered in cadastre takes into account the area of these properties and due to the restriction of data of protected lands and State lands at a municipal level, both areas may be compared without having to remove from the municipal area the area of said lands.

²³ Given that the variable is based on information from cadastre, informality in property rights measured by the area of the registered land lots may be an imperfect proxy as it is possible for some lands that appear as formal not to be so. Additionally, there are cases where a land lot is located between two municipalities but only registered in one, which may create mistaken formality percentages. The cases where the registered area is greater than the municipal area are not taken into consideration in the econometric analysis. In total, 23 percent of the observations are not included, the mean of the formality percentage for the same is 1.14 while the mean for the observations taken into consideration is 0.81.

²⁴ Bogotá, Cali and Medellín

III. C. DESCRIPTIVE STATISTICS

The objective of this section is to analyze descriptive statistics according to attack or displacement presence. Furthermore, graphs are used to determine the relation between the percentage of formality and violent events.

Table 1 shows the municipal characteristics according to presence of attacks and forceful displacement, the descriptive statistics are not used to measure the intensity of the conflict but rather the presence of armed actors measured by the presence of attacks and by the displaced population²⁵. The data show the means of the explanatory variables and the significance of the difference between means according to the presence of attacks and displacement; it should be highlighted that these are descriptive results that without controlling for other variables may present errors. In the following section by means of regressions these results may be statistically proven with a greater degree of statistical rigor.

The variables that measure the municipality's wealth positively influence the presence of armed actors, with the exception of transfers per capita and the distance to the department's capital. The more attractive lands from an economic point of view (greater appraisals, greater size and presence of illegal crops) may attract armed groups and increase the level of violence. Either if the armed groups are motivated by the appropriation of the war "booty" as a way of becoming rich or if said appropriation is only considered as a way to finance the conflict, the land characteristics influence the armed actors' actions. The lands with better quality are surely better appraised, likewise, larger lands allow greater territorial control and from that point of view, independently from its quality, may be more desired by insurgent groups. However, the normalized size of the land lots does not show significant differences according to presence of attacks or displacement. The normalized size is calculated in relation to the mean and to the standard deviation of the size of the land lots at a municipal level, this measure is more precise than the absolute size of the land lots given that it takes into account the characteristic size of the land lots at a regional level. On the other hand, contrary to what was expected, when there is presence of attacks the

²⁵ To measure presence a dichotomy variable is constructed, which is equal to 1 if there were attacks and to 0 if not for the case of the attacks, and equal to 1 if there were displaced individuals and 0 if there was no displacement.

municipalities are on average closer to the capital, however when there is displacement the distance to the capital is greater.

The differences of the means of the variables that measure State presence are significant only for presence of attacks. The percentage of formality shows the expected result, the municipalities with a greater percentage of formality show a smaller presence of attacks as is proposed in this paper's hypothesis, while the differences in the means for investment per capita are not significant.

Finally, the differences of the variables' means that measure social problems and the social cohesion of the community are significant both for the presence of attacks and for the displacement phenomenon. The mean of the number of organizations is greater when there is presence of attacks and forceful displacement: an explanation for this result may be that the strategy of armed groups is related to the destruction of the social networks seeking to increase control and territorial hegemony. Furthermore, land concentration is greater when there are attacks and forceful displacement. On the one hand, this variable may show a greater level of inequality that indicates social problems and decreases the costs for armed groups of entering a municipality; on the other hand, a greater level of land concentration could indicate the presence of landowners that could have more power over their properties and make military actions of insurgent groups difficult. This variables impact over the conflict's intensity is rigorously determined by means of the regressions in the following section.

Graph 1 not only corroborates the relation observed in the previous table between the percentage of formality and the presence of attacks, but also shows a quadratic relation between the two variables. The relation appears to be non-linear, at a greater formality the presence of attacks increases, but reaches a point where the greater formality dissuades the presence of armed actors.

On the other hand, the relation of Graph 1 may be influenced by the size of the land lots given that, as observed in Table 1, larger land lots may be more attractive for armed groups. Size is not always related to the land lot's appraisal (Graph 2) but is related to formality (Graph 3): larger land lots show a smaller percentage of formality, which may influence the decision to attack. The negative relation between size of the land lots and the percentage of formality may imply that in Colombia, the larger land lots are found in areas

of agricultural boundaries as may be observed in Map 1. The darker municipalities are those that show larger land lots and that are located in departments characterized for being agricultural boundary territories, such as: Caquetá, Meta, Casanare, Amazonas, Guainía, Guaviare and Vaupés.

Table 1. Municipal characteristics according to the presence of attacks and forceful displacement. Mean Differences

Variable	Attacks				Forced Displacement			
	Total		Mean		Total		Mean	
	Attacks	No Attacks	Attacks	No Attacks	Displacement	No Displacement	Displacement	No Displacement
Wealth: Xi								
Appraisal rural lands IGAC 2003 (Millions)	33,500***	22,600***	26,400	22,900	26,800	23,500***	26,000*	15,200*
Plot size	85,686***	59,766***	77,950	55,014	77,151***	31,778***	75,083	22,619
Normalized plot size	0.0229	-0.0077	0.0007	0.0002	-0.0011	0.0072	0.0006	0.0007
Illegal crops hectares	238.36***	86.93***	166.04***	15.31***	164.63***	24.89***	136.7972	7.0638
Transfers per capita	97.90***	117.02***	103.83***	138.25***	96.29***	128.06***	109.19***	162.25***
Per capita ICA Tax revenue	6.33***	3.49***	4.39	3.48	4.48	4.16	4.29	1.96
Distance to the department's capital	119.16***	133.82***	130.59	128.00	133.43***	124.05***	130.80	114.10
Presence of State: Zi								
Formality percentage	0.8965***	0.9248**	0.9093*	0.9706*	0.9127	0.9302	0.9251	0.8948
Per capita investment	120.35	251.18	923.98	202.76	276.12	123.25	781.33	216.83
Normalized per capita investment	0.1087***	-0.0466***	0.0000	0.0000	0.1100***	-0.1429***	0.0000	0.0000
Social Problems: Ci								
Number of organizations	720***	226.67***	356.18***	159.81***	412.51***	224.96***	321.65***	90.30***
Unsatisfied Basic Needs	47.27***	50.85***	50.29	49.70	50.60*	49.19*	50.22	48.87
Inequality of plot size: standard Deviation (hectares)	7,586***	3,106***	4,853**	419**	4,190***	2,221***	3,993	254
Inequality of plot size: median area/mean area (hectares)	0.9856**	0.9894**	0.9881	0.9909	0.9880**	0.9921**	0.9887	0.9905

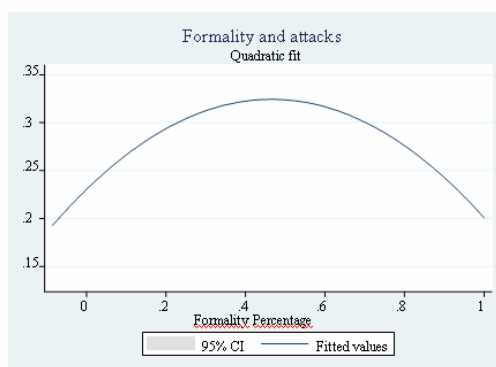
Source: Author's calculations base don CEDE and IGAC databases

*10% significance

**5% significance

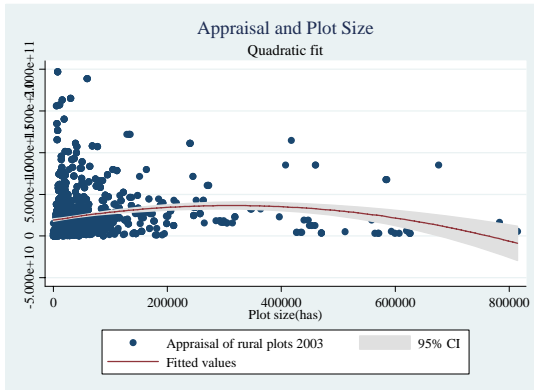
***1% significance

Graph 1. Relation between formality and attacks

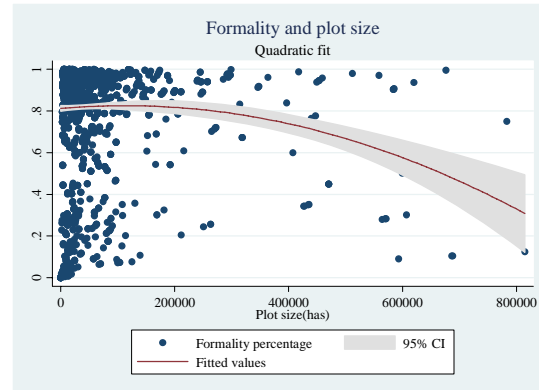


Source: Author's calculations with CEDE and IGAC databases

Graph 2. Relation between appraisals and size



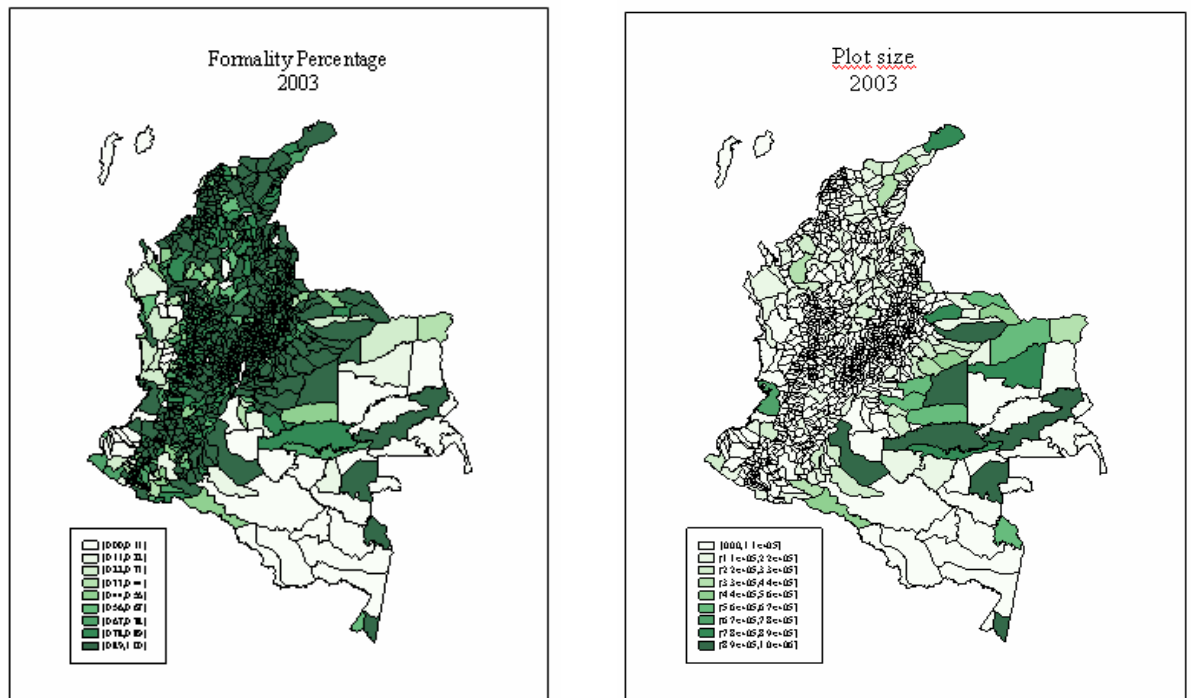
Graph 3. Relation between formality and size



Source: Author's calculations with CEDE and IGAC databases

The relation between formality and attacks (Graph 1) may be therefore influenced by the size and the value of the land lots. A more statistically rigorous analysis through econometric estimations is shown in the following section, which allows controlling for other variables that may influence over these relations.

Map 1. Size of land lots and Formality at the municipal level (2003)



Source: Author's calculations with CEDE and IGAC databases

IV. ECONOMETRIC RESULTS

This section shows the econometric results of the two methodologies describe above. For each dependent variable regressions were estimated by averages and maximums, to control for the problem of endogeneity in the variable of formality of property rights regressions were estimated using as an instrumental variable the percentage of formality in 1985. It is intuitive to use this variable as an instrument given that the informality in past years is a determinant of the current informality. Additionally, although the lagged variables may maintain the endogeneity problem, a Hausman test was conducted as proof of weak endogeneity and the efficiency of the instrument was proven. In each of the estimations departmental controls were included to control for non-observable omitted variables. The average results are presented in this section, while that for the maximums are shown in the Annex given that the results do not show significant differences. Tables 2 and A1 show the results for the total attacks at a municipal level, the tables 3 and A2 for the massacre rate for each 10.000 inhabitants and lastly, tables 4 and A3 show the results for the total of displaced individuals.

For the intensity of violence measured by the total attacks (tables 2 and A1) in regression (1) in the group of variables that measure wealth, the transfers per capita and the distance to the department capital result to be significant, both negatively influence the attacks. The transfers received by municipalities depend on a group of poverty indicators and of characteristics of the population (Sánchez and Palau, 2006). If a municipality received less transfers it may be an indicator of a greater level of economic activity, which could increase incentives for armed groups. On the other hand, the sign for the distance to the department capital corroborates the results observed in Table 1 with the descriptive statistics. The municipalities farthest from the department capital suffer fewer attacks. Although it is a surprising result as it is expected to be easier for armed groups to enter a distant municipality, these may also be the poorest and thus not represent economic benefits for insurgent groups.

From the group of variables that measure state presence the following are significant: the percentage of formality and the investment per capita. The non-instrumentalized estimations include a variable of formality squared and it is found that: the percentage of formality shows a U shape, contrary to what was observed in Graph 1. As is

proposed in the hypothesis, with a greater formality of property rights the attacks decrease. However, there exists a minimum point from which with a greater formality of property rights attacks increase. An explanation of this result may be that lands with better defined property rights may be those with greater value, notwithstanding, when the variable for interaction between the size of the land lots and the formality is taken into account, no significant results were found. There may exist other variables related to formality and wealth of the land that are not observables by means of the size variable: for example, when armed actors appropriate some lands it is not only for their economic value and the geographical position of the land lots plays an important role for the possible economic rent that they may extract. Territorial expansion, as well as the control of strategic corridors is part of the armed groups' strategy. Results indicate that, as was expected, although larger land lots are a more appealing objective for armed groups, when they have established property titles or a greater expenditure in security in the municipality, the attacks by part of the armed agents decrease. On the other hand, per capita investment negatively influences the intensity of the attacks given that it is a *proxy* of state presence and as such dissuades military action from rebel groups.

From the group of variables that measure cohesion and social problems only the number of organizations results to be negative and positively affects the intensity of violence. However, when controlling for the number of organizations only the percentage of formality continues to be significant. One possible explanation could be the high level of correlation with the other variables, however the correlation matrix (Table A4 in the Annex) does not show high correlations with the other explanatory variables. The variable used as a *proxy* for the number of organizations may present problems as it corresponds to different types of organizations not found in all municipalities and there are only data for one year for each organization.

In the interactions group two are significant: the interaction between size of the land lots and expenditure on security and justice, and the interaction between size, formality and expenditure on security and justice, in both cases with a negative sign. This result may be intuitive: despite the larger size of the land lots, if expenditure on security by the State and the expenditure to formalize the land lots by part of their owners is high, armed actors are dissuaded to attack.

When the results of tables 2 and A1 (in the Annex) are compared it may be observed that the significant variables are the same in both cases. When taking as a dependent variable the maximum there are higher coefficients found for each explanatory variable, but their significance level continues to be the same.

Table 2. Estimations for total attacks of armed groups (Means)

Variable ^a	OLS							Instrumental Variable						
	Coefficient (t-statistic)							Coefficient (t-statistic)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formality Percentage	-4.5814 ** (-2.06)	-4.4762 ** (-1.97)	1.8655 (1.02)	-6.2013 ** (-2.02)	-5.9867 ** (-2.06)	-6.1577 ** (-2.06)	-5.0955 ** (-2.28)	-8.1377 ** (-2.36)	-8.2905 ** (-2.36)	-5.0829 * (-1.64)	-8.4848 ** (-2.41)	-8.4898 ** (-2.41)	-8.4899 ** (-2.41)	-8.4802 ** (-2.41)
Wealth: Xi														
Normalized plot size	1.5289 *** (2.70)	1.4981 *** (2.68)	0.2304 (0.57)	1.6833 *** (2.75)	1.5186 *** (2.82)	1.5131 *** (2.84)	1.8039 *** (2.83)	-1.3044 (-1.00)	-1.7555 (-1.31)	-1.1641 (-1.24)	0.1099 (0.00)	0.0109 (0.01)	0.4481 (0.29)	353.4243 (1.00)
Per capita transfers	-0.0078 *** (-2.63)							-0.0088 *** (-2.54)						
Per capita ICA revenue	0.1652 (1.49)	0.1780 (1.54)	0.1436 (1.25)	0.1941 (1.36)	0.1836 (1.34)	0.1839 (1.35)	0.1925 (1.34)	0.1820 (1.42)	0.1980 (1.47)	0.1598 (1.20)	0.1938 (1.42)	0.1937 (1.42)	0.1937 (1.42)	0.1944 (1.42)
Distance from department's capital	-0.0041 (-1.58)	-0.0041 (-1.56)	-0.0005 (-0.30)	-0.0038 * (-1.86)	-0.0030 (-1.37)	-0.0031 (-1.37)	-0.0035 * (-1.73)	-0.0050 * (-1.70)	-0.0051 * (-1.72)	-0.0011 (-0.61)	-0.0043 * (-1.68)	-0.0043 * (-1.69)	-0.0043 * (-1.69)	-0.0044 * (-1.72)
Presence of Government: Zi														
Formality Percentage*Formality Percentage	1.6527 ** (2.03)	1.6052 ** (1.95)	-0.5988 (-0.88)	2.1769 ** (1.98)	2.1193 ** (2.02)	2.1753 ** (2.01)	1.8681 ** (2.25)							
Per capita Investment		-0.0084 ** (-2.03)	-0.0052 (-1.33)	-0.0088 (-1.58)	-0.0083 * (-1.61)	-0.0083 (-1.60)	-0.0090 * (-1.62)		-0.0098 ** (-1.95)	-0.0063 (-1.32)	-0.0095 * (-1.83)	-0.0095 * (-1.84)	-0.0095 * (-1.84)	-0.0098 * (-1.84)
Social Problems: Ci														
Number of organizations			0.0038 *** (4.10)							0.0035 *** (3.70)				
Unsatisfied Basic Needs			0.0182 (1.12)	-0.02856 * (-1.76)	-0.0214 (-1.20)	-0.0217 (-1.21)	-0.0279 * (-1.79)			0.0136 (1.04)	-0.0188 (-1.00)	-0.0189 (-1.01)	-0.0189 (-1.01)	-0.0185 (-0.98)
Interactions: Ai*Zi														
Normalized plot size*Formality Percentage				0.0000 (-0.35)			0.0000 (-0.99)				-1.7564 (-0.01)			-354.4865 (-0.96)
Normalized plot size*Government expenditures in justice and security					0.0000 *** (3.16)		0.0000 (0.29)					-0.0015 ** (-2.55)		0.0342 (0.57)
Normalized plot size*Formality Percentage*Government expenditures in justice and security						0.0000 *** (3.23)	0.0000 (-0.12)						-0.0021 *** (-2.58)	-0.0527 (-0.68)
Constant	4.7754 *** (2.54)	4.8467 *** (2.74)	-1.1400 (-0.55)	9.2064 *** (2.96)	8.6118 ** (2.43)	8.7215 ** (2.43)	9.5298 *** (4.22)	13.49 *** (13.36)	13.49 *** (13.13)	11.14 * (1.72)	23.05 *** (3.04)	23.07 *** (3.04)	23.07 *** (3.04)	23.06 *** (3.04)
Number of Observations	786	786	786	679	679	679	679	639	639	639.0000	639	639	639	639
R-Square	0.2559	0.2621	0.4207	0.2948	0.3044	0.3035	0.3136	0.2216	0.2279	0.4190	0.2262	0.2264	0.2264	0.2274

Source: Author's calculations based on CEDE and IGAC databases

*** 1% significance, ** 5% significance, *10% significance

a. Departmental controls

Tables 3 and A2 show that in fact that the objectives of the different military strategies of armed groups have diverse implications and, therefore, the explanatory variables do not show the same signs or significance. When the conflict's intensity is measured by the massacre rate, the percentage of formality loses significance and the variables that become significant in group X_i are: the normalized size of the land lots (although not in all estimations), the transfers per capita and the ICA collection per capita. The positive sign of transfers per capita may be explained with the results of Sánchez and Palau (2006): the greater level of economic resources at a municipal level increases violence towards local authorities, which increase the conflict's intensity. When violence has the objective of generating pressure over the region's politicians, massacres may be a more effective means from the point of view of violence production. Massacres are able of terrorizing the population without destroying the municipality's wealth, which generates the desired pressure over local authorities. The ICA collection measures a greater level of economic activity in the municipality, and according to the sign of transfers, in this case a positive impact over the level of violence would also be expected, however, it is found that the greater ICA collection the less massacres recorded. The explanation of this result is that with a greater ICA collection the municipality is richer and more industrialized, which may be related to a greater state presence and may thus generate greater costs for armed groups' actions.

The results for the group of variables that measure state presence differ from those found for the total of attacks. The percentage of formality loses significance and although per capita investment continues to be significant, in this case positively affects the level of violence. It seems logical that formality over property rights does not influence the massacre rate given that in this case, the objectives of armed groups are not directed towards specific objectives but towards the whole community. With massacres armed groups seek to terrorize and control the civil population and not necessarily appropriate the community's resources. The sign of per capita investment is not as expected given that, with a greater state presence the entry of armed groups may be more difficult.

From the group of variables that measure cohesion and social problems, none resulted to be significant. Lastly, within the group of interactions of the three most significant variables: interaction between size and formality with a negative sign, and size

with expenditure, and size with formality and expenditure with a positive sign. This result supports the fact that massacres have a military objective different to that of attacks: although formality may dissuade the attack by means of massacres, expenditure in security and justice does not have the same effect. The results for the estimation of maximums do not differ from the estimation for averages and are presented in Annex A2.

Table 3. Estimations for the massacre rate (Means)

Variable ^a	OLS							Instrumental Variable						
	Coefficient (t-statistic)							Coefficient (t-statistic)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formality Percentage	1.8519 (1.28)	2.5174 (1.42)	1.8244 (1.11)	0.1816 (0.10)	0.0032 (0.00)	0.0504 (0.03)	-0.2099 (-0.11)	2.7143 (0.62)	2.8594 (0.66)	2.8445 (0.59)	3.4667 (0.79)	3.4682 (0.79)	3.4674 (0.79)	3.4473 (0.76)
Wealth: Xi														
Normalized plot size	-0.2171 (-0.29)	-0.3633 (-0.49)	-0.3366 (-0.44)	0.1489 (0.23)	0.0615 (0.09)	0.0647 (0.09)	0.1475 (0.21)	-45.54 ** (-1.96)	-30.2130 (-0.9)	-31.7888 (-0.94)	282.16 *** (6.37)	-83.75 *** (-7.51)	-83.79 *** (-7.56)	833.13 (0.06)
Per capita transfers	0.0402 *** (6.27)							0.0408 *** (4.82)						
Per capita ICA revenue	-0.0355 ** (-2.51)	-0.0791 *** (-3.58)	-0.0623 *** (-2.95)	-0.0598 *** (-2.62)	-0.0666 ** (-2.45)	-0.0664 ** (-2.44)	-0.0598 *** (-2.76)	-0.0258 (-1.57)	-0.0759 *** (-2.74)	-0.0624 ** (-2.40)	-0.0661 ** (-2.41)	-0.0662 ** (-2.42)	-0.0662 ** (-2.42)	-0.0662 ** (-2.42)
Distance from department's capital	0.0005 (0.34)	0.0018 (1.14)	-0.0001 (-0.05)	0.0015 (0.76)	0.0019 (0.92)	0.0019 (0.92)	0.0016 (0.79)	0.0036 (1.21)	0.0046 * (1.60)	0.0031 (0.96)	0.0038 (1.31)	0.0038 (1.31)	0.0038 (1.31)	0.0038 (1.33)
Presence of Government: Zi														
Formality Percentage*Formality Percentage	-0.6601 (-0.89)	-0.7763 (-0.92)	-0.5809 (-0.74)	0.0767 (0.09)	0.0338 (0.04)	0.0193 (0.02)	0.2310 (0.29)							
Per capita Investment		0.0372 *** (7.29)	0.0351 *** (6.62)	0.0422 *** (5.93)	0.0428 *** (6.01)	0.0427 *** (6.00)	0.0428 *** (5.77)		0.0433 *** (6.53)	0.0413 *** (5.71)	0.0414 *** (5.67)	0.0414 *** (5.67)	0.0414 *** (5.67)	0.0414 *** (5.65)
Social Problems: Ci														
Number of organizations			-0.0004 *** (-2.79)	-0.0004 (-2.71)	-0.0004 *** (-2.59)	-0.0004 ** (-2.64)	-0.0004 *** (-2.13)			-0.0003 (-1.14)				
Unsatisfied Basic Needs			0.0155 (1.31)	-0.0039 (-0.28)	-0.0006 (-0.04)	-0.0007 (-0.05)	-0.0041 (-0.29)			0.0114 (0.73)	0.0187 (1.33)	0.0186 (1.33)	0.0186 (1.32)	0.0182 (1.26)
Interactions: Ai*Zi														
Normalized plot size*Formality Percentage				0.0000 ** (-2.14)			0.0000 ** (-2.07)				-359.44 *** (-8.39)			-901.05 (-0.07)
Normalized plot size*Government expenditures in justice and security					0.0000 ** (-2.17)		0.0000 (-0.79)					0.0042 *** (8.09)		-0.0942 (-0.15)
Normalized plot size*Formality Percentage*Government expenditures in justice and security						0.0000 ** (-2.14)	0.0000 (0.83)						0.0056 *** (8.05)	0.1175 (0.19)
Constant	-1.1550 (-0.99)	-1.6938 (-1.45)	-1.4273 (-1.19)	-2.7142 * (-1.88)	-3.2061 ** (-2.20)	-3.2256 ** (-2.21)	-2.3909 * (-1.61)	-3.04 * (-1.80)	-5.97 (-1.38)	-6.22 (-1.24)	-7.15 * (-1.63)	-7.15 * (-1.63)	-7.15 * (-1.63)	-4.33 ** (-2.36)
Number of Observations	305	305	305	228	228	228	228	218	218	218	218	218	218	218.0000
R-Square	0.4309	0.4472	0.4639	0.4926	0.4834	0.4835	0.4939	0.4052	0.4526	0.4625	0.4539	0.4539	0.4539	0.4544

Source: Author's calculations based on CEDE and IGAC databases

*** 1% significance, ** 5% significance, *10% significance

a. Departmental controls

Tables 4 and A3 show results for the case in which the intensity of the conflict is measured by the number of displaced individuals. The results in this case are very similar to those of total attacks, despite the fact that displacement is also a decision of the victims of the conflict. Results may be similar because when armed actors seek to establish their territorial hegemony they do so by means of direct threats towards the civil population. In the cases when they seek to reach the displacement of the victims, it may be more likely that they use direct attacks towards the population rather than great scale massacres. Within the group of variables that measure wealth, the following are significant: per capita transfers decrease the number of displaced individuals, as was explained for the total attacks; ICA collection per capita increases the intensity of the conflict measured by the number of displaced individuals because the economic incentives are greater, and lastly and surprisingly, the distance to the department's capital influences in a negative way the number of displaced individuals.

The significant variables in the group that measures state presence are the same as for the case of total attacks. Formality in property rights negatively affects the number of displaced individuals and in the estimation through Least Ordinary Squares when controlling for formality squared it is observed that formality shows a U shape, and per capita investment decreases the number of displaced individuals.

Regarding the social variables, both turned out to be significant: a greater number of organizations increase the cases of displacement, probably in response to the military strategy of insurgent groups of destroying social networks in order to consolidate their territorial power, and with a greater NBI index there are less cases of displacement. The NBI index is not only a measure of social problems at a municipal level, but of the level of poverty in municipality i as well. Greater NBI indexes are related to more precarious economic conditions in the municipality, which makes it less attractive for insurgent groups. Likewise, this result may be related to the migration cost implied by displacement: homes located in poorer municipalities may face greater migration costs, which imposes considerable obstacles in the displacement process. This interpretation deserves attention, given that only in the case in which violence intensity is measured by displacement the Unsatisfied Basic Needs Index results to be negative. The results suggest that the NBI may

be more of a determinant in the decision of homes in the migration process than armed actors when attacking a municipality.

Finally, as in the case of the attacks, significant interactions are the interaction between the size of the land lots and the expenditure in security and justice, and the interaction between size, formality and expenditure in security and justice, in both cases with a negative sign. State presence may therefore dissuade the conflict's intensity, despite the existence of economic resources attractive for armed groups. The results for the estimation of maximums do not differ from those of the estimation for averages and are shown in Annex A3.

Table 4. Estimations for the number of displaced individuals (Means)

Variable ^a	OLS							Instrumental Variable						
	Coefficient (t-statistic)							Coefficient (t-statistic)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formality Percentage	-238.33 *** (-2.92)	-237.73 *** (-2.89)	-19.1171 (-0.32)	-258.16 *** (-2.66)	-238.90 *** (-2.52)	-244.76 *** (-2.51)	-247.58 *** (-3.14)	-241.57 *** (-3.15)	-242.17 *** (-3.14)	-135.04 *** (-2.75)	-254.32 *** (-3.19)	-254.38 *** (-3.20)	-254.38 *** (-3.20)	-254.18 *** (-3.19)
Wealth: Xi														
Normalized plot size	73.45 ** (2.16)	74.25 ** (2.18)	31.44 * (1.73)	74.86 ** (2.27)	76.64 ** (2.37)	76.27 ** (2.38)	77.68 ** (2.36)	-42.72 (-1.28)	-55.19 * (-1.70)	-29.6640 (-1.46)	-2117.18 (-0.80)	12.07 (0.37)	28.09 (0.80)	1396.66 (0.25)
Per capita transfers	-0.2072 *** (-3.20)							-0.2126 *** (-3.09)						
Per capita ICA revenue	1.4060 (1.78)	1.6360 ** (1.97)	0.3893 (0.63)	1.3919 (1.39)	1.3263 (1.41)	1.3233 (1.41)	1.3815 (1.40)	1.6404 * (1.68)	1.8923 * (1.82)	0.4399 (0.60)	1.6270 * (1.62)	1.6289 * (1.62)	1.6289 * (1.62)	1.6382 * (1.62)
Distance from department's capital	-0.1873 (-2.64)	-0.1922 *** (-2.68)	-0.0572 (-1.25)	-0.2037 *** (-3.20)	-0.1946 *** (-3.12)	-0.1942 *** (-3.13)	-0.1972 *** (-3.13)	-0.2849 *** (-3.20)	-0.2904 *** (-3.23)	-0.1282 ** (-2.36)	-0.2386 *** (-3.00)	-0.2395 *** (-3.00)	-0.2395 *** (-3.00)	-0.2398 *** (-3.00)
Presence of Government: Zi														
Formality Percentage*Formality Percentage	85.13 *** (2.76)	84.36 *** (2.71)	8.5687 (0.38)	87.90 ** (2.44)	82.77 ** (2.34)	84.72 ** (2.33)	85.97 *** (2.83)							
Per capita Investment		-0.1602 *** (-2.86)	-0.0427 (-1.24)	-0.0983 ** (-1.96)	-0.0999 ** (-2.03)	-0.0984 ** (-2.01)	-0.1010 ** (-1.99)		-0.1654 *** (-2.81)	-0.0330 (-0.91)	-0.1422 *** (-2.67)	-0.1438 *** (-2.70)	-0.1440 *** (-2.70)	-0.1504 *** (-2.72)
Social Problems: Ci														
Number of organizations			0.1309 *** (5.03)							0.1216 *** (4.80)				
Unsatisfied Basic Needs			0.4678 (1.55)	-1.3427 *** (-2.64)	-1.3098 *** (-2.71)	-1.3093 *** (-2.69)	-1.3542 (-2.67)			-0.0289 (-0.08)	-1.1684 *** (-2.34)	-1.1681 ** (-2.34)	-1.1681 ** (-2.34)	-1.1624 ** (-2.33)
Interactions: Ai*Zi														
Normalized plot size*Formality Percentage				0.0000 (1.25)			0.0000 (-0.40)				2158.87 (0.79)			-712.70 (-0.12)
Normalized plot size*Government expenditures in justice and security					0.0000 ** (2.00)		0.0000 (-0.11)					-0.0527 *** (-3.13)		2.8083 (1.29)
Normalized plot size*Formality Percentage*Government expenditures in justice and security						0.0000 ** (2.05)	0.0000 (0.21)						-0.0745 *** (-3.06)	-3.8682 (-1.33)
Constant	231.25 *** (4.52)	227.27 *** (4.46)	25.74 (0.64)	318.66 *** (4.29)	326.42 *** (4.69)	329.98 *** (4.63)	341.63 *** (5.57)	291.69 *** (9.73)	285.68 *** (9.70)	260.65 ** (2.29)	678.25 *** (3.78)	678.64 *** (3.79)	678.68 *** (3.79)	678.81 *** (3.78)
Number of Observations	786	786	786	679	679	679	679	639	639	639	639	639	639	639
R-Square	0.2291	0.2274	0.5059	0.2778	0.293	0.2933	0.2938	0.1369	0.1347	0.4853	0.1359	0.1363	0.1363	0.1378

Source: Author's calculations based on CEDE and IGAC databases

*** 1% significance, ** 5% significance, *10% significance

a. Departmental controls

V. CONCLUSIONS

The explanation of the causes of the conflict has concentrated in the debate of the theories of the objective and subjective causes. However, trying to understand the logic of civil wars and of their participants using one of these theories may leave many questions unanswered. In the case of the Colombian conflict, it is not easy to determine the causes of the armed conflict given that establishing when it started is a problem in its own.

Understanding a civil war should not be limited to exploring the causes, but rather the factors that determine its persistence. The causes, the triggering effect and the persistence of the conflict depend on objective and subjective causes that are not necessarily the same (Goodhand, 2001). Therefore, it is important not to study them as isolated explanations, but rather understand the interaction as factors that affect the conflict episodes. Collier's work has concentrated on the subjective causes of the war and in the capacity of appropriating economic rents as an explanation to the conflict. Additionally, Collier does not separate the causes of the conflict from the factors that influence persistence. Appropriation of assets is a common characteristic of internal conflict: on the one hand, it is one of the triggers of the conflict given that the appropriation of resources generates incentives to pursue violent actions (Hirshleifer, 1995) and, on the other hand, it is one of the main strategies to increase financing for armed actors, and therefore is a determinant of the persistence of the conflict. Seeking to understand not only the causes, but also the factors that determine the persistence of the armed conflicts, asset appropriation must be analyzed from two points of view.

Asset appropriation, and especially land, has been a recurrent strategy in the Colombian conflict. The objective of this paper is to determine the relation between property rights over the land and violence episodes in Colombia, in order to prove if institutional weakness, measured by the informality of property rights, influences in a positive way the decision to attack armed groups and, therefore, the intensity of the armed conflict.

The results show that, although the variables of subjective causes are significant and may be an explanation for the persistence of the conflict, the state presence variables and especially the formality of property rights play a relevant role. The percentage of formality affects in a negative way the intensity of violence and when it is not controlled by an

instrumental variable shows a U shape: the intensity of the conflict (measured by total attacks and displacement) decreases when formality of property rights increases. However, there is a minimum point from which despite formality the intensity of the conflict increases. The legality over land lots makes a military strategy difficult for the armed actors and dissuades military attacks; thereby decreasing the intensity of the conflict. Notwithstanding, this relation depends on the military strategy of armed actors and of the objectives of the same. In the case of the massacres, where surely attacking a land lot in particular may not be an objective for armed actors, formality of property rights does not have a relevant role.

These results constitute an important contribution for public policy programs. State presence as is to be expected decreases the intensity of the conflict, however, it should not be limited to strengthening the military system. Institutions play an important role and in the Colombian case where land expropriation and territorial hegemony constitutes a military strategy of armed groups, well-defined property rights may appease the intensity of the conflict. The role of the State should not be limited to strengthening the military apparatus, it should also concentrate on defending the institutions, in the Colombian case especially adopt policies that establish and delimit private property. Seeking to strengthen property rights, it is necessary to carry out programs of allocation and title formalization of lands and strengthen the processes related to registry and cadastre. The institutions in charge of strengthening the title formalization of lands should broaden their presence and improve their operative capacity (Ibáñez and Moya, 2005).

Likewise, the results show that the characteristics of land lots influence the intensity of the conflict and are related to the percentage of formality. Larger land lots constitute a more attractive objective for armed actors and the descriptive statistics show that in said land lots there is less formality of property rights. Additionally, these land lots may constitute a more attractive objective because it is less expensive to confront only one owner of a large land lot, than many owners of smaller land lots. Public policy to improve the definition of property rights should therefore: favor the small owners that do not hold property titles but that work the land, and create incentives for large owners to register their land lots. The State should then start programs for the massive title formalization supporting with financial resources the small owners and creating incentives for the

participation of all the group of owners in the population. The high costs for the rural population are an obstacle that should be overcome in order to increase the coverage of title formalization of land (Ibáñez and Moya, 2005).

Economic rent appropriation is without a doubt one of the causes for the persistence of the conflict, but should not be considered independently from the political and social problematic behind the armed conflict. Land expropriation in Colombia is not a phenomenon independent from institutional weakness and from the definition of property rights. Analyzing the Colombian conflict taking into account the interaction between the military strategy of armed actors and the State's role, highlights the importance of the role played by the institutions, especially the definition of property rights at a rural level as a state policy to mitigate the conflict.

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ANNEX ECONOMETRIC RESULTS:

A1. Estimations for the total attacks of armed groups (Maximum)

Variable ^a	OLS							Instrumental Variable						
	Coefficient (t-statistic)							Coefficient (t-statistic)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formality Percentage	-12.63 ** (-1.91)	-12.34 * (-1.84)	4.4917 (0.87)	-18.28 ** (-2.07)	-17.56 ** (-2.08)	-18.03 ** (-2.08)	-15.08 ** (-2.36)	-22.17 ** (-2.37)	-22.61 ** (2.38)	-13.99 * (-1.68)	-23.16 ** (-2.43)	-23.18 ** (-2.43)	-23.18 ** (-2.43)	-23.14 * (-2.43)
Wealth: Xi														
Normalized plot size	4.66 *** (3.02)	4.58 *** (3.01)	1.2600 (1.33)	4.96 *** (2.99)	4.59 *** (3.14)	4.58 *** (3.15)	5.28 *** (3.07)	-7.8865 * (-1.64)	-9.3115 ** (-1.93)	-7.6915 ** (-1.99)	124.44 (0.26)	-5.1545 (-1.00)	-4.0243 (-0.75)	1138.2120 (1.12)
Per capita transfers	-0.0217 *** (-2.67)							-0.0275 *** (-2.93)						
Per capita ICA revenue	0.4295 (1.48)	0.4647 (1.54)	0.3701 (1.24)	0.4956 (1.33)	0.4698 (1.31)	0.4706 (1.32)	0.4906 (1.30)	0.4628 (1.38)	0.5109 (1.46)	0.4072 (1.18)	0.4992 (1.40)	0.4987 (1.40)	0.4987 (1.40)	0.5011 (1.40)
Distance from department's capital	-0.0102 (-1.52)	-0.0103 (-1.51)	-0.0002 (-0.03)	-0.0084 (-1.55)	-0.0064 (-1.10)	-0.0065 (-1.10)	-0.0075 (-1.41)	-0.0115 (-1.51)	-0.0119 (-1.55)	-0.0010 (-0.20)	-0.0095 (-1.44)	-0.0096 (-1.44)	-0.0096 (-1.44)	-0.0098 (-1.48)
Presence of Government: Zi														
Formality Percentage*Formality Percentage	4.92 ** (2.00)	4.79 ** (1.93)	-1.0558 (-0.54)	6.72 ** (2.09)	6.53 ** (2.10)	6.68 ** (2.10)	5.81 ** (2.40)							
Per capita Investment		-0.0233 ** (-2.15)	-0.0144 (-1.41)	-0.0258 * (-1.78)	-0.0246 * (-1.83)	-0.0246 * (-1.83)	-0.0264 ** (-1.82)		-0.0296 ** (-2.24)	-0.0201 * (-1.61)	-0.0287 ** (-2.11)	-0.0287 ** (-2.12)	-0.0287 ** (-2.12)	-0.0297 ** (-2.13)
Social Problems: Ci														
Number of organizations			0.0100 *** (5.03)							0.0094 *** (4.51)				
Unsatisfied Basic Needs			0.0397 (0.85)	-0.0758 * (-1.70)	-0.0584 (-1.21)	-0.0591 (-1.22)	-0.0736 * (-1.74)			0.0340 (0.95)	-0.0533 (-1.05)	-0.0536 (-1.06)	-0.0536 (-1.06)	-0.0523 (-1.02)
Interactions: Ai*Zi														
Normalized plot size*Formality Percentage				0.0000 (-0.21)			0.0000 (-0.87)				-138.76 (-0.28)			-1135.4690 (-1.06)
Normalized plot size*Government expenditures in justice and security					0.0000 ** (2.42)		0.0000 (0.35)					-0.0034 ** (-2.08)		0.1578 (0.79)
Normalized plot size*Formality Percentage*Government expenditures in justice and security						0.0000 ** (2.50)	0.0000 (-0.19)						-0.0049 ** (-2.09)	-0.2320 (-0.88)
Constant	16.70 *** (3.26)	16.88 *** (3.48)	1.2538 (0.23)	25.07 *** (2.94)	23.75 ** (2.49)	24.05 ** (2.49)	25.64 *** (4.14)	51.82 *** (19.08)	51.73 *** (18.67)	40.89 ** (2.35)	72.98 *** (3.57)	73.05 *** (3.57)	73.05 *** (3.57)	73.02 *** (3.57)
Number of Observations	786.00	786.00	786.00	679.00	679.00	679.00	679.00	639	639	639	639	639	639	639
R-Square	0.2495	0.2551	0.3928	0.3078	0.3181	0.3173	0.3255	0.2339	0.2412	0.4312	0.2395	0.2395	0.2395	0.2413

Source: Author's calculations based on CEDE and IGAC databases

*** 1% significance, ** 5% significance, *10% significance

a. Departmental controls

A2. Estimations for the massacre rate (Maximum)

Variable ^a	OLS							Instrumental Variable						
	Coefficient (t-statistic)							Coefficient (t-statistic)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formality Percentage	1.5199 (0.79)	2.2404 (0.95)	1.4972 (0.69)	0.2938 (0.14)	0.1042 (0.05)	0.1646 (0.08)	0.0167 (0.01)	1.3851 (0.32)	1.5296 (0.36)	1.9168 (0.40)	2.5432 (0.59)	2.5447 (0.59)	2.5439 (0.59)	2.5147 (0.57)
Wealth: Xi														
Normalized plot size	0.5577 (0.55)	0.3782 (0.38)	0.3958 (0.38)	0.8651 (0.91)	0.7656 (0.77)	0.7695 (0.78)	0.8644 (0.88)	-48.19 ** (-2.16)	-33.42 (-1.03)	-34.90 (-1.04)	278.21 *** (6.42)	-86.63 *** (-7.77)	-86.65 *** (-7.81)	1875.47 (0.14)
Per capita transfers	0.0438 *** (6.21)							0.0402 *** (4.69)						
Per capita ICA revenue	-0.0356 ** (-2.14)	-0.0818 *** (-3.23)	-0.0628 *** (-2.54)	-0.0572 ** (-2.35)	-0.0647 ** (-2.21)	-0.0644 ** (-2.20)	-0.0572 ** (-2.43)	-0.0306 * (-1.67)	-0.0795 *** (-2.56)	-0.0604 ** (-2.12)	-0.0642 ** (-2.16)	-0.0643 ** (-2.16)	-0.0643 ** (-2.16)	-0.0641 ** (-2.16)
Distance from department's capital	0.0006 (0.28)	0.0021 (1.01)	-0.0001 (-0.06)	0.0012 (0.53)	0.0016 (0.69)	0.0016 (0.68)	0.0013 (0.55)	0.0034 (1.08)	0.0044 (1.46)	0.0025 (0.74)	0.0032 (1.06)	0.0032 (1.06)	0.0032 (1.06)	0.0032 (1.08)
Presence of Government: Zi														
Formality Percentage*Formality Percentage	-0.5468 (-0.61)	-0.6718 (-0.64)	-0.4659 (-0.48)	0.0626 (0.07)	0.0081 (0.01)	-0.0108 (-0.01)	0.1722 (0.20)							
Per capita Investment		0.0389 *** (6.76)	0.0366 *** (6.21)	0.0411 *** (5.86)	0.0418 *** (5.94)	0.0417 *** (5.93)	0.0415 *** (5.68)		0.0422 *** (6.39)	0.0391 *** (5.32)	0.0392 *** (5.28)	0.0392 *** (5.28)	0.0392 *** (5.28)	0.0392 *** (5.26)
Social Problems: Ci														
Number of organizations			-0.0005 *** (-2.52)	-0.0005 *** (-2.54)	-0.0004 ** (-2.37)	-0.0004 ** (-2.42)	-0.0004 ** (-2.05)			-0.0003 (-1.12)				
Unsatisfied Basic Needs			0.0184 (1.28)	-0.0012 (-0.08)	0.0024 (0.16)	0.0023 (0.15)	-0.0014 (-0.09)			0.0231 (1.26)	0.0305 * (1.85)	0.0304 * (1.85)	0.0303 * (1.85)	0.0301 * (1.78)
Interactions: Ai*Zi														
Normalized plot size*Formality Percentage				0.0000 ** (-2.26)			0.0000 ** (-2.05)				-358.47 *** (-8.42)			-1928.2630 (-0.14)
Normalized plot size*Government expenditures in justice and security					0.0000 ** (-2.21)		0 (-0.46)					0.0042 *** (8.13)		-0.1305 (-0.21)
Normalized plot size*Formality Percentage*Government expenditures in justice and security						0.0000 ** (-2.20)	0 (0.48)						0.0056 *** (8.09)	0.1501 (0.23)
Constant	-0.2517 (-0.18)	-0.6638 (-0.45)	-0.4169 (-0.27)	-2.7334 * (-1.69)	-3.2913 ** (-2.03)	-3.3163 ** (-2.03)	-2.503 (-1.50)	-2.5592 (-1.55)	-4.1715 (-0.98)	-5.1786 (-1.05)	-6.1236 (-1.42)	-6.1194 (-1.42)	-6.1172 (-1.42)	-4.8030 *** (-2.48)
Number of Observations	305	305	305	228	228	228	228	218	218	218	218	218	218	218
R-Square	0.3934	0.3894	0.4046	0.4564	0.4468	0.447	0.457	0.3889	0.4249	0.4376	0.4339	0.4339	0.4339	0.4342

Source: Author's calculations based on CEDE and IGAC databases

*** 1% significance, ** 5% significance, *10% significance

a. Departmental controls

A3. Estimations for number of displaced individuals (Maximum)

Variable ^a	OLS							Instrumental Variable						
	Coefficient (t-statistic)							Coefficient (t-statistic)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Formality Percentage	-715.08 *** (-2.68)	-713.65 *** (-2.66)	16.2495 (0.07)	-707.17 ** (-2.37)	-645.12 ** (-2.21)	-663.79 ** (-2.21)	-663.87 *** (-2.68)	-834.38 *** (-2.92)	-835.73 *** (-2.92)	-479.66 *** (-2.50)	-874.94 *** (-2.97)	-875.07 *** (-2.97)	-875.09 *** (-2.97)	-874.52 *** (-2.96)
Wealth: Xi														
Normalized plot size	278.08 ** (2.21)	281.37 ** (2.23)	135.93 * (1.86)	284.19 ** (2.29)	290.44 ** (2.38)	289.30 ** (2.38)	120.98 ** (2.34)	-216.50 * (-1.62)	-262.30 ** (-2.05)	-178.78 ** (-2.10)	-8748.50 (-1.00)	-34.35 (-0.26)	19.65 (0.14)	-83.21 (0.00)
Per capita transfers	-0.7211 *** (-3.16)							-0.7741 *** (-3.10)						
Per capita ICA revenue	4.26112 * (1.63)	5.0284 * (1.84)	1.0451 (0.50)	4.5265 (1.37)	4.3413 (1.39)	4.3349 (1.39)	4.4753 (1.37)	5.2834 * (1.63)	6.1641 * (1.78)	1.3763 (0.55)	5.3058 (1.58)	5.3152 (1.58)	5.3154 (1.58)	5.3384 (1.58)
Distance from department's capital	-0.5853 ** (-2.23)	-0.6035 ** (-2.27)	-0.1798 (-0.97)	-0.6199 *** (-2.53)	-0.5923 *** (-2.46)	-0.5915 (-2.46)	-0.5987 *** (-2.45)	-0.9114 *** (-2.72)	-0.9320 *** (-2.76)	-0.3993 * (-1.74)	-0.7652 *** (-2.54)	-0.7683 *** (-2.54)	-0.7684 *** (-2.54)	-0.7686 *** (-2.54)
Presence of Government: Zi														
Formality Percentage*Formality Percentage	254.15 *** (2.53)	251.62 ** (2.49)	-1.9530 (-0.02)	237.60 ** (2.14)	221.06 ** (2.01)	227.29 ** (2.01)	228.06 ** (2.36)							
Per capita Investment		-0.5381 *** (-2.78)	-0.1610 (-1.24)	-0.3493 ** (-1.96)	-0.3558 ** (-2.02)	-0.3512 ** (-2.00)	-0.3591 ** (-1.98)		-0.5828 *** (-2.80)	-0.1461 (-1.07)	-0.5071 *** (-2.67)	-0.5135 *** (-2.70)	-0.5140 *** (-2.70)	-0.5323 *** (-2.71)
Social Problems: Ci														
Number of organizations			0.4331 *** (4.21)							0.4029 *** (3.93)				
Unsatisfied Basic Needs			2.0152 (1.56)	-4.5381 ** (-2.48)	-4.4500 *** (-2.55)	-4.4503 *** (-2.54)	-4.5571 *** (-2.49)			0.0131 (0.01)	-3.7646 ** (-2.08)	-3.7615 (-2.08)	-3.7616 ** (-2.08)	-3.7469 ** (-2.07)
Interactions: Ai*Zi														
Normalized plot size*Formality Percentage				0.0000 (1.45)			0.0000 (-0.32)				8874.59 (0.98)			2411.72 (0.12)
Normalized plot size*Government expenditures in justice and security					0.0000 *** (2.71)		0.0000 (-0.05)					-0.1804 *** (-3.03)		9.3240 (1.45)
Normalized plot size*Formality Percentage*Government expenditures in justice and security						0.0000 *** (2.78)	0.0000 (0.16)						-0.2540 *** (-3.00)	-12.7896 (-1.48)
Constant	774.99 *** (4.55)	759.35 *** (-4.47)	72.8277 (0.46)	1406.81 *** (5.95)	1433.60 *** (6.41)	1445.02 *** (6.32)	1468.95 *** (7.26)	1128.32 *** (10.17)	1104.81 *** (810.11)	927.76 ** (2.04)	2311.64 *** (3.50)	2312.74 *** (3.50)	2312.87 *** (3.50)	2313.44 *** (3.50)
Number of Observations	786	786	786	679	679	679	679	639	639	639	639	639	639	639
R-Square	0.2195	0.2176	0.4205	0.2673	0.2777	0.2778	0.2780	0.1331	0.1308	0.4020	0.1306	0.1309	0.1309	0.1320

Source: Author's calculations based on CEDE and IGAC databases

*** 1% significance, ** 5% significance, *10% significance

a. Departmental controls

A4. Correlation Matrix

	# of organizations	Appraisal of land plots	Land plot size	Normalized plot size	Area of illegal crops	Per capita Transfers	ICA Revenue	Distance from department's capital	Formality percentage	Per capita investment	Government expenditure in justice and security	Unsatisfied Basic Needs	Standard deviation land plot size
# of organizations	1												
Appraisal of land plots	0.2447	1											
Land plot size	0.0596	0.0428	1										
Normalized plot size	0.0004	-0.0197	-0.0061	1									
Area of illegal crops	0.0188	-0.0244	0.1548	-0.0047	1								
Per capita Transfers	-0.2277	-0.1866	-0.0309	0.0073	-0.041	1							
ICA Revenue	0.1678	0.2964	-0.005	-0.0148	-0.0178	0.0361	1						
Distance from department's capital	-0.1594	-0.19	-0.0297	0.0037	0.0099	0.0491	-0.0995	1					
Formality percentage	-0.161	-0.0284	0.4796	-0.006	-0.1065	0.067	-0.0488	-0.0218	1				
Per capita investment	-0.1714	-0.087	-0.0329	-0.0105	-0.0447	0.8975	0.2419	0.0045	0.0422	1			
Government expenditure in justice and security	0.7037	0.1987	0.0075	-0.0058	-0.0159	-0.1114	0.2503	-0.1537	-0.1549	-0.0488	1		
Unsatisfied Basic Needs	-0.0686	-0.2679	0.2041	0.0578	0.1851	0.0546	-0.2335	0.2332	0.0417	-0.029	-0.1744	1	
Standard deviation land plot size	0.0776	0.0226	0.2647	-0.0043	0.4966	-0.0207	-0.0024	-0.0591	0.0343	-0.0231	0.0178	0.121	1

Source: Author's calculations with CEDE and IGAC databases

