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Causes of Civil War: Micro Level Evidence from Côte d'Ivoire

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Abstract: A multiethnic country like Côte d'Ivoire, which was relatively stable until the late 1980s, has been mired in crisis in the last two decades and experienced large-scale violence. This paper undertakes a disaggregated analysis of the civil war at sub-national levels in Cote d'Ivoire for the period from 1998 to 2006 using: (1) nationally representative household survey data, and (2) the ACLED conflict database that contains information on the date and geographical location of conflicts. We use both the department and the sub-prefecture levels as units of analysis, and find robust evidence that ethnic diversity is significantly associated with conflicts. We also find strong empirical evidence that the share of *Ivoirites* population and the share of Muslim population is a significant determinant of civil war at the sub-prefecture level. Furthermore, more populous areas are at high risk of civil war, but the outcome is statistically significant only at the department level. However, we do not find significant evidence that income inequality and land inequality have determined the level of civil conflict. Overall the findings suggest ethnicity and religious identities are the significant determinants of civil war in Cote d'Ivoire.

Key words: Civil war; Disaggregated data; Ethnicity; GIS; Cote d'Ivoire

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I. Introduction

Why do civil wars occur at all when, given the high costs of war, groups have every incentive to reach a peaceful agreement? A vast body of interdisciplinary research shows that – among other factors - the outbreak of civil war is commonly attributed to poverty, inequality and ethnic fractionalization[i]. While many studies have provided empirical support at the cross-country level, it has been increasingly acknowledged that the intensity of such factors varies geographically within a country[ii]. This necessitates further research at the sub-national level to discover the causes of civil war. In this paper we perform a disaggregated analysis of civil war at sub-national levels in Cote d'Ivoire. More specifically, this paper examines the determinants of civil war incidents at the local level in Cote d'Ivoire for the period from 1998 to 2006 using: (1) households survey data, and (2) precise information on the date, geographic location and intensity of the conflict events.

After two decades of successful economic development since its independence in 1960, Côte d'Ivoire became mired in a crisis in the past two decades. The current difficulties have lasted much longer than expected and the consequences for the population's welfare have been tragic. Between 1985 and 2008, the percentage of people who lived below the poverty line increased from around 10 percent to 45 percent. A combination of economic shocks and lack of competitiveness, from the early 1980s and into the mid-1990s were primarily responsible for the observed decline. The pain about brought by the structural problems was compounded in recent years by a series of political and social crises. The first sign of trouble began with the failure to manage the political transition following the death of President Houphouet Boigny. This led to an attempted coup in 1999. An armed rebellion in 2002 split the nation in two which left

thousands of people dead. Since then, peace deals have alternated with renewed violence as the country slowly edged its way towards a political resolution of the conflict.

The question why a multiethnic country as Côte d'Ivoire which has been relatively stable for decades experienced wide-scale violence along ethnic lines is an important topic deserving of research. Scholars from various disciplines have focused on many factors and proposed different conflict narratives. To cite a few, Maclean (2004) argues that the lack of local level ethnic cooperation and characteristics of local voluntary organizations stunted the development of democratic values and practices which only prolonged the misery of political exclusion and intensified social strife. In another paper, Woods (2003) postulates that Côte d'Ivoire's property rights regime and cycle of conflicts over the ownership of land led to the ethno-regional division and civil war. More recently, Nordas (2007) argues that even though civil war in Côte d'Ivoire did not feature many of the characteristics of a religious war, religious polarization was nonetheless transmitted into identity polarization and this became politically important. This, according to Nordas (2007), made civil war inevitable due to the religious fault lines.

A large body of cross-disciplinary studies brings to light the factors and the trajectories through which Côte d'Ivoire slid into the pernicious cycles of civil war. However, empirical studies are lacking at the local level regarding our ability to systematically understand these scattered but influential narratives. In general the literature on local level studies of civil war is challenged by a number of factors. First, mapping the disaggregated conflict data to household characteristics and socio-economic welfare indicators at the local level has made it difficult to conduct an empirical exercise at the sub-national level. Second, there is lack of robust evidence on the determinants of civil war at various sub-national levels within a country. Many studies have used smaller geographical regions or artificial geographical grid-cells (without reference to

any meaningful sub-national border) as the unit of analysis. However, little is known about the extent to which one should disaggregate the studies on civil war.

In this study, we make an attempt to overcome these shortcomings. We use two data sources to map the conflict outcomes to a range bridge this knowledge gap. The data on local incidences of civil war in Cote d'Ivoire is taken from the Armed Conflict Location and Event Database (ACLED) for the period 1997 to 2008. A wide range of variables including household characteristics, demographic and socio-economic information are constructed from two rounds (1998 and 2002) of the Enquete sur le Niveau de Vie de Menage (ENV) survey data administered in Cote d'Ivoire. The rich disaggregated information at the household level allows us to examine the determinants of civil war in Cote d'Ivoire at various sub-national levels. We use both the department and sub-prefecture levels as units of analysis and compare the empirical outcomes. This provides robustness to the empirical findings at various sub-national levels.

Using various indicators of inequality and polarization constructed at the sub-national level, we find robust evidence that ethnic diversity is significantly associated with conflicts. Poverty is widespread but is more profound in the north west of the country where the Muslim population is more concentrated, while the southern region is dominated by relatively wealthy Christians. However, we do not find significant evidence of income or land inequality as a cause of civil conflict. The qualitative evidence suggests that ethnic fractionalization has deepened the religious polarization over time, and this factor along with the concept of *Ivoirites* made the civil war unavoidable in Cote d'Ivoire. We find strong empirical evidence supporting this view at the sub-prefecture level. Both the share of *Ivoirites* population and the share of Muslim population are significant determinants of civil war at the sub-prefecture level. Furthermore, more populous areas are at a high risk of civil war, but the outcome is statistically significant only at the

department level. Overall the findings suggest ethnicity and religious identities are the significant determinants of civil war in Cote d'Ivoire.

This study is structured as follows. In the next section we provide brief discussions of the determinants of civil war. This section is followed by a brief description of the civil war in Côte d'Ivoire. In section IV, we discuss data and provide some descriptive evidence. Section V explains the empirical models we propose and the main findings. This is followed by concluding remarks.

II. Determinants of Civil War: A Brief Survey

The literature on the connection between conflict, poverty and inequality has investigated the reasons why they occur in countries experiencing conflict or have a history of conflict. According to the *Human Development Report (HDR) 2005*, "Nine of 18 countries whose HDI declined in the 1990s experienced conflict in the same period. Per capita incomes and life expectancy fell in virtually all of these countries". A number of studies have shown that conflict can deepen poverty and inequality (Collier, 1999; Collier et al., 2003; Collier, Hoeffler and Söderbom, 2004; Collier and Hoeffler, 1998, 2004; Do and Iyer, 2007; Doyle and Sambanis, 2006; Elbadawi and Sambanis, 2000, 2002; Fearon, 2004; Fearon and Laitin, 2003; Hegre and Sambanis, 2006; Murshed and Gates, 2005; Stewart and Fitzgerald, 2001; World Bank, 2005). Economic stagnation and conflicts interact in several ways: economic and political factors contribute to war, while war has an adverse effect on economic growth and political development. Here, we review studies that focus on the causes of civil unrest in developing countries.

Income inequality and polarization

Income inequality has been deemed one of the main factors that cause civil conflicts. However, the impact of income inequality on conflict has remained ambiguous, primarily due to lack of credible empirical findings. One of the reasons for the lack of strong empirical support for the role of economic inequality on conflict is mainly due to lack of clear-cut definition, measurement strategy and indicator. Such differences fundamentally depend on the underlying properties of inequality measures. Several studies considered income distribution or landownership to assess the role of inequality in civil conflicts. Addressing the issue of rural conflict, Binswangeer et al. (1995) relate its causes to disproportionate land distribution. Economic and social dislocation due to unequal land distribution in El Salvador and Mozambique, and the 1970s revolution in Ethiopia – to name just a few countries - support the notion that extreme disparity in land (and property) ownership could cause civil unrest. Nonetheless, other researchers contend this argument by noting that 'maldistribution of land' is not the cause of civil conflicts, it is only a symptom of a larger problem, which is national income inequality (see Muller and Seligson, 1987).

Using a multivariate model of determinants of conflicts, Muller and Seligson (1987) found that national income inequality has a significant causal effect on conflicts, while land inequality has an indirect impact on conflict through its effect on national income distribution (inequality). These findings are corroborated by other studies that suggest income inequality triggers conflicts. Looking at a sample of 71 developing countries, Alesina and Perotti (1996) find that income inequality, as shown by the presence of a wealthy middle class[iii], increases civil unrest and political instability. On the other hand, Collier and Hoeffler (1998) and Collier (2000)

find that income inequality is not a factor that causes conflict. Using per capita income as a proxy they find that there is weak correlation between income distribution and civil conflicts. However, the use of per capita income as a measure of income inequality is clearly questionable. Gurr (2000) examined the link between ethnicity and economic circumstances. The study weighs the extent to which individuals have been systematically excluded from accessing essential or desirable goods and services. Regardless of the nature of such disparities, that is, whether it is based on discrimination or not, inequality in access to economic opportunities and benefits can provoke conflicts between ethnic groups.

Ethnic fractionalization and polarization

More recent studies on conflicts have shifted their focus from income distribution to ethnic diversity as a key causal factor. The basic premise of this approach is that the higher the number of ethnic groups the higher ethnic fractionalization will be in a given society. Ethnic polarization, on the other hand, increases when there are few large groups with homogenous features within each group and differences in a cluster of characteristics between groups. In their seminal study, William Easterly and Ross Levine (1997) developed an index of ethnic fractionalization that was used to analyze the role of ethnic diversity in how well African nations performed economically. The index captures the likelihood that two people chosen at random will be from different ethnic groups. Their findings indicate that ethnic diversity has a statistically and economically significant negative impact on economic growth in Africa. More specifically, they found that moving away from a homogenous country to one with an ethnically diverse society caused economic growth to fall by more than 2 percent per year. These finding were widely acknowledged and the indices of ethnic diversity have been used in a number of studies (see for

example, Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg 2003; Collier and Gunning, 1999; Collier and Hoeffler, 2004; Edward Miguel, Shanker Satyanath and Ernest Sergenti, 2004; Easterly, 2002; Englebert, 2000; Hall and Jones, 1999; Fearon and Laitin, 2003, Brock and Durlauf, 2001; Rodrik, 1999). All these studies use the index of ethnolinguistic fractionalization (ELF), which is calculated using the data of the Atlas Narodov Mira (Taylor and Hudson, 1972).

A number of researchers have introduced alternative indices in recent decades but their basic difference lies in the index of fractionalization. Using structural distance between languages, Fearon (2003) developed an index of cultural fractionalization. This index captures the cultural distance between groups in a country. Citing the weaknesses of ELF, its individualist interaction topologies and failing to articulate explicit causal mechanisms, Cederman and Girardin (2007) introduced an index of ethnonationalist exclusiveness, which is a star-like configuration of ethnic groups that rejects the symmetric interaction topology implied by the index of fractionalization. The main argument behind the index is that specific ethnonationalists' configurations are more prone to generate violence in civil wars. Based on two assumptions – the state is at the center of nationalist conflict and conflicts occur between groups not individuals - Cederman and Girardin (2007) developed the index N* which maps ethnic configurations onto political violence and centered around the ruling ethnic group.

Desmet, Ortuño-Ortin and Wacziarg (2009) propose a different method to measure ethno-linguistic diversity and provide new results linking such diversity with a range of political economy outcomes -- civil conflict, redistribution, economic growth and the provision of public goods. While most researchers conclude that ethnic diversity is significantly associated with conflicts, Collier and Hoeffler (2004) find that ethnic heterogeneity has no effect on the risk of a civil war. Collier et al. (2004), using the piecewise exponential duration model, find that income inequality and population have a positive effect on civil wars, while ethnic fractionalization have a

non-linear influence on the incidence of conflict since its squared-term is also significant. Their findings were also corroborated by Fearon and Laitin (2004). Randall Blimes (2006) finds that "ethnic fractionalization" has a significant and positive "indirect" effect on the probability of a civil war starting. He observes that "ethnic composition itself is not a cause of civil conflict but rather increases the likelihood that other variables that can increase the likelihood of civil war onset will have an effect."

Ethnic polarization is one important dimension of conflict, and a number of studies integrate polarization while assessing the link between inequality and civil conflict. Unlike vertical inequality, which focuses on the overall income distribution between individuals, polarization entails grouping in the distribution. The magnitude of polarization increases when two or more large groups have homogenous features within each group but differences between them emerge. Esteban and Ray (1994) introduced the concept of economic polarization, a concept associated with unique characteristics that groups of people feel against each other, and this distinctiveness is supported by within-group cohesion and identity. The main theme of their argument is that the current inequality measures only focus on interpersonal alienation and overlook important facets of group identity. In their subsequent study, Esteban and Ray (2005) focus on ethnicity and religion rather than income status as the alienating characteristics of groups in conflict.

Furthermore, while economic or social class might be an important factor for intergroup conflicts, it might not be the relevant factor that defines group identity (Stewart, 2000). Ethnicity has appeared to be a key factor that has caused conflicts in many countries, as it is essentially characterized by common language, race and religion. Montalvo and Reynal-Querol (2005) incorporated ethnic polarization in their analysis of the incidence of civil wars, and they find that ethnic polarization is a very robust determinant of their incidence. Their findings also show that

neither primary exports nor democracy nor ethnic fractionalization had any significant effect on the incidence of civil wars. While many civil conflicts do have an ethnic dimension (Murshed and Gates, 2005), empirical findings to date are inconclusive regarding different forms of ethnicity and civil conflicts (Ellingsen, 2000; Fearon and Laitin, 2003; Montalvo and Reynal-Querol, 2005).

Micro-level studies

Most of the empirical analyses on economic inequity and conflicts consider macro-level approach, using aggregate variables like per capita income and Gini coefficient against national conflicts. Although it seems that the link between income inequality and conflicts is intuitively permissible, the empirical results have been inconclusive. There has been little research done on the link between micro-level economic factors and civil conflicts. Stewart (2000) developed an important theoretical framework in his analysis of civil conflict in Uganda, noting that micro-level horizontal inequalities have a more important effect on conflict than macro-level vertical inequalities. Stewart's analysis 'starts from the premise that crisis prevention is essential for poverty reduction as well as to alleviate immediate human suffering; and that policies aimed at reducing political violence.' This method essentially invalidates macro-level approaches. Aggregate inequality measures do not capture the actual inequality dynamics as they only represent inequalities - either inter- or intra-group differences. The results also confirm that such horizontal inequality measures are key determinants of civil conflicts in Uganda. Using data for 1959-1991, the results show that the politically dominant North perpetrated violence on the economically dominant South.

Wayne Nafziger and Juha Auvinen (2003) adopt a similar approach and find that horizontal inequity has indeed caused conflict in Nigeria, Pakistan, South Africa and Mexico. Their results show that the magnitude of political conflicts increases with a surge of income inequalities by region, class and community ethnic. Applying a different theoretical framework from Stewart, Deininger (2003), examined the causes of conflict at the micro-level in Uganda for the period 1992-1999. The main premise of his argument is that conflict will decrease as the opportunity cost for an individual of joining a rebellion becomes more expensive and that resource concentration will increase conflict. Addressing the shortcomings of macro-level studies to distinguish country-level fixed effects, Deininger (2003) developed a model that captures the variation in levels of civil conflicts across communities in Uganda. The results show that greed factors (for example resources) escalates the probability of civil conflicts, as in the case where there is poor access to education, infrastructure and asset holdings. Higher physical attacks are also associated with levels of education and wealth inequality. The results appear to suggest that inequity becomes a more important factor as the conflict becomes more localized. One important dimension of conflict that appears to be overlooked in Deininger's analysis is a discussion on horizontal inequality. In countries like Uganda, ethnic and cultural dynamics are very important factors for socio-economic as well as political activities.

III. The Ivoirian Civil War

In this section we provide a brief account of the Ivoirian civil war. To gain a better understanding of the socio-political attributes that are deeply rooted in Ivoirian society and the rollercoaster performance of the Ivoirian economy, we go back to 1960, when Félix Houphouët-Boigny became the first president after Côte d'Ivoire gained independence. Under his rule, Côte d'Ivoire

became one of the greatest success stories of sub-Saharan Africa with an annual average growth rate of over 7 percent throughout the 1960s and 1970s. Many factors were behind this miracle, such as sound economic management, close trade relationships with the Western world, effective development of the cocoa and coffee industries but more importantly the establishment of ethnic quotas in the political system which helped prevent exclusion of any sort. However, the worldwide recession and volatility in cocoa and coffee prices prompted Côte d'Ivoire to sign up for the structural adjustment programs offered by the World Bank and the International Monetary Fund. It only made the situation worse in leading the Ivorian economy to a prolonged economic crisis.

Economic stagnation along with the declining state-run welfare system and rising unemployment gradually created political opposition, which finally led to a multi-party election for the first time in 1990. The incumbent president, Félix Houphouët-Boigny, won the election by a significant margin defeating his closest opponent Laurent Gbagbo from the *Front Populaire Ivorien* (FPI) party. He died in 1993 and Henri Conan Bedie from the same political party *Parti Democratique de la Côte d'Ivoire* (PDCI) succeeded him, thus ending the power struggle against Alassane Ouattara. Following a split in the PDCI, Ouattara formed a new political party known as the *Reasemblement des Republicans* (RDR). Bedie remained in power until 1999 when he was overthrown by a military coup led by General Guei.

[Figure 3.1 is about here]

Throughout the 1990s, the concept of *Ivoirite* became the major political discourse. The ethnic and eventually the religious cards were frequently used by all the major political parties to

gain greater political voice. Against the background of a prolonged economic crisis, migrants and settlers from other countries were made the scapegoat for the decline in Ivoirian economic performance. The ongoing crisis was envisioned as an outcome of the liberal pro-migration policies and liberal landownership rights which had been practiced for decades. In 1994, the concept of Ivoirite was institutionalized, as the new Electoral Code restricted the right to vote to Ivorian nationals and all presidential candidates should have complete Ivoirian parenthood. Both Gbagbo and Bedie embraced this concept to gain political advantage but more importantly to prevent Ouatarra from contesting the election since his father was from Burkina Faso. As a result in 1995 Outarra was barred from running for president. Moreover, in 1998, Bedie introduced a new Land Code which allowed only Ivoirians to buy land. It also prevented non-Ivoirites or immigrants from settling in the southern part of the country. Consequently immigrant landowners in the south became more vulnerable to forceful land-grabbing. Meanwhile, Ouatarra and his RDR supporters attempted to create an ethnicized support base in the North. The fact that Ouatarra was from the North and a Muslim helped this process and the religious fault line between the Muslim dominated north and the Christian dominated south became more prominent over time (Figure 3.2)

[Figure 3.2 is about here]

In 2000, Laurent Gbagbo from the FPI party became the Ivoirian president after defeating General Guei by a considerable margin. He was from the Baoule ethnic group and the 'baoulisation' of the political system under Laurent Gbagbo's presidency marked a significant departure from Félix Houphouët-Boigny's thirty years-long policy of ethnic quotas. Northern

ethnic groups, predominantly Mande and Krou among others, experienced growing political exclusion which only exacerbated the social strife that already existed since the early 1990s. In 2002, Gbagbo decided to demobilize the northern troops who had been recruited under the presidency of Robert Guei. Amidst growing social tensions and economic stagnation, this proved to be the catalyst in turning social strife into a full blown civil war.

The first round of armed conflict started in September, 2002 but lasted for only a few months. The national army (FANCI) was joined by the Young Patriots, a youth militia that supported President Gbagbo. On the other side, a few small rebel groups like the *Movement for Justice and Peace* (MJP), the *Movement of the Ivory Coast of the Great West* (MPIGO) and supporters of Outarra joined together under the banner *Forces Nouvelles* (FN) led by Guillame Soro. The first peace agreement between the two opposing forces, The Linas-Marcoussis, was signed in January 2003. The *Forces Nouvelles* took charge of the Ministry of Defense and the Ministry for the Interior. Around the same time French troops and the UN peace-keeping force formed a narrow 'peace belt', which constituted a line of control near the religious fault line (see Figure 3.2). Since then a number of peace agreements had been signed between President Gbagbo and opposition forces, but the tension remained until 2007, when Guillame Soro became Prime Minister under Gbagbo. Both sides agreed to a free and fair general election to be held in 2008.

The long-anticipated presidential election was held towards the end of 2010, after having been postponed six times. The presidential contest morphed into a political stalemate with the deadly power struggle between the renegade incumbent Laurent Gbagbo - who refused to relinquish power despite losing the election and Alassane Ouattara - who was finally given the

chance to stand in the election in 2011 and was declared the winner by the Electoral Commission. Despite growing international pressure, Gbagbo refused to leave the office which again initiated fresh spells of violence and Côte d'Ivoire remained at the brink of another deadly civil war. When world leaders interfered, Gbagbo was finally forced to stand down in April 2011 and since then Ouattara has been president of Côte d'Ivoire.

[Figure 3.3 is about here]

There were many factors associated with the Ivorian civil war. From the rivalry of political elites to the fragile land tenure system near the cocoa belt, politicization of ethnicity to the creation of religious fault lines – all deserve attention to disentangle the causes of the Ivorian civil war. Before we turn to a systematic empirical analysis, this section provides some anecdotal evidence. Figure 3.3 depicts the Christian and Muslim populations' distribution from 1998 to 2008 according to departments. The darker shades indicate a higher population share. As Figure 3.3 makes clear, the Muslim population gradually became more concentrated in the northern part of the country, while Christians increasingly dominated the south. Over time, between the 1990s and late 2000sa huge concentration of Muslims in the north west of the country resulted from their migration from the south; conversely, Christians fled the north for the south. We also note that while there are still considerable numbers of Muslims in the south, the Christian population in the north has declined over the years.

[Figure 3.4 is about here]

We examine the ethnic and religious diversity in greater detail in the subsequent sections, but the above evidence suggests that over time the religious fault line was basically characterized by a Muslim North and Christian South. However, poverty is widespread and this is evident from Figure 3.4. In 1998, poverty was more profound in the north west of the country, coincidentally in the Muslim dominated region. This may be explained by the wealthy cocoa and coffee farmers who are located in the south, while the north happens to be Muslim dominated primarily because neighboring countries adjacent to the north are also Muslim dominated, like Burkina Faso, Liberia, etc. However, in recent years the poverty rate has increased in the war-torn region, particularly the mid-west of the country and the south has also experienced higher poverty rate in recent years compared to the late 1990s. Together these problems amount to a significant welfare loss for Ivoirians.

IV. Data and Descriptive Evidence

This study analyzes the causes of the civil conflict in Cote d'Ivoire over a period of 10 years - 1998 to 2008. The data on local incidences of civil war is taken from the Armed Conflict Location and Event Database (ACLED) for the period 1997 to 2008. To match with the conflict outcomes, the potential causal factors are constructed based on the Enquete sur le Niveau de Vie de Menage (ENV) survey data administered in Cote d'Ivoire. We use three rounds of nationally represented ENV data - 1998, 2002 and 2008. In this section, we describe both data sets and provide some descriptive statistics as anecdotal evidence.

Incidences of Conflict

[Figure 4.1 is about here]

The Armed Conflict Location and Event Database[iv] (ACLED) (Raleigh, Hegre, and Carlson, 2009) compiles exact locations, dates, and additional characteristics of individual battle events in states affected by civil war. The conflict data for Cote d'Ivoire is available for the period from 1997 to 2010. It tracks rebel activity and distinguishes between territorial transfers of military control from governments to rebel groups and vice versa. The conflict events are disaggregated into six categories: (i) Battle - government regains territory, (ii) Battle - no change of territory, (iii) Battles - rebels overtake territory, (iv) Non-violent activity by a conflict actor, (v) riots/protests, and (vi) Violence against civilians. In Figure 4.1, we show the total number of reported conflicts according to year. In our study period, the frequency of conflict events follows a twin-peaked distribution. The first peak is around 1999-2000 and the second peak is between 2002 and 2006, when the conflict was at its most violent. The ACLED database on Cote d'Ivoire reports a total number of 965 armed conflict events for the period 1998 to 2008.

[Figure 4.2 is about here]

To decipher the causes of civil war at the local level, many studies have used smaller geographical regions or artificial geographic grid-cells (without pertaining to any meaningful sub-national border) as the unit of analysis. Some researchers prefer to follow the grid-cell approach because the unit of analysis does not change spatially (Buhaug and Rod, 2006). In comparison, when the unit of analysis is the sub-national regions, they are likely to vary in terms

of area. However, the grid-cell approach is more appropriate in cases where the explanatory variables are mostly related to geography. We have detailed information available at the household level, which offers more choices and flexibility to construct a range of explanatory variables at various sub-national levels. In this study, we use both departments and sub-prefectures as a unit of analysis.

[Figure 4.3 is about here]

As per the 1998 Census, Cote d'Ivoire is divided into 185 sub-prefectures. ACLED provides the exact locations of the civil war events. Based on the data on latitude and longitude, we map these conflict events into 185 sub-prefectures using spatial coordinates taken from the DIVA-GIS[v] website. In Figures 4.2 and 4.3, we plot the total number of events at the department sub-prefecture level for two periods: from 1998 to 2002 and from 2003 to 2008, respectively. In both figures, the regions marked with darker shading refer to a higher frequency of war events. This allows us to compare the intensity of conflict incidence across sub-national jurisdictions (departments and sub-prefectures). Figures 4.2 and 4.3 also compare the conflict events maps directly taken from the ACLED website[vi] and the map that we generated at both department and sub-prefecture level. A quick glance of these graphs indicates that the incidences of civil conflict have been more frequent in the western and southern parts of Core d'Ivoire and in the neighborhood Abidjan. In 2003, the number of armed conflict events escalated to more than 150. These events are recorded at a large number near the Line of Control administered by the UN and the French troops.

[Table 4.1 is about here]

In Table 4.1 we depict the descriptive statistics concerning conflict counts at the department (N=50) and sub-prefecture level (N=185). At both levels the average conflict counts were higher in the period 1999-02 compared to 2003-06. The average number of conflict events per department stood at 9.16 and 8.58 in the periods 1999-02 and 2003-06, respectively. Similarly, the average number of conflict events per sub-prefecture was recorded at 2.25 and 2.14 in the periods 1999-02 and 2003-06, respectively. However, the conflict incidences were more scattered during the period 2002-06.

Ethnic Diversity

Cote d'Ivoire has a rich history of detailed household surveys dating back to 1985. To match with the conflict events, we use household survey data from the 1998, 2002 and 2008 rounds of the Enquete sur le Niveau de Vie de Menage (ENV). The sample size varied from 4200 households in 1998 to 10800 households in 2002 and 12600 households in 2008. These surveys were designed to collect information on household composition and demographic characteristics, education, consumption expenditures, socio-economics status, occupation and assets. In order to evaluate the consequences of the civil war, a new section was added in the 2008 questionnaire.

[Table 4.2 is about here]

In Table 4.2, we show the distribution of ethnic groups over the period 1998 to 2008. We construct the variable Ivoirite by adding up the five major ethnic groups Akan, Krou, Mande

North, Mande South and Voltaic. The Ivoirite population share recorded around 82 percent of the total population in Core d'Ivoire. Of the rest, about 8 percent of the total population comes from Burkina Faso and the remainder are from neighboring countries including Ghana, Sierra Leone and Liberia. As evident from Table 4.1, the ethnic population shares did not change over time significantly. A few exceptions include a drop in the share of the Mande north group from 18 percent in 1998 to around 13 percent in 2002. Likewise, the share of the Voltaic group increased from 9 percent in 1998 to almost 14 percent in the next 10 years. Below, we show the distribution of some key economic factors across the ethnic groups.

[Figure 4.4 is about here]

To find the extent of diversity in major ethnic groups, we combine the five major ethnic tribes into one group and call them *Ivoirite*. For the sake of comparison, we call the immigrants from the neighboring countries *Others*. To obtain a better picture of the grievances across these broad social groups, we look at some of the key economic outcomes. While the average poverty rates are found to be lower for the *Ivoirite* population by almost 5 and 10 percentage points in 1998 and 2002 respectively, the poverty rates were virtually the same by 2008.

[Figure 4.5 is about here]

Next, we look at the distribution of land. Cote d'Ivoire is primarily an agrarian economy, where agriculture provides a living for more than 60 percent of the population. The contemporary history of land reforms in Cote d'Ivoire indicates that land ownership has been a

contentious issue among different social groups. Based on the available information, we find a persistent gap in the landownership in favor of the *Ivoirite* throughout the period of study. The gap in average land owners narrowed down over time, from about 28 percentage points in 1998 to 14 percentage points in 2008.

To get a picture of the overall inequality that has resulted in Côte d'Ivoire, it is important to look at the degree to which distinct ethnic groups are systematically over- or under-represented at the different income quantiles. As defined by Jayadeb and Reddy (2009), the concept of the *Representational Inequality* documents this theme. In Figure 4.6, we plot the share of different ethnic groups at each quantile of the total income distribution. Looking at both figures, they reveal that the degree of segregation between the ethnic groups is high. The representation of Akan people clearly increases as we move from lower to upper quantiles in both years. The Akan group emerges as the wealthiest class. Of the other groups, Mande in the north in 1998 and Mande in the south in 2002 demonstrate a declining trend on the same scale. Thus the Mande constitute the poorest group with minimum representation in the top income quantile.

[Figure 4.6 is about here]

The theoretical arguments regarding poverty and conflict have mostly referred to horizontal inequality (Stewart, 2002; Ostby, 2008). The systematic difference between ethnic groups is more likely to cause conflict at the local level than at the national level arising in a cross-country framework. The presence on representation inequality (Figure 4.6) convincingly shows evidence of horizontal inequality in Cote d'Ivoire, which could be a potential explanation for the outbreak of civil war in that country.

Religious Diversity

The conflict in Cote d'Ivoire split the country in half between the religious the mainly Muslim north and the mainly Christian south. In several studies it has been stressed that the polarization of religious identity can increase the risk of conflict and can also intensify ongoing conflicts (Horowitz, 1985). In a recent study, Reynal-Querol (2002) shows that religious polarization in terms of having two groups of equal size is a decisive factor in the likelihood of civil war. As shown in Table 4.3, Muslims and Christians constitute almost similar percent of the population (close to 40 percent) and it did not change much over time.

[Table 4.3 is about here]

In Table 4.4 we highlight the relationship between different ethnic groups and their religious practices from the latest round of household survey in 2008. As shown in Table 4.4, the wealthy Akans and Krou are predominantly Christians whereas the Mande North and Voltaic groups are mainly Muslims. Of the immigrants the Muslims make up the majority of this population group. This supports the *autochthony*[vii] discourse and the concept of *Ivoirite* which later merged with the country's economic and political inequalities, which also coincided with the religious fault line.

[Table 4.4 is about here]

Based on the literature and the anecdotal evidence supported by the household surveys we empirically test the following propositions. We hypothesize that the outbreak or risk of civil war in Cote d'Ivoire is positively associated with: (1) Local population density, (2) Local dominance of ethnic diversity, (3) Local dominance of religious diversity, (4) Income inequality at the local level, and (5) Unequal land ownership. We test one more hypothesis – that the outbreak or risk of civil war is negatively associated with the (6) Local Ivoirite population density, and (7) Average per capita income level. We build six inequality indices[viii] to empirically test all of these hypotheses. These are M1: Ethnic Fractionalization Index (based on the Hirschman-Herfindahl Index); M2: Ethnic Polarization Index (based on the Reynol-Querol, 2002); M3: Religious Fractionalization Index (based on the Hirschman-Herfindahl Index); M4: Gini Coefficient of Income Inequality (or Vertical Income Inequality); M5: Gini Coefficient of the Inequality of Land Ownership; and M6: Horizontal Income Inequality between the richest and the poorest ethnic group (based on Brockerhoff & Hewett, 2000; Ostby, 2008). These indices are constructed at the department[ix] level whereas the conflict outcomes are gathered both at the department and sub-prefecture levels. At some sub-prefectures the existence of a small population might not provide meaningful inequality measures.

[Table 4.5 is about here]

In Table 4.5 we report descriptive statistics on the inequality measures constructed from the 1998 and 2002 household surveys. The average value of the inequality measures remained the same in both rounds. The variance and range of conflict outcomes change over time. In Table 4.6 we show the correlation matrix between the inequality measures and the actual conflict

counts. The ethnic fractionalization index (M1) shows a positive and statistically significant correlation with conflict counts. A similar outcome is found for the inequality of land distribution index (M5). The ethnic fractionalization index (M1) and the ethnic polarization index (M2) indicate a positive and statistically significant correlation. Overall, all inequality measures are positively correlated with the conflict events except M6, which measures the horizontal inequality (or income gap) between the poorest and richest ethnic groups.

[Table 4.6 is about here]

V. Empirical Model and Findings

We model the causes of civil war by using a repeated cross-sectional framework using both departments and sub-prefectures as the unit of analysis. For convenience we separate this section into two parts. In the first part we discuss the empirical model selection and report the main empirical results using departments as the unit of analysis. The second part repeats the same exercise but using sub-regions as the unit of empirical analysis. To overcome the problem of endogeneity we consider the following strategy. At each sub-regional level, the empirical model explains the variation in the conflict counts at the local level for the period 1999-02 using a set of control variables and the inequality indices constructed from the 1998 household survey data. Similarly, the variation in the conflict counts at the local level is explained by a set of control variables and the inequality indices constructed from the 2002 household survey. We do not expect this strategy to address the endogeneity issues completely. It could be possible that an increase in population in a certain department resulted from a strategy to gain territorial control in anticipation of a civil war in the future. However, a clear identification of the precedence

between two events certainly makes the empirical model credible. Figure 5.1 plots the number of civil war events and shows how they overlap with various rounds of household surveys.

[Figure 5.1 is about here]

A. Empirical analysis at the department level

The histogram of conflict counts (Figure 5.2) for the periods 1999-02 and 2003-06 shows that the distribution of conflict events is skewed to the right. This clearly follows a non-normal distribution of conflict events in both periods. As a result of this a simple Ordinary Least Squares (OLS) regression model fails to produce an ideal estimate for the causes of civil war. An ordinary count model such as a Poisson or Negative Binomial model is likely to produce a better fit with the data. However, the variance of the conflict counts in both periods is much larger than the average conflict counts (Table 4.1). This suggests that we need a richer model. A Negative Binomial model might show a better fit with the data compared to a Poisson model. A Negative Binomial model permits overdispersion and furthermore it is often the case that little efficiency gain is achieved over the Poisson model with robust standard errors (Cameron and Trivedi, 1986).

[Figure 5.2 is about here]

The right hand column of Table 4.1 shows the percent of zero outcomes, i.e. percentage of departments with no conflict events in the period under consideration. In the presence of higher frequency of zeros, the maximum likelihood estimator (MLE) is inconsistent if any aspect of the parametric model is misspecified. We therefore need to make an assumption about

whether the process of non-zeroes is the same as zeroes. The existing literature on civil war in Cote d'Ivoire does not provide us with sufficient knowledge that distinguishes between non-zeroes and zeroes. One can specify an additional model to determine the zero conflict counts separately from the standard count model. This estimation technique is known as the Zero-Inflated Negative Binomial Model (ZINB) (Lambert, 1992). However, as noted by Greene (1994), we can choose the best model by performing the Vuong (1989) test. A significant outcome of the Vuong test indicates the ZINB model has a better fit with the data over the Negative Binomial model.

In Table 5.1 we compare the descriptive statistics on control variables. There is a positive growth in the average population at the department level between 1998 and 2002; however, the average per capita income moves in the opposite direction in the same period. The average religious population share at the department level remained the same as did the share of the Ivoirite population. However, the share of population with land holding declines between 1998 and 2002. The average share of the Christian population holding land drops from 64% in 1998 to 57% in 2002. Likewise, the average share of Muslim population with land holding drops from 66% in 1998 to 58% in 2002.

[Table 5.1 is about here]

Table 5.2 reports the empirical findings. The outcome of the Vuong test is statistically insignificant for all the models we consider. This indicates that the Negative Binomial model has a better fit with the data over the Zero-Inflated Negative Binomial model. Also in Table 5.2 we report the regression outcomes of the pooled negative binomial model with a time fixed dummy

at the department level. The more populous departments are more likely to experience the civil war events. This outcome is robust and statistically significant. On the other hand, richer (higher per capita consumption) departments are less likely to experience conflict. However, the estimated coefficient of per capita income is statistically insignificant. Departments where more Ivoirites live are negatively associated with the likelihood of experiencing a civil war. Overall, we find strong evidence supporting the main hypothesis we discussed in section 4. Local population density is negatively associated with the risk of civil war events, whereas Ivoirite density and richer areas are negatively associated with the likelihood of a civil war event.

Local dominance of ethnic diversity shows a positive and statistically significant coefficient. This indicates that a more ethnically fragmented department has a higher propensity to experience conflict. Likewise the ethnic polarization index which measures the proximity to a bipolar distribution of ethnic groups shows a positive and statistically significant coefficient. Together, these findings indicate that in an ethnically fragmented department, if the two most populated ethnic groups have equal population share, then it is more likely to experience conflict. Departments with less religious groups are more likely to experience conflict, but the coefficient of religious fractionalization is not statistically significant. Areas with higher income inequality are at a higher risk of experiencing conflict. Similarly, conflict events are more likely to occur in departments with unequal land distribution is unequal. However, the inequality measures fail to show statistically significant outcomes. Surprisingly, a lower income gap between the richest and poorest ethnic groups is associated with higher conflict events.

[Table 5.2 is about here]

B. Empirical analysis at the sub-prefecture level

The histogram of conflict counts at the sub-prefecture level (Figure 5.3) shows similar outcomes to those at the department level. The distribution of conflict events is skewed to the right and contains a large proportion of zeros. In the period from 1999 to 2002, about 64% of the sub-prefectures show no conflict events. Likewise, for the period from 2003 to 2006, almost 63% show zero outcomes (Table 4.1). The percentage of zero outcomes almost doubled at the sub-prefecture level compared to the department as a unit of analysis. As discussed previously, the issue of excess zero in the dependant variable can be addressed through the application of the ZINB model. We assume that the participation decision and the positive outcomes are generated by separate processes. In other words, if the local dominance of a particular event is believed to cause incidents of armed conflict in some sub-prefectures, this does not imply that in other sub-prefectures where there is no incidence of conflict, it is due to the absence of that particular event.

[Figure 5.3 is about here]

In Table 5.3 we compare the descriptive statistics on control variables at the sub-prefecture level. We find similar evidence of a positive growth in the average population at the sub-prefecture level between 1998 and 2002. Unlike in the department level, the average per capita income increases when we compare at the sub-prefecture level. The average religious population share at the department level remained the same so as the share of Ivoirite population. However, the share of population with land holding shows lowers between 1998 and 2002. The average share of Christian land owners declines from 58% in 1998 to 53% in 2002. Likewise, the average share of Muslim land owners falls from 64% in 1998 to 57% in 2002. Since some of the

sub-prefectures have low populations, we decide to use the inequality measures constructed at the department level. We cluster at the department level for robust standard errors.

[Table 5.3 is about here]

Table 5.4 reports the results of negative binomial regression at the sub-prefecture level. The outcome of the Vuong test is statistically insignificant for all the models such as at the department level. This indicates that the Negative Binomial model has a better fit with the data over the Zero-Inflated Negative Binomial model. The more populous departments are more likely to experience civil war events; however, at the sub-prefecture level this outcome is not statistically significant. Sub-prefectures with a higher share of Ivoirites are negatively associated with the likelihood of experiencing a civil war. Moreover, the share of Muslim population at the sub-prefecture level shows a negative and statistically significant relationship with the likelihood of conflict outcomes.

[Table 5.4 is about here]

A more ethnically fragmented sub-prefecture shows a higher propensity for experiencing conflict. Likewise the ethnic polarization index measuring the proximity to a bipolar distribution of ethnic groups also demonstrates a positive and statistically significant coefficient. Sub-prefectures with less religious groups and more equal societies in terms of land distribution and income are less likely to experience conflict, but none shows statistically significant outcomes.

Similar to the findings at the department level, a lower income gap between the richest and poorest ethnic groups is associated with higher conflict events.

To sum up, we find mixed evidence when comparing regression results between the department and sub-prefecture levels. More populous areas are at high risk of civil war, but the outcome is statistically significant only at the department level. The population ratios of Ivoirites and Muslims are significant determinants of civil war at the sub-prefecture level. We do not find significant evidence of income inequality and land inequality as a determinant of civil conflict at either level of analysis. However, both the ethnic fractionalization and ethnic polarization indices show robust and statistically significant evidence. In line with important studies (Easterly and Levine, 1997; Fearon and Laitin, 2003) our findings confirm that ethnic diversity is significantly associated with conflicts.

VI. Conclusion

Despite the recent spur in the micro level analysis of the causes of civil war, the bulk of the evidence is still provided at the macro level. There are many factors that seriously undermine the growth of micro level studies, and one of them is the difficulties in linking the disaggregated conflict data to household characteristics and socio-economic welfare indicators at the local level. Moreover, robust evidence is lacking on the determinants of civil war at various sub-national levels within a country. Little is known about the extent to which one should disaggregate the studies on civil war.

This study contributes to "Disaggregating the Study of Civil War". We provide an empirical analysis of the determinants of civil war in Cote d'Ivoire. We use two data sources to map the conflict outcomes to a range of explanatory factors at the department and sub-prefecture levels. The data on local incidences of civil war in Cote d'Ivoire is taken from the Armed Conflict Location and Event Database (ACLED) for the period 1997 to 2008. A wide range of variables including household characteristics, demographic and socio-economic information are constructed from two rounds (1998 and 2002) of the Enquete sur le Niveau de Vie de Menage (ENV) survey data administered in Cote d'Ivoire. We use both the department and the sub-prefecture levels as units of analysis and compare the empirical outcomes. This provides robustness to the empirical findings at various sub-national levels.

Using various indicators of inequality and polarization created at the sub-national level, we find robust evidence that ethnic diversity is significantly associated with conflicts. Poverty is widespread but is more profound in the north west of the country where the Muslim population gradually became more concentrated, while the southern region is dominated by relatively wealthy Christians. However, we do not find significant evidence of income inequality and land inequality as a determinant of civil conflict. The qualitative evidence suggests that ethnic fractionalization has deepened the religious polarization over time, and this factor along with the concept of *Ivoirites* made the civil war unavoidable in Cote d'Ivoire. We find strong empirical evidence supporting this view at the sub-prefecture level. Both the share of Ivoirites and the share of Muslim are significant determinants of civil war at the sub-prefecture level. Of the other factors, more populous areas are at high risk of civil war, but the outcome is statistically significant only at the department level. Overall the findings suggest ethnicity and religious identities are the significant causes of civil war in Cote d'Ivoire.

Furthermore, the rich household survey data and availability of disaggregated conflict data enabled us to compare the empirical outcomes between two sub-national levels, namely department and sub-prefecture. We used this as a robustness strategy and found ethnicity as the most robust indicator of conflict. However, there are certain caveats deserving mention. We used a decade's worth of conflict data and it is likely that the nature of conflict has changed over time. For example, around 1999 the conflict events were preceded by a coup d'etat whereas conflict events after 2002 turned into a full blown civil war. We did not use any strategy to address this issue in our empirical model. The inequality indices are calculated only at the department level because some sub-prefectures have very low populations. Despite the fact that we used clustered standard errors for our estimation, it is still open to debate whether creating an index at the sub-prefecture level would have produced more credible outcomes.

Anecdotal and intuitive explanations suggest that civil war should be analyzed at the sub-national level. A growing body of literature on micro-level studies of civil war attests to this. However, to obtain a more robust picture of the determinants of civil war, further studies need to be done at various sub-national levels in different parts of the world. We believe that our contribution takes us closer to this goal.

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Appendix 1

X.1. List of the Measures of Inequality used in this study:

I. **Ethnic Fractionalization Index** (based on the Hirschman-Herfindahl Index)

$$M1 = \sum_{i=1}^{N} \phi_i (1 - \phi_i),$$

where ϕ_i is the share of population belonging to ethnic group i, N equals total number of ethnic groups. This simple index measures the probability that two randomly selected individuals in a department (in the context of our study) will not belong to the same ethnic group.

II. **Ethnic Polarization Index** (based on the Reynol-Querol (2002) index)

$$M2 = 4\sum_{i=1}^{N} \phi_i^2 (1 - \phi_i),$$

where ϕ_i is the share of population belonging to ethnic group i, N equals total number of ethnic groups. The purpose of this index is to record how far the distribution of the ethnic groups is from the bipolar distribution. Literature shows a two-point

symmetrical distribution of population maximizes the likelihood of conflict (Horowitz (1985), Esteban & Ray (1999), Montalvo & Reynol-Querol (2002), Montalvo & Reynol-Querol (2005).

III. **Religious Fractionalization Index** (based on the Hirschman-Herfindahl Index)

$$M3 = \sum_{i=1}^{N} \phi_i (1 - \phi_i),$$

where ϕ_i is the share of population belonging to religious group i, N equals total number of religious groups. This simple index measures the probability that two randomly selected individuals in a department (in the context of our study) will not belong to the same religious group.

IV. **Gini Coefficient of Income Inequality** (or Vertical Income Inequality), income is measured by per capita households consumption expenditure

$$M4 = \sum_{i=1}^{N} \sum_{j=1}^{N} \phi_i \phi_j \mid y_i - y_j \mid,$$

where ϕ_i is the share of population belonging to income group i, N equals total number of income groups, and y_i represents income level of group i (same for j).

V. **Gini Coefficient of the Inequality of Land Ownership**, land ownership is measured by the area of land owned in hectares by each household

$$M5 = \sum_{i=1}^{N}\sum_{j=1}^{N}\phi_i\phi_j \mid y_i - y_j \mid,$$

where ϕ_i is the share of population belonging to income group i, N equals total number of income groups, and y_i represents area of land owned by group i (same for j).

VI. **Horizontal Income Inequality** between the richest and the poorest ethnic group (based on Brockerhoff & Hewett (2000), Ostby (2008))

$$M6 = 1 - \frac{\ln(y_{worst})}{\ln(y_{best})},$$

where y_{worst} represents the average income level of the poorest ethnic group, and y_{best} represents the average income level of the richest ethnic group.

Appendix 2

Model 1: Zero-Inflated Negative Binomial model

Instead of assuming that zeros are determined using a different process, one can specify an additional model to determine the zero conflict count separately from the standard count model. This estimation technique is known as the Zero-Inflated Negative Binomial (ZINB) model. Let us denote the extra model for zeros having a density function $f^{a}(y \mid x_a, \theta_a)$ and the usual model follows $f^{b}(y \mid x_b, \theta_b)$.

Then the joint density function of the zero-inflated model can be written as:

$$f(y \mid x_a, x_b, \theta_a, \theta_b) = \begin{cases} f^{a}(0 \mid x_a, \theta_a) + [1 - f^{a}(0 \mid x_a, \theta_a)] \times f^{b}(0 \mid x_b, \theta_b) & y = 0 \\ [1 - f^{a}(0 \mid x_a, \theta_a)] \times f^{b}(0 \mid x_b, \theta_b) & y \geq 1 \end{cases}$$

Appendix 3

Measures of Inequality: Index Values

M1: Ethnic Fractionalization Index; M2: Ethnic Polarization Index; M3: Religious Fractionalization Index: M4: Gini Coefficient of Income Inequality; M5: Gini Coefficient of the Inequality of Land Ownership; M6: Horizontal Income Inequality between the richest and the poorest ethnic group

Departments		1998						2002					
		M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
1	Abengourou	0.58	0.85	0.54	0.40	0.61	0.92	0.56	0.74	0.61	0.41	0.68	0.61
2	Abidjan	0.76	0.64	0.60	0.36	0.94	0.36	0.77	0.63	0.55	0.42	0.96	0.35
3	Aboisso	0.67	0.75	0.47	0.28	0.86	0.62	0.53	0.70	0.61	0.40	0.69	0.82
4	Adzopé	0.40	0.60	0.53	0.32	0.55	0.55	0.64	0.72	0.64	0.33	0.74	0.35
5	Agboville	0.52	0.75	0.55	0.31	0.54	0.27	0.59	0.73	0.46	0.37	0.92	0.65
6	Agnibilékrou	0.58	0.85	0.54	0.40	0.61	0.92	0.57	0.70	0.53	0.28	0.68	0.51

7	**Bangolo**	0.45	0.71	0.62	0.29	0.54	0.47	0.46	0.69	0.58	0.39	0.40	0.46
8	**Biankouma**	0.23	0.39	0.51	0.45	0.71	0.94	0.01	0.03	0.38	0.31	0.84	0.71
9	**Bondoukou**	0.38	0.59	0.66	0.36	0.51	0.77	0.31	0.58	0.40	0.38	0.31	0.88
10	**Bongouanou**	0.28	0.51	0.56	0.23	0.55	0.58	0.59	0.78	0.60	0.39	0.57	0.45
11	**Bouaflé**	0.51	0.72	0.56	0.33	0.90	0.67	0.20	0.35	0.44	0.28	0.51	0.62
12	**Bouaké**	0.50	0.89	0.49	0.38	0.87	0.76	0.56	0.83	0.44	0.37	0.50	0.57
13	**Bouna**	0.69	0.76	0.64	0.32	0.87	0.46	0.64	0.71	0.64	0.40	0.97	0.57
14	**Boundiali**	0.33	0.59	0.37	0.32	0.49	0.83	0.59	0.85	0.47	0.46	0.62	0.54
15	**Béoumi**	0.51	0.88	0.28	0.36	0.86	0.73	0.57	0.82	0.42	0.33	0.52	0.68
16	**Dabakala**	0.27	0.45	0.37	0.31	0.54	0.63	0.21	0.38	0.42	0.34	0.48	0.81
17	**Daloa**	0.77	0.66	0.59	0.31	0.58	0.39	0.72	0.69	0.64	0.37	0.68	0.49
18	**Danané**	0.38	0.70	0.57	0.29	0.52	0.59	0.31	0.54	0.52	0.32	0.58	0.82
19	**Daoukro**	0.53	0.93	0.60	0.30	0.33	0.79	0.28	0.46	0.62	0.46	0.55	0.81
20	**Dimbokro**	0.37	0.59	0.52	0.28	0.92	0.49	0.13	0.25	0.55	0.32	0.79	0.58
21	**Divo**	0.75	0.71	0.65	0.30	0.61	0.72	0.77	0.68	0.64	0.42	0.56	0.18
22	**Duékoué**	0.59	0.74	0.67	0.29	0.75	0.64	0.58	0.75	0.66	0.38	0.49	0.69
23	**Ferkessédougou**	0.64	0.82	0.58	0.32	0.62	0.59	0.62	0.86	0.42	0.39	0.76	0.70

24	**Gagnoa**	0.71	0.73	0.56	0.33	0.79	0.30	0.73	0.65	0.64	0.30	0.86	0.49
25	**Grand-Lahou**	0.26	0.46	0.36	0.28	0.51	0.21	0.55	0.77	0.14	0.35	0.63	0.57
26	**Guiglo**	0.71	0.74	0.54	0.35	0.76	0.69	0.72	0.74	0.63	0.45	0.79	0.88
27	**Issia**	0.29	0.49	0.58	0.37	0.82	0.79	0.62	0.74	0.67	0.31	0.51	0.66
28	**Katiola**	0.36	0.58	0.52	0.27	0.57	0.86	0.25	0.45	0.63	0.36	0.52	0.74
29	**Korhogo**	0.60	0.85	0.57	0.31	0.86	0.78	0.45	0.72	0.56	0.40	0.66	0.65
30	**Lakota**	0.75	0.69	0.57	0.39	0.51	0.52	0.66	0.80	0.59	0.30	0.78	0.54
31	**Man**	0.70	0.78	0.65	0.32	0.61	0.53	0.63	0.85	0.58	0.40	0.58	0.76
32	**Mankono**	0.29	0.50	0.59	0.26	0.28	0.64	0.60	0.78	0.42	0.32	0.51	0.86
33	**Mbahiakro**	0.05	0.10	0.03	0.27	0.28	0.58	0.21	0.38	0.65	0.37	0.64	0.81
34	**Odienné**	0.28	0.46	0.13	0.31	0.49	0.64	0.12	0.23	0.03	0.32	0.41	0.70
35	**Oumé**	0.70	0.75	0.38	0.34	0.83	0.66	0.63	0.82	0.37	0.36	0.60	0.80
36	**Sakassou**	0.14	0.27	0.54	0.33	0.60	0.79	0.00	0.00	0.62	0.25	0.27	0.00
37	**San-Pédro**	0.80	0.60	0.64	0.43	0.79	0.45	0.83	0.56	0.62	0.37	0.62	0.26
38	**Sassandra**	0.48	0.82	0.51	0.30	0.54	0.65	0.61	0.71	0.54	0.34	0.59	0.48
39	**Sinfra**	0.68	0.79	0.57	0.38	0.87	0.53	0.39	0.63	0.51	0.29	0.66	0.65
40	**Soubré**	0.82	0.57	0.63	0.33	0.72	0.51	0.69	0.77	0.62	0.33	0.59	0.29

41	**Séguéla**	0.35	0.63	0.09	0.28	0.61	0.76	0.67	0.84	0.04	0.31	0.60	0.38
42	**Tabou**	0.32	0.56	0.48	0.25	0.44	0.45	0.74	0.73	0.54	0.29	0.44	0.86
43	**Tanda**	0.30	0.54	0.52	0.32	0.39	0.80	0.56	0.91	0.43	0.52	0.69	0.66
44	**Tengréla**	0.33	0.59	0.37	0.32	0.49	0.83	0.36	0.59	0.07	0.26	0.67	0.56
45	**Tiassalé**	0.59	0.74	0.65	0.33	0.58	0.93	0.50	0.66	0.53	0.36	0.61	0.78
46	**Touba**	0.36	0.67	0.00	0.27	0.30	0.02	0.16	0.30	0.07	0.27	0.54	0.52
47	**Toumodi**	0.21	0.43	0.40	0.36	0.55	0.04	0.30	0.53	0.59	0.33	0.45	0.65
48	**Vavoua**	0.79	0.62	0.65	0.31	0.84	0.60	0.70	0.74	0.52	0.27	0.51	0.63
49	**Yamoussoukro**	0.56	0.69	0.66	0.40	0.64	0.51	0.41	0.61	0.61	0.34	0.74	0.34
50	**Zuénoula**	0.51	0.68	0.54	0.38	0.91	0.73	0.80	0.62	0.50	0.40	0.79	0.71

Appendix 4 Tables and Figures

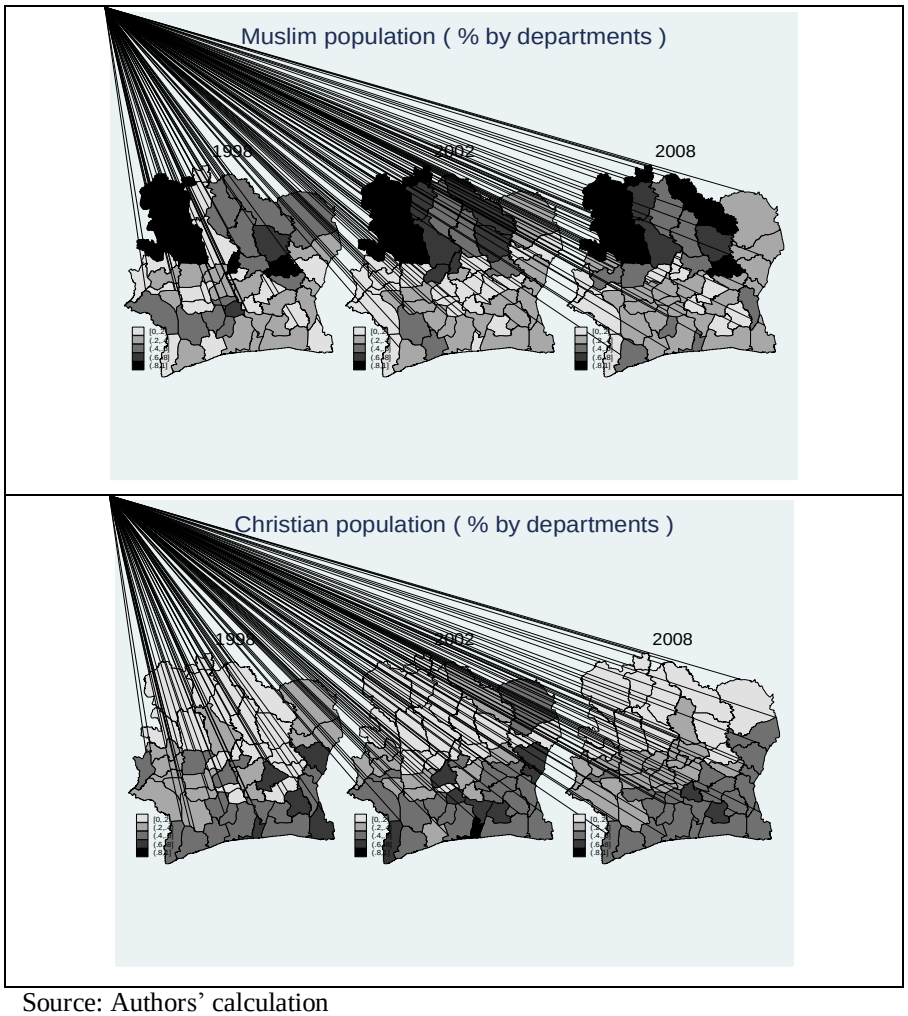
Figure 3.1 A Brief History of the Ivorian Civil War

Timeline	President	Election	Challenger	Events
1960-1989	Félix Houphouët-Boigny	No		
1990		Yes	Laurent Gbagbo	Félix Houphouët-Boigny won with 81.68% of the vote
1991-1993		No		Félix Houphouët-Boigny nominated Henri Bedie as the next president
1994-1998	Aimé Henri Konan Bédié	Yes	none	Ouattara was barred from participation, birth of the "Ivoirite" concept—both his parents were from Ivory Coast
1999	Robert Guei	No		Robert Guei led a successful Coup, Bedie fled to Burkina Faso
2000-2001	Laurent Gbagbo	Yes	Robert Guei	PDCI-RCA (Bedie) and RDR (Ouattara) boycotted the election, Gbagbo won with 59.4% of the vote
2002		No		• Around 800 mutineers took up arms against Gbagbo. • Their demand included reintegration of deserters into the army, the release of military and paramilitary officers from the prison, along with better pay. • The coup was successful only in the north; rebels retreated to the Muslim dominated North
2003				• Civil war broke out • Government blamed immigrant population workers • French troops came and UN peace-keeping forces succeeded in creating a ceasefire line between the rebel controlled north and the government controlled south
2004-2009				• From 2003 to 2005, there were many failed attempts to stop the war, with mass killings and leaving thousands displaced • Preparation for the much awaited election started at a slower pace • Took two years to achieve with the complete voters list, identification card for the voters, etc
2010		Yes	Alassane Outtara	• Following the disputed election, Ouattara was initially declared as the winner, but recounting favored Gbagbo • Two cabinets ran simultaneously
2011	Alassane Ouattara			Outarra became president as a result of international interference

Source: Authors' calculation

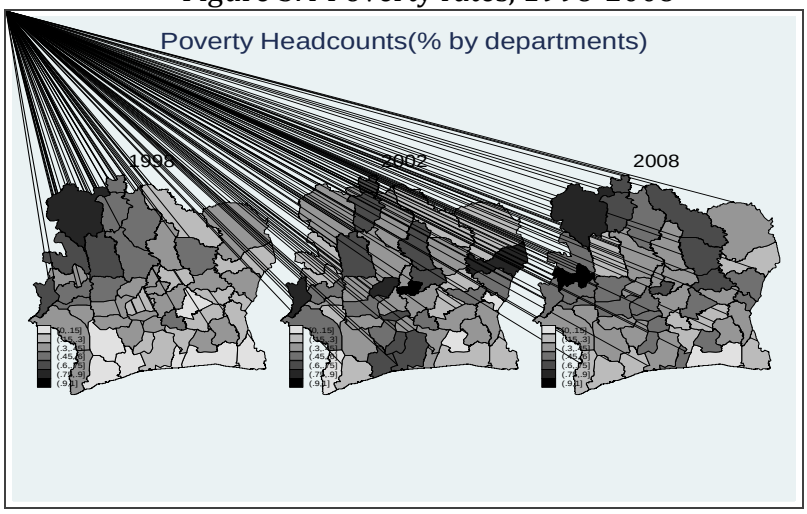
Figure 3.2 The ‘Peace Belt’ near the religious fault line

Figure 3.3 Muslim and Christian populations, 1998-2008



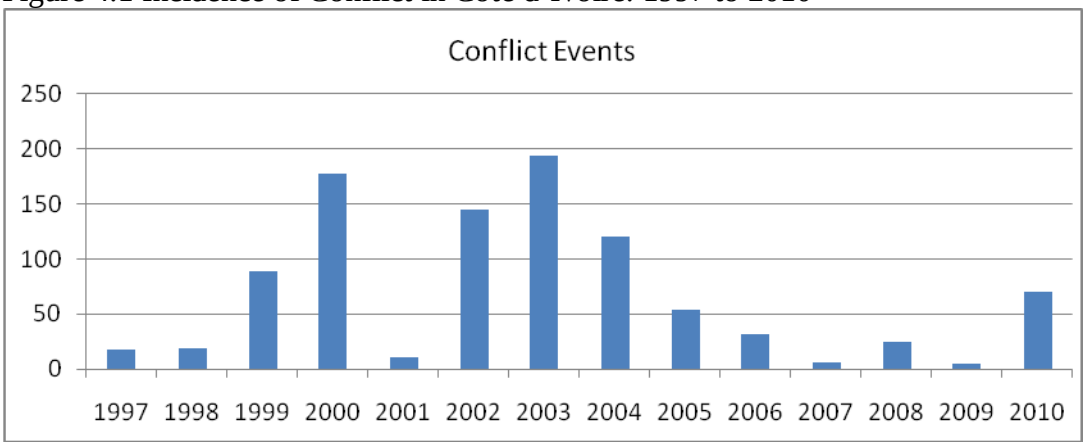
Source: Authors' calculation

Figure 3.4 Poverty rates, 1998-2008



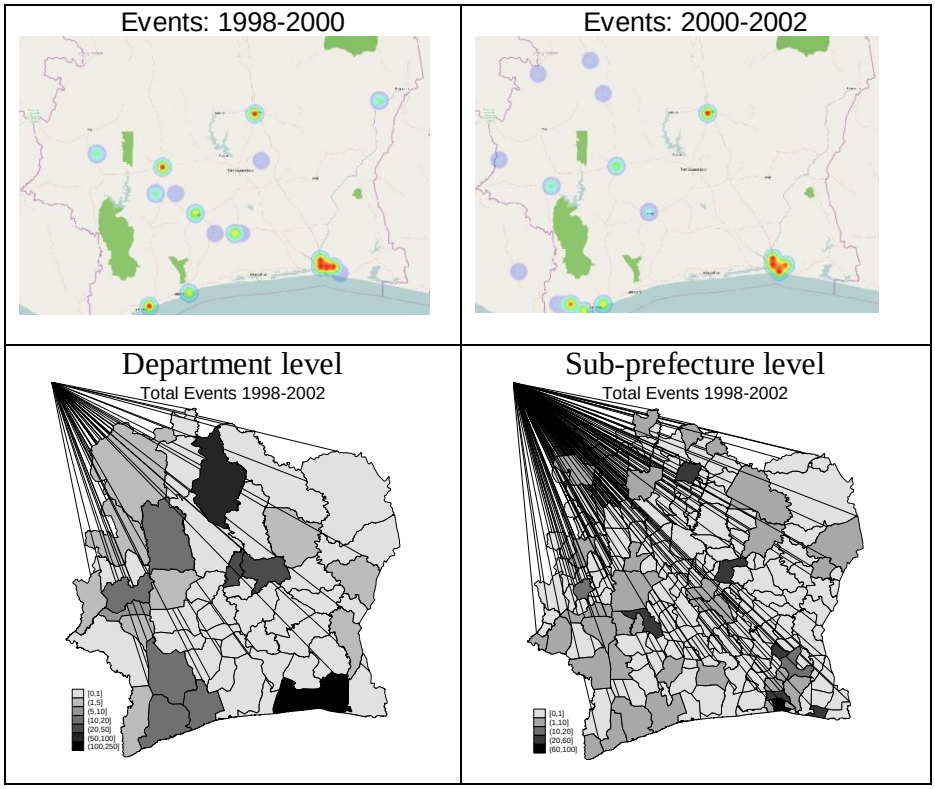
Source: Authors' calculation

Figure 4.1 Incidence of Conflict in Cote d'Ivoire: 1997 to 2010



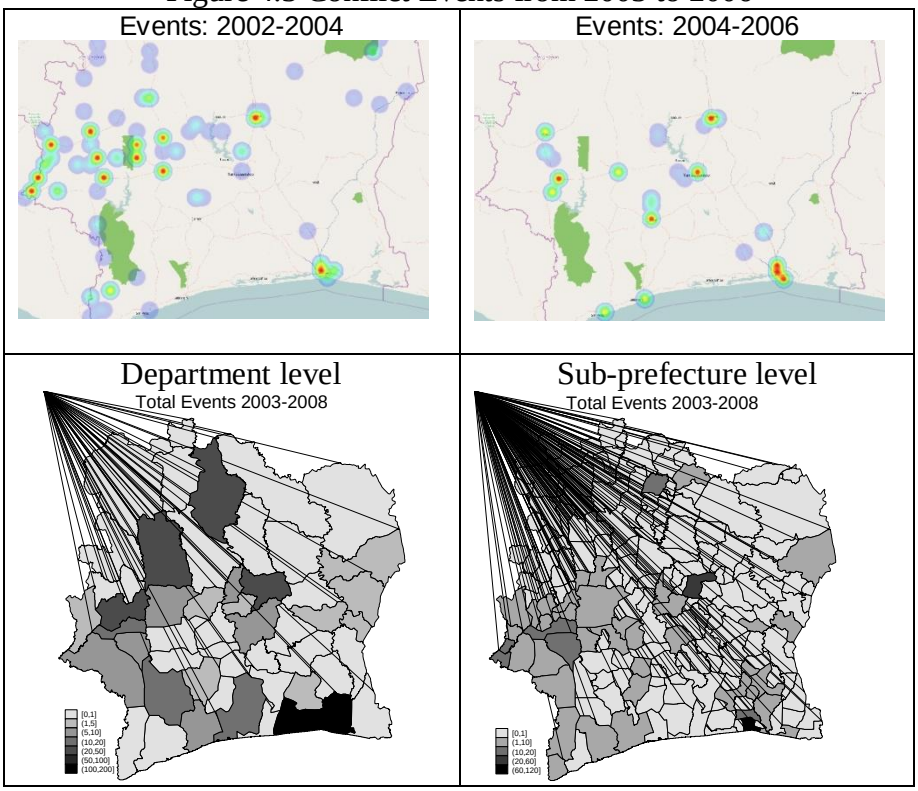
Source: Authors' calculation based on the ACLED database

Figure 4.2 Conflict Events from 1998 to 2002



Source: ACLED and authors own calculations

Figure 4.3 Conflict Events from 2003 to 2006



Source: ACLED and authors' own calculations

Table 4.1 Descriptive statistics of conflict counts at department/ sub-prefecture level

Level	Total events	Obs	Mean	Std. Dev.	Min	Max	Zeros (%)
Department	1999-2002	50	9.16	32.73	0	223	44%
	2003-2006	50	8.58	24.78	0	169	26%
Sub-prefecture	1999-2002	185	2.25	8.86	0	101	64%
	2003-2006	185	2.14	9.49	0	122	63%

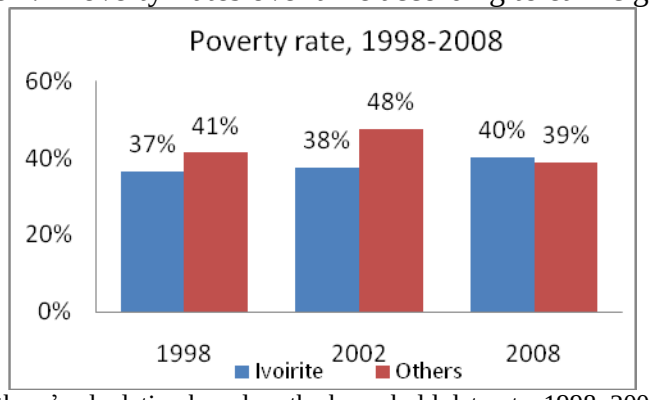
Source: ACLED and authors' calculation

Table 4.2 Ethnic population shares from 1998-2008

	1998	2002	2008
Akan	30.7	31.56	30.74
Krou	14.87	15.76	13.53
Mande north	18.14	13.37	15.35
Mande south	9.39	11.95	7.57
Voltaic	9.14	11.07	13.91
Ivoirite	82.23	83.71	81.1
Burkinabe	8.84	8.59	7.55
Others	8.93	7.71	11.35
Total	100	100	100

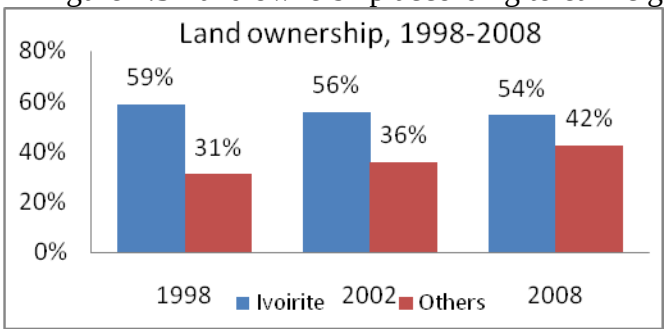
Source: Authors' calculation based on the Household datasets, 1998, 2002 and 2008

Figure 4.4 Poverty Rates over time according to ethnic groups



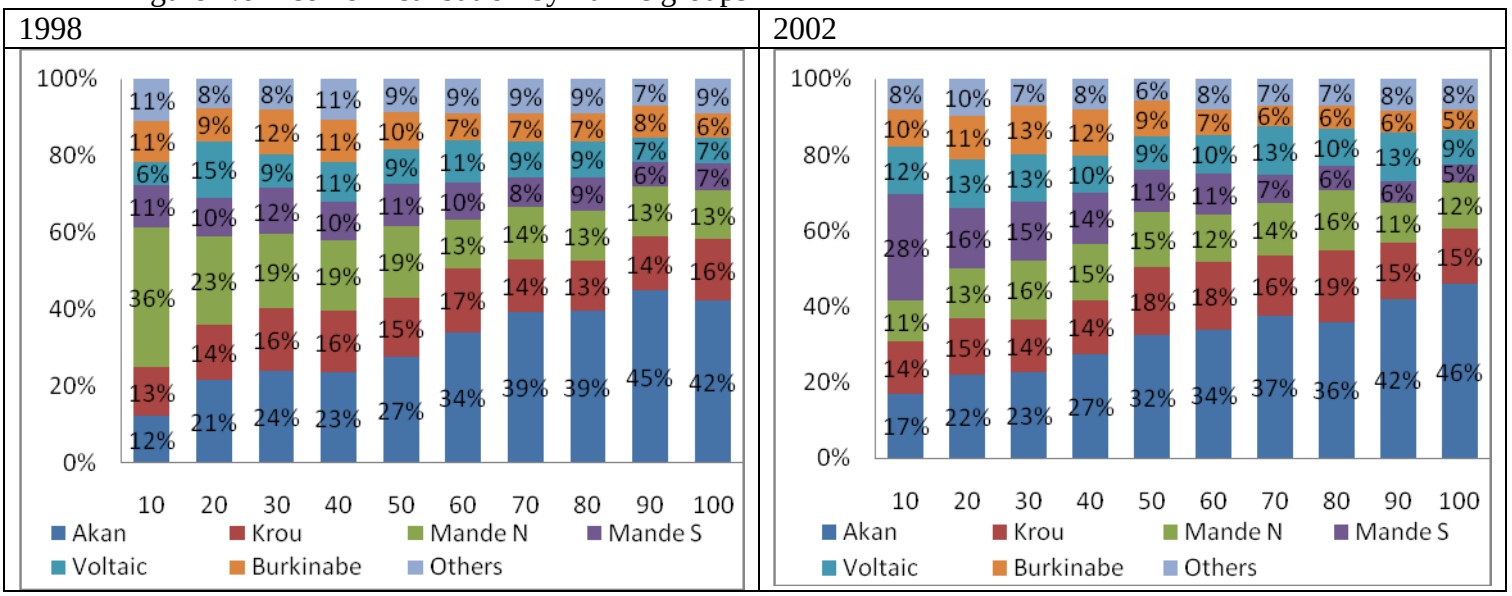
Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008
Notes: Ivoirite consists of five ethnic groups – the Akan, Krou, Mande North, Mande South and Voltaic. Poverty rates are calculated based on the per capita consumption expenditures

Figure 4.5 Land ownership according to ethnic group



Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008

Figure 4.6 Income Distribution by Ethnic groups



Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008

Table 4.3 Religious populations fraction from 1998-2008

	1998	2002	2008
Muslim	37.25	32.35	38.3
Christian	37.29	40.53	40.65
Other/No religion	25.47	27.13	21.06
Total	100	100	100

Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008

Table 4.4 Demographic compositions by ethnicity and religion, 2008

	Muslim	Christian	Other	No religion	Total
Akan	2.64	19.44	3.74	4.99	30.81
Krou	0.38	9.18	1.18	2.76	13.5
Mande north	14.19	0.85	0.08	0.25	15.38
Mande south	0.83	3.14	1.69	1.95	7.6
Voltaic	7.44	2.81	2.24	1.28	13.78
Burkinabe	4.97	2.37	0.07	0.16	7.57
Others	7.95	2.8	0.21	0.4	11.36
Total	38.4	40.59	9.22	11.8	100

Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008

Table 4.5 Descriptive outcome of Inequality Measures

	1998					2002				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Ethnic fractionalization index	50	0.49	0.20	0.00	0.82	50	0.50	0.22	0.00	0.83
Ethnic Polarization index	50	0.65	0.16	0.00	0.93	50	0.63	0.21	0.00	0.91
Religion fractionalization index	50	0.47	0.19	0.00	0.67	50	0.46	0.20	0.03	0.67
Gini coefficient of income	50	0.32	0.04	0.23	0.45	50	0.36	0.06	0.25	0.52
Gini coefficient of landownership size	50	0.63	0.19	0.28	0.94	50	0.64	0.15	0.27	0.97
Horizontal inequality between richest/poorest ethnic groups	50	0.61	0.21	0.00	0.94	50	0.60	0.18	0.00	0.88

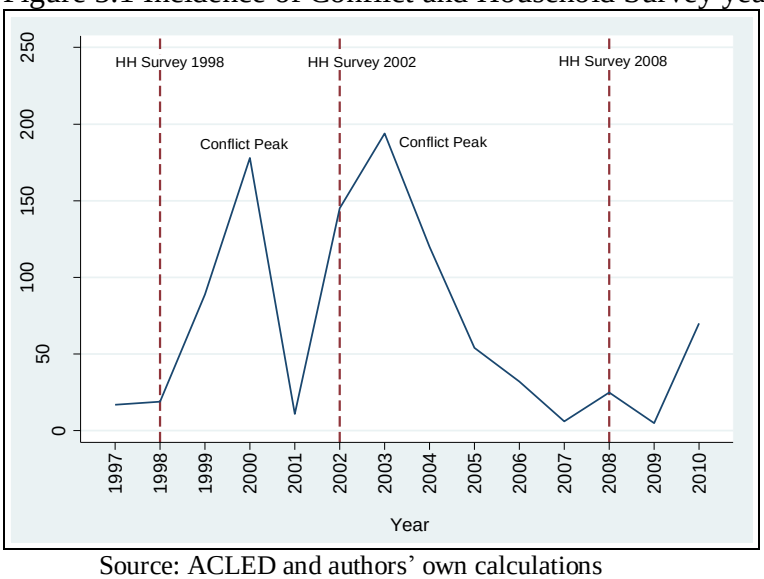
Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008 and ACLED

Table 4.6 Correlation matrix between Inequality Measures and Conflict Events

	M1	M2	M3	M4	M5	M6
M2	0.77**					
M3	0.39**	0.22**				
M4	0.29**	0.26**	0.26**			
M5	0.43**	0.26**	0.25**	0.29**		
M6	-0.08	0.17*	0.03	0.18	0.02	
Conflict events	0.24**	0.11	0.04	0.15	0.30**	-0.17*

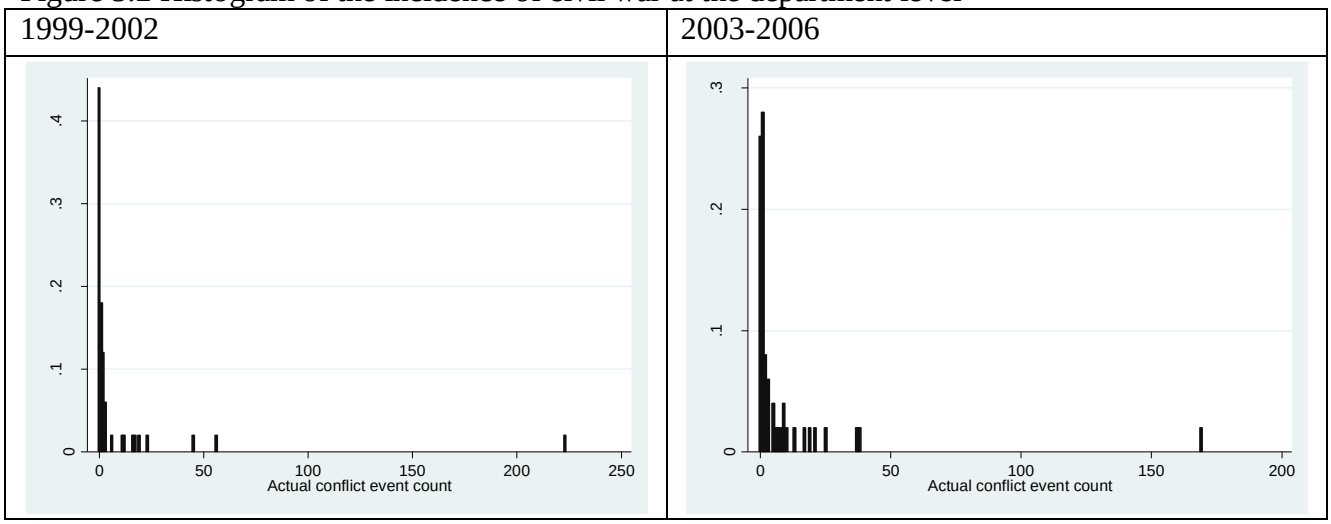
Source: Authors' calculation based on the household datasets, 1998, 2002 and 2008

Figure 5.1 Incidence of Conflict and Household Survey years in Cote d'Ivoire



Source: ACLED and authors' own calculations

Figure 5.2 Histogram of the incidence of civil war at the department level



Source ACLED and authors' own calculations

Table 5.1 Descriptive statistics on demographic and household controls (department level)

	1998					2002				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Log of total population	50	5.85	0.73	4.51	8.72	50	6.50	1.04	4.34	9.52
Log of average per capita income (real)	50	11.71	0.34	10.96	12.43	50	11.64	0.34	10.71	12.33
Muslim population share	50	0.36	0.27	0.00	1.00	50	0.36	0.27	0.00	0.98
Christian population share	50	0.33	0.22	0.00	0.77	50	0.36	0.23	0.00	0.93
Ivoirite population share	50	0.86	0.14	0.37	1.00	50	0.86	0.13	0.28	1.00
Christian pop share holding land	50	0.64	0.31	0.00	1.00	50	0.57	0.30	0.00	1.00
Muslim pop share holding land	50	0.66	0.28	0.00	1.00	50	0.58	0.30	0.00	1.00

Source: Authors' own calculations based on household surveys

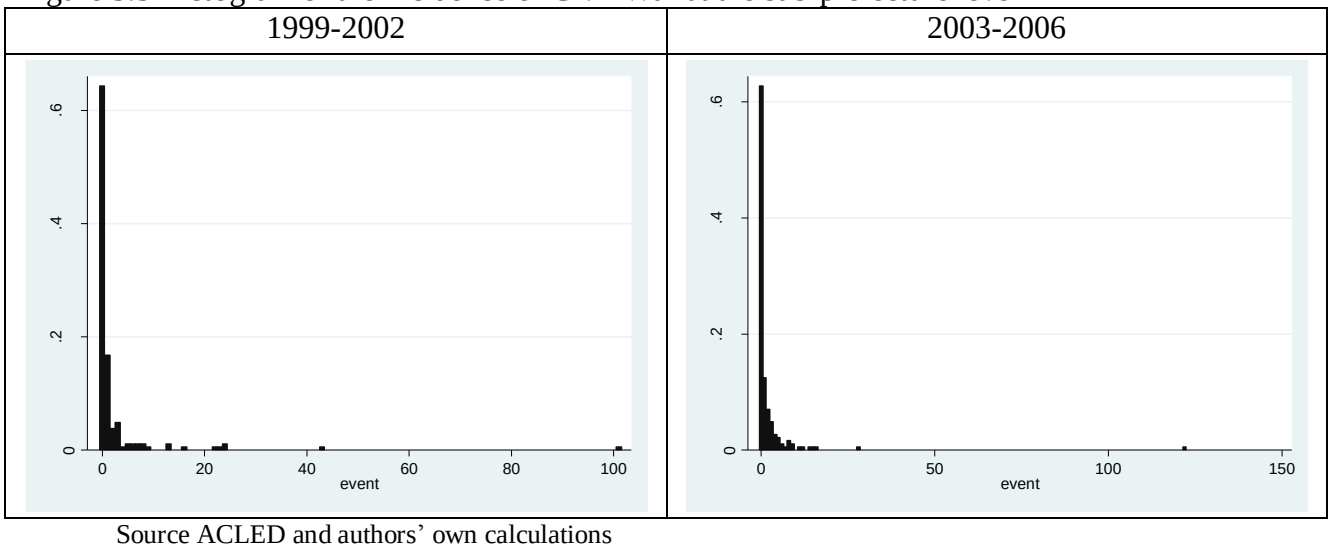
Table 5.2 Negative binomial regression outcomes at the department level

	Model: Base	Model: M1	Model: M2	Model: M3	Model: M4	Model: M5	Model: M6
Log of total population	0.545***	0.442***	0.541***	0.556***	0.525***	0.509***	0.504***
Log of average per capita income	-0.388	-0.390	-0.480	-0.376	-0.634	-0.463	-0.163
Muslim population share	-0.455	-0.557	-0.472	-0.657	-0.345	-0.491	-0.616
Christian population share	-1.524	-1.919*	-1.332	-1.525	-1.550	-1.604	-1.907*
Ivoirite share	-2.128*	-0.820	-1.591	-2.268**	-1.965*	-1.889*	-2.034*
Year dummy (2002=1)	-0.126	-0.078	-0.131	-0.140	-0.261	-0.057	-0.111
Ethnic fractionalization index		2.163**					
Ethnic polarization index			2.874***				
Religion fractionalization index				-0.470			
Gini coefficient of income					4.228		
Gini coefficient of landownership size						0.876	
Horizontal inequality between richest/poorest ethnic groups							-0.843
Constant	3.410	1.956	2.036	3.640	4.826	3.737	1.639
Ln (alpha)	-0.304	-0.446	-0.682	-0.318	-0.403	-0.363	-0.355
Number of observations	100	100	100	100	100	100	100
Vuong test of ZINB versus NB	1.490	1.070	1.030	1.260	1.160	1.160	1.180

note: *** p<0.01, ** p<0.05, * p<0.1

Vuong test shows insignificant outcomes for all the models

Figure 5.3 Histogram of the Incidence of Civil War at the sub-prefecture level



Source ACLED and authors' own calculations

Table 5.3 Descriptive statistics on demographic and household controls (sub-prefecture level)

	1998					2002				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Log of total population	185	6.06	0.91	4.51	8.72	185	6.82	1.04	4.34	9.52
Log of average per capita income (real)	185	11.66	0.32	10.96	12.43	185	11.72	0.31	10.71	12.33
Muslim population share	185	0.44	0.29	0.00	1.00	185	0.45	0.30	0.00	0.98
Christian population share	185	0.28	0.22	0.00	0.77	185	0.30	0.23	0.00	0.93
Ivoirite population share	185	0.87	0.13	0.37	1	185	0.87	0.11	0.28	1
Christian pop share holding land	185	0.58	0.30	0.00	1	185	0.53	0.29	0.00	1
Muslim pop share holding land	185	0.64	0.32	0.00	1	185	0.57	0.30	0.00	1

Source: Authors' own calculations based on household surveys

Table 5.4 Negative binomial regression outcomes at the sub-prefecture level

	Model: Base	Model: M1	Model: M2	Model: M3	Model: M4	Model: M5	Model: M6
Log of total population	0.203	0.105	0.210	0.189	0.199	0.165	0.179
Log of average per capita income	-0.367	-0.480	-0.397	-0.386	-0.398	-0.470	-0.272
Muslim population share	-2.251***	-2.482***	-2.273***	-1.892***	-2.241***	-2.319***	-2.326***
Christian population share	-0.102	-0.573	0.001	-0.101	-0.100	-0.239	-0.248
Ivoirite share	-2.635**	-0.609	-2.140**	-2.350**	-2.621**	-2.316**	-2.569**
Year dummy (2002=1)	-0.139	-0.103	-0.155	-0.120	-0.157	-0.098	-0.119
Ethnic fractionalization index		2.804***					
Ethnic polarization index			1.689**				
Religion fractionalization index				1.015			
Gini coefficient of income					0.517		
Gini coefficient of landownership size						0.885	
Horizontal inequality between richest/poorest ethnic groups							-0.366
Constant	5.208	4.115	3.940	4.603	5.407	5.850	4.481
Ln (alpha)	0.609**	0.441	0.579*	0.600*	0.611**	0.598**	0.608**
Number of observations	370	370	370	370	370	370	370
Vuong test of ZINB versus NB	0.730	0.720	0.790	0.770	0.730	0.780	0.740

note: *** p<0.01, ** p<0.05, * p<0.1

Vuong test shows insignificant outcomes for all the models

[i] See Blattman and Miguel (2009) for a broad literature survey
[ii] Blattman and Miguel (2009); Buhaug and Rod (2006); Hegre, Ostby and Raleigh (2009)
[iii] The presence of a middle class represents the share of the third and fourth quintiles of the population.
[iv]For more information please look at the ACLED website located at http://www.prio.no/CSCW/Datasets/Armed-Conflict/Armed-Conflict-Location-and-Event-Data/
[v]DIVA-GIS website for Cote d'Ivoire http://www.diva-gis.org/datadown

[vi]The following website http://www.acleddata.com/index.php/dynamic-maps provides conflict maps for a number of countries.
[vii] Anthropologists use this term to describe those whose 'native-ness' confers particular rights upon them McGovern (2011)
[viii] Annex 1 provides detailed description of these indices

[ix] The number of departments rose from 50 to 58 between 1998 and 2008. To be consistent we kept the number of departments to 50 by mapping back, those that were established after 1998, to the old departments (Appendix 2). We used the information available at the following website for mapping:http://www.statoids.com/yci.html.