Local-level exposure to conflicts and child health: evidence from Côte d'Ivoire

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***Abstract*:** This paper analyses the impact of the 2002-2011 period of instability in Côte d'Ivoire on child health. It uses two rounds of DHS surveys (1998-1999 and 2011-2012) and geo-referenced data on conflict events locations, which gives a more precise estimates of the effects of conflict on child welfare. Difference-in-difference regressions show a negative association between proximity to conflict events and child height-for-age z-scores. The study also suggests that maternal stress and disruptions of health care services are possible channels through which conflict affect child wellbeing.

Keywords: Child health; Conflict; Côte d'Ivoire, Geolocation

JEL Classification: I1, J13, O1

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1. Introduction

Early childhood development critically influences children's quality of life and economic outcomes as adults. Since the seminal work of Almond (2006), several studies have confirmed the fetal origins hypothesis proposed by Barker (1990). The hypothesis claims that life events happening until age five such as civil war, rainfall variability and income shocks impact children's cognitive ability, educational attainment, health, anthropometric measures, and future contribution to society[2]. Understanding the effects of such shocks on child welfare is crucial since around 250 millions of children worldwide live in countries affected by violent, and sometimes prolonged armed conflicts (UNICEF, 2016).

With the availability of household surveys conducted in war-affected countries more and more studies have dealt with the microeconomic effects of wars (Pivovarova and Swee, 2015). Those studies not only found strong negative effects of armed conflicts on child health but also unravelled important channels explaining these effects. Among them are war-related victimization such as the loss of economic assets (Minoiu and Shemyakina, 2014), the disruptions of health care services and the impossibility for aid to reach conflict-affected populations (Akresh, Lucchetti, and Thirumurthy, 2012; Akresh, Caruso, and Thirumurthy, 2016). Equally important is the period in life where the effects of shocks are more pronounced (Mansour and Rees, 2012; Alderman, Hoddinot, and Kinsey, 2006; Lee, 2014).

One major limitation of previous microeconomic studies on the effect of conflict on child outcomes is their propensity to use regions, provinces, or villages level information to assign individuals into conflict-affected versus non-conflict-affected localities before quantifying the impact of conflict on child health based on difference-in-difference estimations. Such an approach,

[2] Almond and Currie (2011) provide and extensive literature on the relationship between early-life events and child outcomes.

by dividing up individuals into much larger spaces might not accurately predict the effect of conflict on child welfare (Akresh et al., 2016). Fortunately, with more and more household surveys and administrative data containing geographical positioning system (GPS) information, there is now a growing trend toward estimating the relationship between child health and other economic indicators, or shocks at a disaggregate level (Kotsadam et al., 2018; Marty, Dolan, Leu, and Runfola 2017; Akresh et al., 2016).

This study aims to estimate the effects of conflicts on child welfare in Côte d'Ivoire focusing on the 2002-2011 period of political instability, which ended up with a violent post-electoral crisis. The study not only compares children born in war-affected versus non-war affected regions, but also and more importantly, those born in proximity to conflict event locations versus those born farther away from the conflict sites. It makes use of the temporal and spatial variation of the conflict as well as difference-in-difference estimation techniques to evaluate the effects of conflict on children height-for-age z-scores, an indicator of child long-term nutritional status (WHO, 1995).

This study makes three contributions to the literature on the effects of armed conflicts on children. First, unlike previous studies on Côte d'Ivoire, this research is not limited to shocks occurring between 2002 and 2007 with the Ouagadougou Peace Accord. The Accord signed in March 2007 led to a power-sharing agreement between the rebel groups and the government but did not solve the underlying causes of the conflict (Cathelin, 2011). Consequently, the analysis in this paper encompasses a much longer time period starting from September 2002 when the Ivorian civil conflict erupted to April 2011 when the post-electoral violence ended. Second, previous studies on Côte d'Ivoire relied on household data having no GPS information of the surveyed individuals. The current study differs from them by using two rounds of Demographic and Health

Surveys (DHS) conducted before the conflict (DHS 1998-1999) and few months after the post-electoral violence (DHS 2011-2012) and containing GPS information of the household clusters. Those pre and post conflict DHS surveys are linked with another dataset (ACLED) providing geo-located conflict events. This combination allows not only to investigate the effect of conflict at the provincial level, but also and more precisely the effect of conflict on child health relying on distances between household clusters and conflicts event locations. Although panel data would be ideal for this type of study as the same children would be observed over time, the repeated cross-sectional data at hand are still appropriate because they are representative of the Ivorian population. Finally, to the best of my knowledge this study is the first to use geographical information to study the effect of the Ivorian protracted period of instability on children long-term nutritional status.

The empirical results show that proximity to conflict event locations during the 2002-2011 time period reduces child height-for-age z-scores by 0.3-0.4 standard deviations. Unexpectedly, the effect of conflict is more important for children living within 100 km of conflict event sites compared to those living within 75 km of conflict event sites. The study did not however, find any gender-based differential impact of the conflict on child welfare. Finally, the evidence suggests that disruptions of health care services and maternal stress are possible mediating factors of the impact of conflict on children. The results are robust to a placebo test and specifications including mother fixed effects.

The remainder of the paper proceeds as follows. Section 2 gives a background of the Ivorian conflict. Section 3 describes the data, provides summary statistics of the main variables of interest, and highlights the estimation methodology. Section 4 presents the results. Section 5 suggests some conflict-impact mediating factors. Section 6 concludes.

2. Background

Côte d'Ivoire is the world largest producer of cocoa and one of the richest country in West Africa. Following its independence in 1960, the country experienced several years of high rates of economic growth and sustained poverty reduction (World Bank, 2015). However, the death of the first President Felix Houphouët-Boigny in 1993, ushered in a period of political instability that affected the country's overall economic performance and progress towards development. This period was marked by a military coup in 1999, a civil war in 2002, and the 2010-2011 post-electoral violence.

Between 2000 and 2009, GDP per capita declined by 1.2% annually, and the poverty rate increased from 38.4% in 2002 to 48.9% in 2008 (IMF, 2009). After the conflict erupted in 2002, many attempts in 2003 and 2004 to reach a ceasefire and a negotiated peace agreement proved to be unsuccessful in bringing about a sustainable peace. For example, the January 2003, Linas-Marcousis agreement brokered by the former colonial power, France, included the formation of a National Reconciliation Government, the disarming of all forces, the rebuilding of the army and the preparation of elections by dealing with the citizenship problem and the conditions of eligibility to the Presidency of the Republic. These later issues, in addition to the land tenure regime were at the root of the Ivorian conflict according to rebel forces[3]. However, the failure of the Linas-Marcousis peace agreement to reunify the country and organize elections led to a new peace agreement in March 2007 in Ouagadougou with the appointment of the rebel leader Guillaume Soro as Prime Minister. He was in charge of spearheading the disarmament process, the country reunification and the population identification in view of the national elections. All of this under

[3] Babo (2010) gives a detailed and historical analysis of the root causes of the Ivorian crisis.

the supervision of the United Nations peacekeeping mission then present in the country. Thus, the Ivoirian crisis, from its beginning seems to be inextricably linked to the electoral process.

The Ivorian civil conflict had had devastating consequences on children. Malnutrition rates and food insecurity increased among children under five living in the northern and western regions while up to 3,000 children were recruited by armed groups, and over 80% of health personnel and trained teachers fled from rebels-controlled regions to more secure areas in the South (UNICEF, 2009). Against this backdrop, few studies have evaluated the impact of conflict on child outcomes using household surveys conducted in the country (Minoiu and Shemyakina, 2014; Dabalen and Saumik, 2014). The present study follows in their footsteps while using a much longer period of observation (September 2002 to April 2011) and GPS information allowing to pinpoint the location of the different conflict events.

3. Data and Methods

3.1. The data

To estimate the effect of the 2002-2011 protracted Ivorian conflict on child welfare, this study uses two rounds of nationally representative DHS surveys (Côte d'Ivoire DHS 1998-1999 and 2011-2012). The 1998-1999 DHS was fielded between September and November 1998 and February and March 1999 while the 2011-2012 survey was conducted between December 2011 and May 2012. The children sample of the first round contains 1,992 observations located in 248 clusters and the second round consists of 7,766 observations spread into 352 clusters. The surveys provide information on the mother socio-economic characteristics, her health service utilization pre and post pregnancy for each of the children born in the past 5 years and aged 0-59 months, as well as information about their nutritional status.

The DHS surveys are suitable for this study compared to other household surveys in the country because they contain geographical information (latitudes and longitudes) of the different clusters in which the individuals are located. The surveys also contain child anthropometric measures such as height-for-age z-scores, an indicator of child long-term health status (WHO, 1995). The second round of DHS survey presents another advantage because it was conducted few months after the end of the post-electoral violence. This also helps better capture the effect of conflict on child health.

The study relies also on the Armed Conflict Location and Event Database (ACLED) by Raleigh et al. (2010), reporting exact locations, dates, and other characteristics of individual battle events in states affected by civil conflicts. Georeferenced and provincial level conflict events data from Côte d'Ivoire are available from 1997 onwards. As shown in Figure 1, there is a high level of casualties and conflict events in 2002 when the war started. The conflict subsided after 2007 with the signing of the Ouagadougou peace agreement. From that time forward, the country entered a period of no-war but not quiet peace until the 2010-2012 post-electoral violence.

Figure 2 presents the spatial distribution of conflict events across the country over the period of analysis. The map shows a high occurrence of conflict events in the western and central regions, and in some regions of in south and the north of the country. The household clusters are also well distributed across the country between conflict-affected provinces and non-conflict affected ones. Moreover, as described in Table 1, there is a significant difference in the average height-for-age z-scores between children living in the vicinity of conflicts sites versus those living farther away from them. The average height-for-age z-scores between the different types of conflict sites is 1.28 showing that children across Côte d'Ivoire are 1.3 standard deviations below the average height-for-age z-score of the international reference child. There are also significant

differences in almost all household characteristics including ethnicity, poverty level, and rural residency. Those variables will serve as controls in the regressions.

3.2. Methods

Drawing on Akresh et al. (2016), and Minoiu and Shemyakina (2014), the following model is specified:

$$HAZ_{ijt} = \beta_1\left(ConflictRegion_j * \text{born during conflict}_t\right) + \theta \boldsymbol{X_{ijt}} + \alpha_j + \delta_t + \lambda_{jt} + \varepsilon_{ijt} \quad (1)$$

For child i (aged 6-60 months), born in region or department j, at time t.

HAZ_{ijt} is the child's height-for-age z-scores, X_{ijt} is a vector of child, mother and household head characteristics, δ_t are birth-cohort fixed effects (year of birth fixed effects). α_j stand for district or province fixed effects, and ε_{ijt} represents the error terms.

Born during conflict is a binary variable for children exposed to the conflict and thus measured in the 2011-2012 survey.

$ConflictRegion$ is a dummy variable for regions or provinces with at least one event of conflict between September 2002 and April 2011[4].

To examine the impact of proximity to conflict event locations on child health, the next equation is estimated:

$$HAZ_{ijt} = \beta_2\left(Proximity75km_j * \text{born during conflict}_t\right) + \theta \boldsymbol{X_{ijt}} + \alpha_j + \delta_t + \lambda_{jt} + \varepsilon_{ijt} \quad (2)$$

Where, $Proximity75km_j$ ($Proximity100km_j$) is a dummy variable taking the value 1 if the child lives in a cluster that is located within 75km or 100 km from a conflict event site. The

[4] The April 2011 cut-off coincides with the end of the hostilities and the arrest of the former president Laurent Gbagbo on April 11, 2011.

term λ_{jt} represents province-year of birth effects (i.e., the interaction of year of birth dummies with provinces fixed effects) to capture pre-existing province trend in cohort health.

The vector of exogenous control variables **X** includes the gender of the child, ethnicity, rural residency, the age and gender of the household head, the mother's education and marital status.

As a robustness check, the sibling sample is used to control for mother fixed effects by estimating the following equation:

$$HAZ_{ijt} = \beta_1\left(Proximity75km_j * \text{born during conflict}_t\right) + \theta \boldsymbol{X_{ijt}} + \partial_m + \delta_t + \lambda_{jt} + \varepsilon_{ijt} \qquad (3)$$

The estimation of equation 3 accounts for the effects of conflict on child nutritional status by exploiting within-sibling variations. Equation 3 controls for observed and unobserved factors that might be correlated with both child health and conflict. Hence, the term ∂_m which represents the characteristics of the mother that are constant across siblings such as mother's education, rural residency, ethnicity and height are included in equation 3.

The models are estimated using the difference-in-difference method. In all specifications, the coefficients of interest, the β_S , are expected to be negative.

4. Empirical Results

4.1. Effect of conflict child health (conflict regions and proximity)

Table 2 presents the results of the difference-in-difference estimations of the impact of conflict on child health as described in equations 1 and 2. The results show consistently a negative association between conflict and child nutritional status (columns 1-6). Conflict reduces child's height-for-age z-scores by 0.33-0.34 standard deviations compared to non-exposed children (columns 1 and 2). The coefficients are statistically significant at 1% and robust even after

controlling for mother and household characteristics as well as province specific-time trends. In addition, the results obtained by measuring the effect of conflict on child height-for-age z-scores using provincial level information (0.3-0.4 lower standard deviations of the international reference child) are similar in size and direction to those of Minoiu and Shemyakina (2014) in the case of Côte d'Ivoire and Akresh et al. (2012) for the Eritrea-Ethiopian conflict.

Looking at the proximity to conflict locations, children within 75 km of conflict event locations have 0.30 lower standard deviations in their long-term nutritional status compared to those living farther away from conflict event sites with statistically significant coefficients at 5% (columns 3 and 4). In columns 5 and 6, the distance between household clusters and conflict locations increases to 100 km. Results are still consistent as children in close proximity to conflict events suffer more health setbacks than those living more than 100 km away from conflict event sites. The coefficients are statistically significant at conventional levels. Furthermore, compared to the results obtained at the imprecise provincial level (columns 1 and 2), the results using distance to the conflict sites show a much lower impact when the nearness to conflict sites is within 75km (columns 3 and 4) than when the proximity to the conflict is within 100km (column 5 and 6). Table 2 also shows that the effect of proximity to conflict events increases with distance to the conflict sites. The effect is lower when the distance is 75 km rather than 100km. This seems counterintuive. One might expect that the closeness to conflict event sites will lead to a much bigger impact of conflict on child health. For instance, Akresh et al. (2016) considered distances between villages and three conflict sites at the Ethiopian-Eritrean border and found that the negative impact of conflict falls as distance from conflict locations increases. One possible explanation for the counterintuitive result obtained in the current study is that being far away from conflict events

might delay or prevent children from receiving much needed humanitarian assistance (Goldschmidt and Kumar, 2016; Olympio, Burgess, and Kaufman, 2006).

4.2. Robustness checks

4.2.1. Effect of conflict on child health (mother fixed effects regressions)

As a first robustness check of the results obtained in Table 2, estimations with mother fixed effects are performed. These estimations account for the child's mother characteristics that do not vary across siblings using the sample of households with more than one child under 5. As shown in Table 3, the impact of conflict on child health is still negative and the results are significant at conventional levels (columns 1, 2, and 3).

4.2.2. Placebo analysis

One crucial assumption for the difference-in-difference estimations to be valid is to verify that children living in treated and controlled regions, or those living in close proximity of the conflict sites versus those living farther away from the conflict locations would have experienced similar health patterns absent the conflict. It is also known as the parallel trend assumption. To test this assumption, the Côte d'Ivoire 1994 DHS which also contains information on provinces and the geo-localization of household clusters is used. Since the conflict dataset report GPS information on conflicts events in the country from January 1997 onwards, I use the 1994 and 1998-1999 DHS surveys and conduct a placebo test. Here, children born during conflict are those born between 1997 and 1999. According to Table 4, conflict has no effect on child health. Hence, the effects obtained in Table 2 are driven by proximity to conflict events occurring during the 2002-2011 period of instability.

4.2.3. Heterogeneity by gender

The results so far have shown that conflict negatively impact child health. However, shocks might adversely affect girls more than boys (Alderman and Gertler, 1997; Maccini and Yang, 2009; Rose, 1999; Cogneau and Jedwab, 2012). This hypothesis is tested in Table 5. According to Table 5 the impact of conflict on child health is statistically significant and negative but there is no heterogeneity by gender as evidenced by the triple interaction between conflict proximity, child period of birth and gender status (columns 1 and 2). These results are in line with past studies on the differential impact of conflict on children by gender (Minoiu and Shemyakina, 2014; Akresh et al., 2012)

4.2.4. Migration, Fertility, Mortality

Migration, mortality, and fertility patterns may undermine the validity of the relationship between conflict and child health. For instance, if children in affluent households move from conflict to non-conflict areas, the impact of the conflict will be overestimated. However, if poor children move from conflict to non-conflict areas, the impact of the conflict will be underestimated. Previous studies (La Mattina, 2017; Minoiu and Shemyakina 2014; Akresh et al., 2012) used the migration history of households and defined a binary variable of migrants versus non-migrants (those who have lived continuously in their current place of residence since before or at the start of the shock) and estimated separately their models for the full population and the sub-sample of non-migrants. They then tested whether the effect of the shock on child health is statistically different by migration status. This approach could not be implemented in this paper because the surveys do not provide information on the child entire migration history.

Nonetheless, the 2011-2012 Côte d'Ivoire DHS survey asked the mothers about how many times they spent a night or more outside of their home in the 12 months preceding the survey. Since this survey was conducted between December 2011 and May 2012, and the conflict under consideration ended in April 2011, non-migrant households (those who never spent a night outside their home) would fall pretty much within the conflict timeframe. I use this information and follow an approach similar to Baez (2011) and run regressions models of the migration status in the 2011-2012 DHS survey on conflict variable, child, mothers and household head characteristics including some time-invariant socio-demographic variables (i.e. proxies of pre-shock conditions). The results in Table 6 show that conflict has no effect on the migration status. This suggests that population migration is not a source of major concern. The surveys also contain information on those who lived at their current place of residence at the time of the interview. I also run regressions using this subsample. As show in Table 7 the results are robust to the place of residence at the time of the survey.

Endogenous fertility and mortality due to sex-selective behaviour of the mothers can affect the results if there is a systematic correlation between mothers' characteristics and their fertility decisions, which can influence child outcomes or sex ratios. To deal with these issues, I regress sex ratios by province and year-of-birth conditional on non-missing information on the child gender and current residence as in Minoiu and Shemyakina (2014). The sex is ratios are defined as the ratio of boys to girls in the pool surveys. According to Table 8 there is no systematic difference in sex ratios by proximity to conflict event locations. Similar results are found by comparing the characteristics of women based on their proximity to conflict and whether they had children during conflict (Akresh et al., 2012). Table 9 shows little evidence of a systematic

difference in women characteristics by proximity to conflict events locations in almost all the regressions.

5. Mechanisms

The results presented in the previous sections show that conflict and proximity to conflict event locations negatively affect child health. However, understanding how this happens has important policy implications, especially in order to design possible attenuating interventions. Bundervoet, Verwimp, and Akresh (2009) suggest that conflict might prevent access to food aid from the international community. They also claim that population displacement might be another explanatory factor through which conflict impacted children in Burundi although they did not have household level information on conflict-induced displacement. For Rwanda, Akresh, Verwimp, and Bundervoet (2011) argue that the destruction of economic assets, the theft of livestock, or the burning of crops could be possible mechanisms through which conflict affects child health. Minoiu and Shemyakina (2014) used the 2008 Côte d'Ivoire household survey in their study of the effect of the 2002-2007 Ivorian conflict on child health. A major advantage of this post-conflict household survey is that it contained information about war-related victimization such as the loss of economic assets, health impairment, displacement and violence. They showed that conflict-induced victimization in the form of economic losses has a statistically significant effect on child health and therefore can be an important mechanism through which the conflict impacted child health.

Unfortunately, the 2011-2012 DHS survey used for the post-conflict period in this paper did not contain household level information on conflict-induced victimization. This paper rather uses other mediating factors suggested by Akresh et al. (2016) such as maternal stressors and the disruptions of health care services. The results from Table 10 show that proximity to conflict sites

increases women stress as indicated by the duration of postpartum amenorrhea by 1.7-1.9 months (columns 1 and 2). Similarly, proximity to conflict events sites increases the likelihood of the child having diarrhea (columns 3 and 4). Also, proximity to conflict events locations affects child nutrition by reducing the likelihood for children to have access to baby formula. This later result is highly plausible because during the post-electoral crisis displacement and access to health care services were highly restricted.

6. Conclusion

This study has examined the impact of the 2002-2011 protracted civil conflict in Côte d'Ivoire on child welfare using the 1998-1999 and 2011-2012 DHS as well as geographical information on the exact timing and location of conflict events. The evidence shows a strong negative effect of proximity to conflict on child long-term health status. Child height-for-age z-scores decreases by 0.3-0.4 standard deviations. Moreover, the effect of conflict on child welfare increases with distance to conflict events sites. One possible explanation might be the lack of coordination or the delay in the delivery of conflict-mitigating humanitarian aid. The study did not find any gender-based differential impact of conflict on children. The negative impact of conflict on child health measured at the provincial level is similar to the results of Akresh et al. (2012) for Ethiopian-Eritrean conflict and Minoiu and Shemyakina (2014) for Côte d'Ivoire using different datasets.

Previous studies have proposed many channels through which conflict negatively affects child welfare including household idiosyncratic shocks such as illness of the parents, a sudden loss of household income, displacement, looting, loss of assets and the death of the breadwinner. Others have considered the impact of non-conflict related shocks on child welfare such as drought or climate change. Still others have documented the prevalence of disease, poor infrastructure or the destruction of health infrastructure as possible vehicles for the impact of conflict on child health (Minoiu and Shemyakina, 2014). This study has suggested as in Akresh and al. (2016) that disruptions of health care services and maternal stress are possible mediating factors of the impact of conflict on children. However, the main of contribution of this study to the growing literature on the impact of early life shocks on children wellbeing is to offer more precise estimates of the effect of conflict on child long-term health using GPS information available in household surveys and administrative data from Côte d'Ivoire.

Although this study presents some advantage over much broader regional or village level estimation of the effect of conflict on child health, it did not compare conflict and non-conflict related shocks or analyse in more detail households coping mechanisms during conflict. It would also be interesting to examine the effect of conflict at difference stages of life using geographical information. These issues will be investigated in future work as more data become available.

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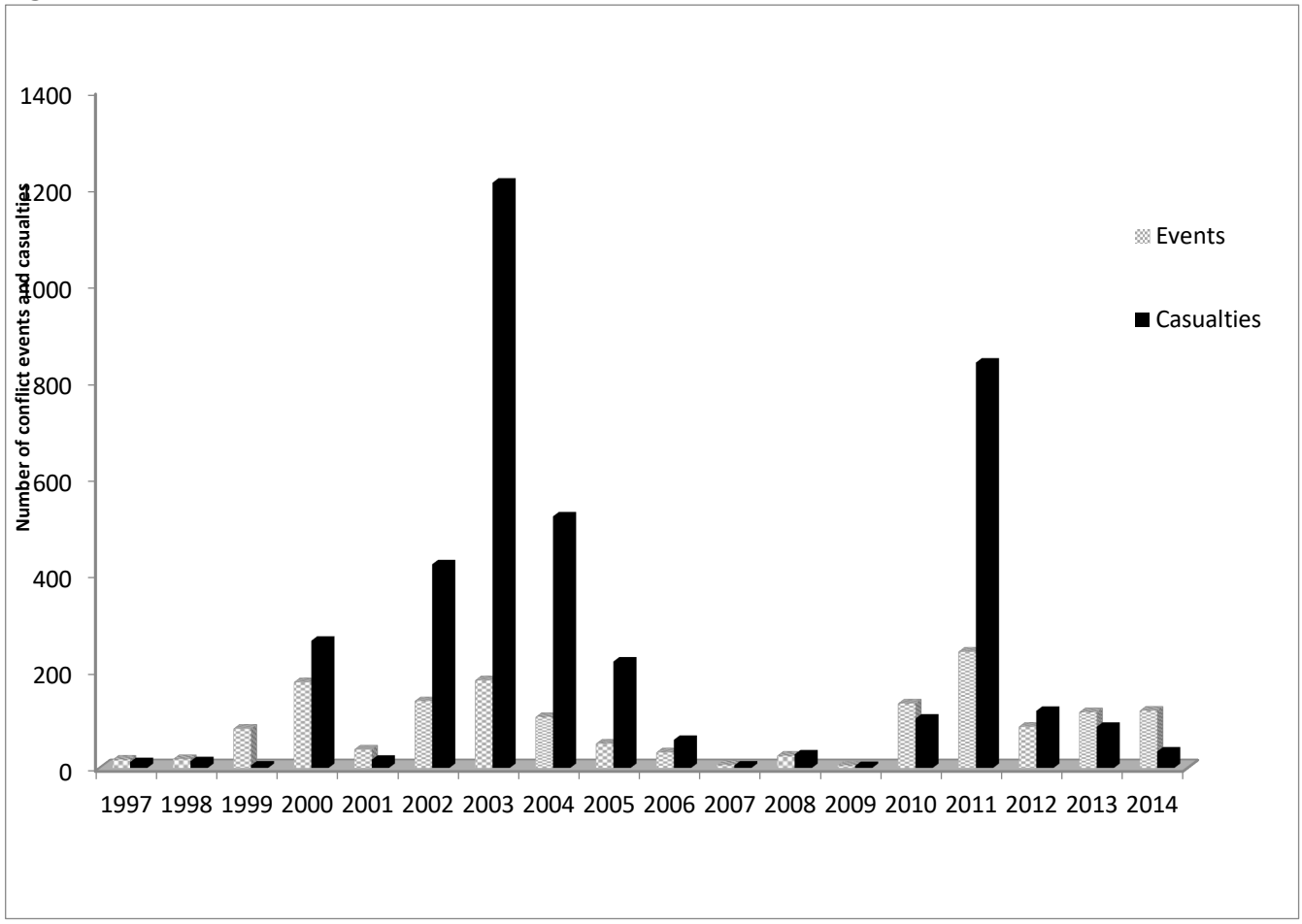
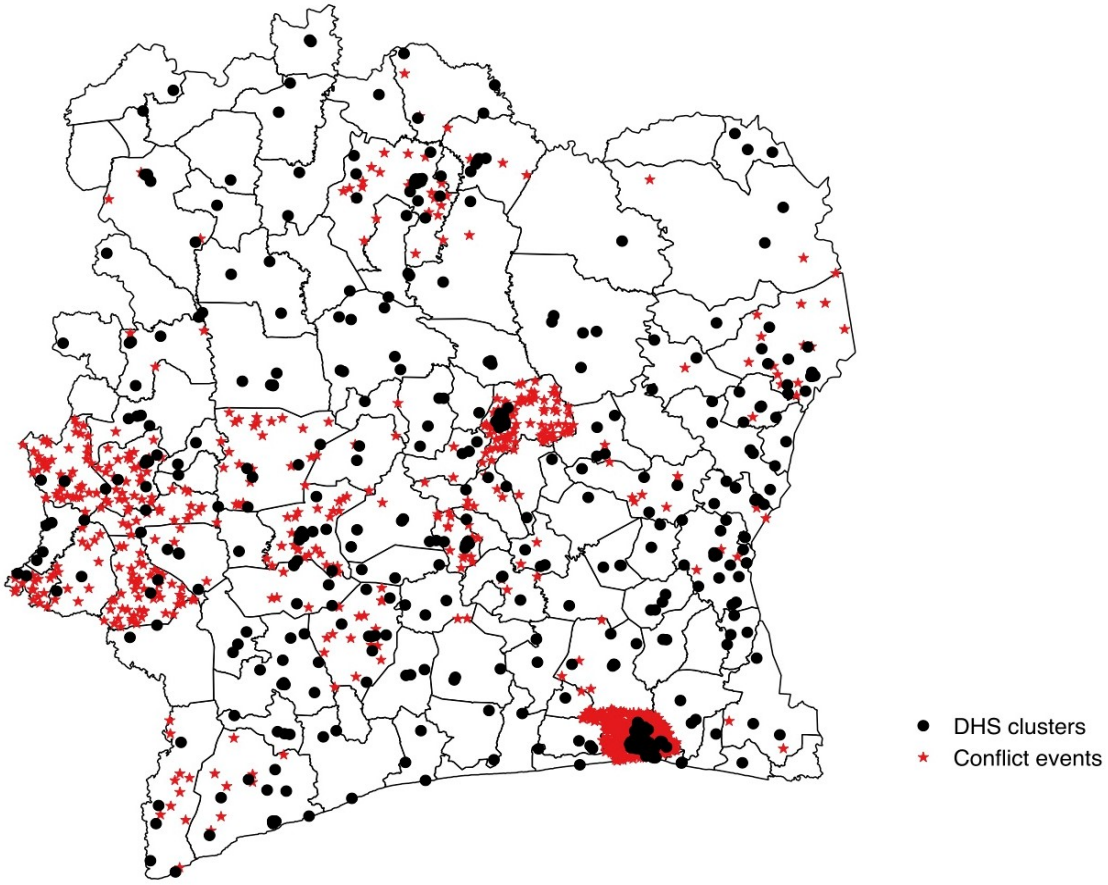
Figure 1: Conflict events and casualties



Source: Author's calculation based on ACLED (2010)

Figure 2: Map of conflict events in Côte d'Ivoire, September 2002-April 2011



Notes: constructed by the author using QGIS 2.3
Data sources: 1998-1999 and 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)

Table 1: Summary statistics

	Near conflict events (1)	Not near conflict events (2)	Difference (2)-(1)
Child characteristics			
Height-for-age Z-score	-1.202	-1.373	-0.171*
Child is male	0.503	0.496	-0.007
Child age in years	1.885	1.909	0.024
Household characteristics			
Household head is male	0.851	0.886	0.035***
Household head age	44.385	44.282	-0.103
Poor households	0.478	0.789	0.311***
Rural residency	0.571	0.883	0.312***
Mother has some education	0.361	0.155	-0.206***
Mother is married	0.588	0.680	0.092***
Mother's height in cm	159.178	158.759	-0.419
Number of children under 5	2.198	2.879	0.681***
Ethnicity			
Akan	0.274	0.171	-0.103***
Krou	0.079	0.004	-0.075***
Northern Mandé	0.150	0.243	0.092***
Southern Mandé	0.101	0.008	-0.093***
Voltaiques	0.162	0.405	0.243***
others	0.233	0.169	-0.064***

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. "Near conflict events" refers to children who live within 75 km from any conflict events. "Not near conflict events" refers to children living more than 75 km away from the conflict events.
Using assets available across the two surveys such as access to Radio, TV, Fridge, Bicycle, Motorcycle, Car, Toilet and Finished floor an asset index is built with principal component analysis. The wealth quintiles range from 1 to 5, where 1 is the poorest quintile and 5 is the wealthiest. The wealth index is recode as binary variable – poor or not poor – so that poor households are those leaving in the lowest two quintiles.
The conflict period under consideration runs from September 2002 to April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)

Table 2: Impact of conflict on child health

	(1)	(2)	(3)	(4)	(5)	(6)
Conflict regions*born during conflict	-0.340***	-0.327***				
	(0.119)	(0.119)				
Proximity 75km*born during conflict			-0.289**	-0.296**		
			(0.122)	(0.120)		
Proximity 100km*born during conflict					-0.353**	-0.361***
					(0.139)	(0.136)
Mother's controls	No	Yes	No	Yes	No	Yes
Household head controls	No	Yes	No	Yes	No	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4416	4388	4416	4388	4416	4388
R-squared	0.159	0.170	0.158	0.170	0.159	0.171

Notes: The dependent variable is height-for-age z-scores. Robust standard errors are in parentheses, clustered at the DHS cluster level. All regressions include province fixed effects, province specific trends, child's year of birth fixed effects and child's gender. Household head controls include age and sex of the head of the household head. Mother's controls include marital status, rural residency, education (a dummy for having some education) and ethnicity (Akan, Krou, Northern mandé, Southern mandé, Voltaiques and others (the excluded category)).
The conflict period under consideration runs from September 2002 to April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)
* significant at 10%, ** significant at 5%, *** significant at 1%

Table 3: Impact of conflict on child health using sibling sample

	(1)	(2)	(3)
Conflict regions*born during Conflict	-0.319**		
	(0.136)		
Proximity 75km*born during conflict		-0.307**	
		(0.144)	
Proximity 100km*born during conflict			-0.332*
			(0.169)
Mother fixed effects	Yes	Yes	Yes
Province fixed effects	No	No	No
Year of birth fixed effects	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes
Observations	3175	3175	3175
R-squared	0.226	0.226	0.226

Notes: The dependent variable is height-for-age z-score. Robust standard errors are in parentheses, clustered at the DHS cluster level. All regressions include province specific trends, child's year of birth fixed effects and child's gender. Mother's time invariant characteristics used in the mother fixed effects regressions are mother's education (a dummy for having some education), rural residency, height and ethnicity (Akan, Krou, Northern mandé, Southern mandé, Voltaiques and others (the excluded category)). The conflict period under consideration runs from September 2002 to April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)
* significant at 10%, ** significant at 5%, *** significant at 1%

Table 4: Placebo effects of conflict on child health

	(1)	(2)	(3)	(4)	(5)	(6)
Conflict regions*born during Conflict	0.119	0.081				
	(0.239)	(0.242)				
Proximity 75km*born during conflict			0.120	0.064		
			(0.234)	(0.230)		
Proximity 100km*born during conflict					0.029	-0.007
					(0.280)	(0.292)
Mother's control	No	Yes	No	Yes	No	Yes
Household head control	No	Yes	No	Yes	No	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4803	4779	4803	4779	4803	4779
R-squared	0.151	0.164	0.151	0.164	0.151	0.164

Notes: The dependent variable is height-for-age z-scores. Robust standard errors are in parentheses, clustered at the DHS cluster level. All regressions include province fixed effects, province specific trends, child's year of birth fixed effects and child's gender. Household head controls include age and sex of the head of the household head. Mother's controls include marital status, rural residency, education (a dummy for having some education) and ethnicity (Akan, Krou, Northern mandé, Southern mandé, Voltaiques and others (the excluded category)).
The conflict period under consideration runs from January 1997 to December 1999. Data sources: 1994, 1998-1999 Côte d'Ivoire DHS, and ACLED (2010)
* significant at 10%, ** significant at 5%, *** significant at 1%

Table 5: Impact of conflict on child health by gender

	(1)	(2)
Proximity 75km*born during conflict	-0.236*	
	(0.129)	
Proximity 75km*born during conflict*Male	-0.127	
	(0.094)	
Proximity 100km*born during conflict		-0.312**
		(0.143)
Proximity 100km*born during conflict*Male		-0.105
		(0.096)
Mother's controls	Yes	Yes
Household head controls	Yes	Yes
Province fixed effects	Yes	Yes
Year of birth fixed effects	Yes	Yes
Province specific trends	Yes	Yes
Observations	4388	4388
R-squared	0.171	0.171

Notes: see notes in Table 2.

Table 6: Effects of conflict on the likelihood of migration

	(1)	(2)
Proximity 75km*born during conflict	-0.081	-0.091
	(0.107)	(0.086)
born during conflict	0.444***	0.331***
	(0.103)	(0.084)
Proximity 75km	-0.045	0.043
	(0.101)	(0.080)
Child is male		0.010
		(0.009)
Rural residency		0.098***
		(0.021)
Mother has some education		-0.108***
		(0.015)
Household head is male		-0.012
		(0.020)
Akan		0.020
		(0.024)
Krou		-0.145***
		(0.036)
Northern Mandé		0.016
		(0.025)
Southern Mandé		-0.143***
		(0.042)
Voltaiques		0.032
		(0.027)
constant	0.314**	-0.055
	(0.099)	(0.097)
Mother Year of birth fixed effects	No	Yes
Mother Month of birth fixed effects	No	Yes
Observations	9004	8997
R-squared	0.130	0.232

Notes: The dependent variable is migration (more than one trip in the past 12 months using the 2011-2012 DHS survey). Robust standard errors are in parentheses, clustered at the DHS cluster level. The conflict period under consideration runs from September 2002 to April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)

* significant at 10%, ** significant at 5%, *** significant at 1%

Table 7: Impact of conflict on child health using residency at the time of the survey sample

	(1)	(2)	(3)	(4)	(5)	(6)
Conflict regions*born during conflict	-0.334**	-0.321***				
	(0.121)	(0.121)				
Proximity 75km*born during conflict			-0.295**	-0.304**		
			(0.123)	(0.120)		
Proximity 100km*born during conflict					-0.354**	-0.363***
					(0.140)	(0.137)
Mother's controls	No	Yes	No	Yes	No	Yes
Household head controls	No	Yes	No	Yes	No	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4246	4219	4246	4219	4246	4219
R-squared	0.161	0.175	0.161	0.175	0.161	0.175

Notes: see notes in Table 2.

Table 8: Effects of conflict on sex ratios

	(1)	(2)	(3)	(4)
Proximity 75km*born during conflict	-0.088	-0.052	-0.091*	-0.013
	(0.055)	(0.054)	(0.052)	(0.042)
born during conflict	0.097*	0.067	0.094*	0.030
	(0.054)	(0.053)	(0.052)	(0.046)
Proximity 75km	0.066	0.015	0.070	-0.029
	(0.051)	(0.057)	(0.047)	(0.045)
Province fixed effects	No	Yes	No	Yes
Year of birth fixed effects	No	No	Yes	Yes
Province-specifics trends	No	No	No	Yes
Observations	7273	7095	7273	7095
R-squared	0.001	0.031	0.006	0.049

Notes: The dependent variable is the sex ratio and defined as the ratio of girls to boys. Robust standard errors are in parentheses, clustered at the DHS cluster level. The conflict period under consideration runs from September 2002 to April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)

* significant at 10%, ** significant at 5%, *** significant at 1%

Table 9: Effects of conflict on mother and household characteristics

	Number of children ever born	Mother's height	Mother's age	Mother has some education	Household head age	Household head is male
	(1)	(2)	(3)	(4)	(5)	(6)
Proximity 75km*born during conflict	0.431	-2.426	1.062	-0.135***	0.407	0.031
	(0.403)	(9.341)	(0.815)	(0.040)	(1.933)	(0.045)
born during conflict	-0.176	-2.351	0.352	0.089**	-1.095	-0.022
	(0.397)	(9.004)	(0.790)	(0.035)	(1.870)	(0.044)
Proximity 75km	-0.470	5.458	-0.818	0.291***	-0.150	-0.055
	(0.371)	(8.603)	(0.719)	(0.032)	(1.665)	(0.040)
constant	4.144***	1588.811***	28.524***	0.100***	44.974***	0.900***
	(0.367)	(8.496)	(0.701)	(0.028)	(1.616)	(0.039)
Observations	9002	5469	9004	9004	8953	9004
R-squared	0.003	0.002	0.009	0.017	0.001	0.001

Notes: Robust standard errors are in parentheses, clustered at the enumeration level. The conflict period under consideration runs from September 2002 to April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)

* significant at 10%, ** significant at 5%, *** significant at 1%

Table 10: Impact of conflict on child health (possible mediating factors)

	Duration of Postpartum Amenorrhea (in months)		Child had diarrhea in the past two weeks		Access to baby formula		Hospital Delivery	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proximity 75km*born during conflict	1.666***		0.072***		-0.025**		-0.032	
	(0.292)		(0.020)		(0.011)		(0.029)	
Proximity 100km*born during conflict		1.869***		0.068***		-0.029**		-0.042
		(0.264)		(0.023)		(0.012)		(0.029)
Mother's controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household head controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province specific trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	6784	6784	7601	7601	5337	5337	8728	8728
R-squared	0.107	0.107	0.064	0.063	0.126	0.126	0.249	0.249

Robust standard errors are in parentheses, clustered at the DHS cluster level. All regressions include province fixed effects, province specific trends, child's year of birth fixed effects and child's gender. Household head controls include age and sex of the head of the household head. Mother's controls include marital status, rural residency, education (a dummy for having some education) and ethnicity (Akan, Krou, Northern mandé, Southern mandé, Voltaiques and others (the excluded category)).
The conflict period under consideration run from September 2002 and April 2011. Data sources: 1998-1999, 2011-2012 Côte d'Ivoire DHS, and ACLED (2010)
* significant at 10%, ** significant at 5%, *** significant at 1%