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Armed Conflict and Children's School/Work Time Allocation: Evidence from Côte d'Ivoire

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Abstract

This paper examines the relationship between armed conflict and school/work time allocation for children aged 10 to 14 years. The paper uses household level data from Côte d'Ivoire combined with information on the exact location and date of conflict events. The identification strategy uses the specific numbers of conflict events across "départements" and self-reported victim status indicators at the individual level to measure children's exposure to the conflict. Based on a bivariate probit model, which has the advantage of considering the simultaneity of decisions in school and work, and, controlling for the individual and household characteristics that determine household choices in schooling and in child labor, my results suggest that individuals from "départements" more affected by the conflict have higher probability of being involved in economic activities and lower probability of being enrolled in school. I further examine possible war impact mechanisms using a victim status indicator at the household level. The results suggest that conflict-related household victim status is an important channel through which armed conflict negatively affects the allocation of the children's' time.

Keywords

Civil conflict, Child Labor, Education, Bivariate Probit, Côte d'Ivoire

JEL Codes

I25, J24, O10, C35.

1 Introduction

The dynamics of internal conflicts impose direct and indirect shocks on civilian populations during the conflict, and for years thereafter. Loss of human life, destruction of property, asset depletion, drops in agricultural production, human capital losses, and a weakening of insurance mechanisms are, among others, the transmission channels by which these violent shocks are likely to affect incomes (Brück, 2004; Justino and Verwimp, 2013; Shemyakina, 2011). They also create long-term consequences through their impact on the economy, on infrastructure, and on households' decisions especially those whose livelihoods have been directly affected. Also, households who are not directly affected may face short-and long-term economic costs such as increased transaction costs, reduced demand for market goods, uncertainty, and other effects (Naufal et al., 2019). Household responses to the consequences of these violent conflicts to protect family consumption consist of a wide range of creative coping strategies which include forced migration, drawing down liquid assets held by the household, taking loans, asking for assistance from members of informal insurance networks, and intra-household re-allocation of labor (Justino, 2009). The latter includes the use of children as risk-coping instruments. Such household responses to the post-conflict situation can affect children's time allocation.

The literature suggests several possible ways in which war can affect children's time allocation between work and school. Firstly, exposure to conflict often unexpectedly reduces the financial resources available to households, and forces them to focus on their daily survival rather than their future well-being. In such a situation of reduced income, children's schooling is not the household's only choice (Shemyakina, 2011). Using the children's productive capacity is an option (Grootaert, 1998; Basu and Van, 1998). Children who are needed to contribute to family income may be removed from school to save on costs, and sent to work to help the household mitigate the negative consequences of conflict on consumption. They are involved in the labor market, in home-based businesses, or as substitutes for parents in doing household chores. Secondly, children whose schools are destroyed during war have to attend different schools or interrupt their education (Glewwe and Jacoby, 1994). In the case of school destruction, an overcrowding of the school facilities is implied, which, in turn may negatively affect returns to education. This consequence plays a large role in households' decisions and can lead to the interruption of children's education by redistributing their resources away from investments with lower returns. In the case of parental substitution, the destruction of industries, infrastructure and the scarcity of job opportunities for skilled labor in conflict-affected areas can lead household to interrupt children's schooling. The problem, however, is that children who leave school temporarily may be less likely to subsequently return to school. When they are used as a form of economic security mechanism in post-conflict situations, it may lead to a permanent effect on the children's human capital development and future earnings.

This study explores the role that war plays in the school/work tradeoff, and to what extent, if any, child labor displaces schooling. Using household data from Côte d'Ivoire, we consider that school and work are two forms of allocation of children's time. School is aimed at human capital formation, the ultimate goal of which is to improve productivity and income in adulthood. Work is the use of children's time for the immediate productive needs of the household. The key issue is the extent of trade-off between these two forms of time allocation given the post conflict context.

Firstly, I believe that Côte d'Ivoire provides an optimal setting for such a study, given that it suffered from a long internal conflict between 2002-2007. The violent attacks during this period affected the State armed forces and national infrastructure, but also the civil population sector

through homicides, kidnaps, population displacement, and forced recruitment. All these actions against civilians could have changed households' decisions, one of which is human capital accumulation. Prior to the outbreak of the rebellion in 2002, the United Nations Education, Scientific and Cultural Organization (UNESCO) reported that the net enrollment rate in primary education was 58.3% in 1997; this ratio increased in 2001 to reach 64.19%. Furthermore, according to National Statistics Institute (NSI), child labor increased significantly during this period, it was 20.32% in 2002 (NSI, 2002), 22% in 2005 according to the national child labor survey (ENTE, 2005), and 28,2% in 2013 according to the national survey on the state of employment and child labor (ENSETTE, 2013). Secondly, unlike previous studies which separately analyze the effect of war on investment decisions in education on the one hand and on child labor on the other, my study considers the interrelated nature of decisions about school and work. I combine 2 sets of data. The first is drawn from the 2008 household survey data and provides rich information on households and their investment decisions on education and child employment. The second contains reports on armed conflict events at the *département* level in Côte d'Ivoire between 2002 and 2007 drawn from a separate dataset to identify the population groups that were most affected by the conflict. With this information, we are able to analyze, using a bivariate probit model, how exposure to conflict and violent events leads households to allocate children's time between school and work. Thirdly, I take advantage of the household experiences during the war to construct a measure of conflict-related household victim status from the 2008 post-conflict survey. This measure will allow me to examine the idiosyncratic effect of violent conflict on children's time allocation.

The 2002–2007 conflict in Côte d'Ivoire was a relatively low-intensity but highly disruptive conflict. During this period, access to basic public services such as electricity and water, health clinics, and schools was severely impaired¹. According to [Sany \(2010\)](#), school was limited for many children. It was estimated in 2004 that as many as 700,000 children had been out of school since the beginning of the crisis, and that 80% of government-paid teachers had abandoned their posts in the northern and western parts of the country. Access to basic services in southern zones became overheated due to the massive displacements caused by the civil war². For instance, school infrastructures such as schools in the south were burdened with the large numbers of IDP children (internally displaced people) who had fled the violence in the north to continue their education in the southern school system. This overcrowding probably shaped schooling decisions and influenced school drop-out by children. In addition, the Ivorian civil war was marked by a serious economic impact at the household level, such as the loss of jobs, livestock, and farms. According to the Côte d'Ivoire National Statistics Institute, about 28.4% of the affected population lost their economic activities, and 4.4% lost their jobs. Deaths were also reported in some households. GDP growth was negative between 2002 and 2007 (on average -1.5%) with a poverty rate that has rose sharply, and there was a significant portion of the population living below the poverty line of 2 dollars per person per day³.

Building on this background, the objective of this study is to highlight the effects of exposure to the 2002- 2007 civil conflict on the allocation of children's time. Two outcomes of interest were used: school enrolment and child labor. School enrolment is defined as the probability of

¹ 50% of school-age children were deprived of education by 2004 ([Sany, 2010](#))

² This displacement concerned globally about 7% of the population (National Institute of Statistics report, 2008)

³ World Bank (2010)

being enrolled in school for school-age youth. Child labor is defined as all work performed by a child (i.e. participation in economic activities) if he/she is engaged in paid or unpaid work, inside or outside the household during the last week or last twelve months preceding the survey. The data analyzed are based on the ACLED data and the 2008 Côte d'Ivoire Households Living Standard Surveys (HLSS) data, also known as “*Enquête sur le Niveau de Vie des Ménages (ENV)*”. After data processing, the sample used for this analysis is made up of 6,207 children aged from 10 to 14 years old in 2008 living in 4,161 households across 58 *départements* of Côte d'Ivoire. It is worth mentioning that the 2008 post-conflict data, collected shortly after the end of the war, only captures the short-term impact of the conflict. My results based on the bivariate probit model show that the Ivorian civil conflict had a strong negative impact on children's time allocation. Indeed, the results show that exposure to war increased the incidence of the child labor and decreased school enrolment. The results are robust to household composition and area of residence.

The remainder of the paper is organized as follows: Section 2 presents the literature review and describe the historical context of the Ivorian conflict. Section 3 presents the data and the estimation strategy, and the results and robustness checks are presented in section 4. Section 5 conclude.

2 Literature review and historical background

2.1 Literature review

In this paper, we examine the role of civil war on a household's decision regarding school attendance and work. The previous literature only provides separate analysis on this relationship. The empirical evidence on the effect of civil war on children's schooling is mixed in the literature. According to some studies, conflict has a low impact on schooling ([Chen et al., \(2008\)](#)). Other studies highlight the long-term negative effects of violent conflict on school enrolment, school achievement, and on school dropout rates ([Di Maio and Nandi, 2013](#)). Several studies, dealing with the impact of civil war on education (especially schooling) combine household survey data with GIS-based data on conflict intensity, and adopting either a difference-in-differences (DID) or instrumental variables (IV) approach ([Arcand and Wouabe, 2009](#)).

Among the studies which have previously analyzed the role of civil war on education is [Akresh and de Walque \(2008\)](#). They consider the impact of the 1994 Rwandan genocide on the educational outcomes of different cohorts of Rwandan children. Using a DID approach, they find that children exposed to the genocide experienced a drop in educational achievement of almost a half-year of completed schooling, and were 15% less likely to complete the third or fourth grade. In Guatemala, [Chamarbagwala and Morán \(2011\)](#) combine household survey data from 2002 and the distribution of the number of human rights violations and victims to examine the impact of civil war. Their results suggest civil war had a strong negative impact on the education of indigenous children exposed to the war during their school-age. Similarly, [Dabalen and Paul \(2012\)](#) consider the impact of the conflict in Côte d'Ivoire during the 2002-2007 period on school enrollment using a DID approach. Using the Household Living Standards Survey (HLSS) data collected in 2008 and the data on local incidences of conflict taken from the Armed Conflict Location and Event Database (ACLED), they find that exposure to war is associated with decreased education accumulation for individuals of primary school age during conflict.

In Colombia, [Rodríguez and Sánchez \(2012\)](#) use a combination of household and violence data sets and a duration analysis methodology to estimate the effect that exposure to armed conflict has on school drop-out decisions of Colombian children. They find that armed conflict reduces the average years of schooling by 8.78%.

Regarding the relationship between civil war and child labor, the literature is less abundant. Existing empirical studies that examine armed conflict and child labor ([Naufal et al., 2019](#); [Di Maio and Nandi, 2013](#); [Rodríguez and Sánchez, 2012](#)) use the number of deaths, the number of attacks on infrastructure or the closure of border crossings as proxies for conflict intensity. [Naufal et al. \(2019\)](#) consider the impact of armed conflict in Iraq on child labor using household survey data and DID approach. They find that armed conflict is positively associated with economic activities which could be as child labor. [Di Maio and Nandi \(2013\)](#) examine the impact of changes in the local labor market and in the Israeli-Palestine conflict on child labor and school attendance for Palestinian children aged 10-14. Using 2 separate probit models, they observe that an increase in market wage increases child labor. They also find that increases in the military restrictions imposed by Israel increases child labor, and modifies the relationship between market wage and child labor. [Rodríguez and Sánchez \(2012\)](#) find that conflict in Colombia increased child labor by inducing children to drop out of school and enter the labor market early.

As far as I am aware, there are no studies which have analyzed the effect of armed conflict on the simultaneous choice of households regarding schooling and work. However, the deterioration in household living conditions resulting from exposure to civil war forces many households to focus on their daily survival rather than their future well-being. Thus, a trade-off emerges between school attendance and work, or a combination of both activities, due to financial difficulties. [Maitra and Ray \(2002\)](#) show that if children combine work and school, they contribute on average about 20% of household income. This contribution is about 30% of income if children are sent only to the work.

2.2 Historical background

For almost two decades after its independence, Côte d'Ivoire experienced unprecedented economic prosperity due to sound economic management, improved trade relationships with the developed countries (particularly Western Europe), effective development of the cocoa and coffee industries, and an ethnically inclusive political system. During these 2 decades, between 1960 and 1980, the country maintained strong and sustained economic growth of more than 7% per annum and over the same period, average GDP per capita was about \$1,330 (in 2005 US dollars), nearly 6.3% of GDP per capita of the United States. Strongly dependent on primary commodities such as cocoa and coffee (more than 50% of total exports in 2000), the Ivorian economy faced its first difficulties with the deterioration of the terms of trade which lead an abrupt and lengthy decline in the 1980s ([Bogetic et al., 2007](#)). The fall in the price of cocoa and coffee in the 1980s exacerbated poverty in the country, and lead to an increase in poverty in the poorest regions of the north rising from 25.6% to 56.9% in this period. By the time the country devalued its currency in 1994, its 10-year average GDP growth had fallen to 0.50%.

This situation changed after the death of long-standing President Felix Houphouët-Boigny in 1993 with the advent of the first coups d'état in the 1990s, including the first military coup in December 1999 which caused a deep socio-political crisis. In September 2002, there was another attempt at a military coup, whose roots can be traced back to widespread discontent

over land ownership and nationality laws since in the 1990s⁴. The scarcity of employment opportunities due to the decline of the economy had led landowners in the south to demand the return of their land. Multiple attacks in several cities, including Abidjan in the south, Bouaké in the centre and *Korhogo* in the north, were carried out by rebel forces mainly representing the Muslim regions in the north of the country. This action split the country into two, each controlled by rivals. The central, northern, and western parts of the country were under the control of rebel forces⁵ and government control was restricted to the southern part. A buffer zone, manned by 8,000 UN troops (UNOCI) and 4,000 troops from the French Licorne forces, was established along the frontline which reduced the attacks from both sides. From that moment the country entered a period of neither peace and nor war in which several mediations were undertaken. In 2007, the protagonists signed an agreement in Ouagadougou (Burkina Faso) for the formation of a new government incorporating the main political actors in the country, including the rebels. This agreement also included the participation of all political actors in the next presidential elections. The agreement was intended to bring an end to the war and lead to free and fair elections. In 2007, the protagonists signed an agreement in Ouagadougou (Burkina Faso) for the formation of a new government incorporating the main political actors in the country, including the rebels. This agreement also included the participation of all political actors in the next presidential elections. The agreement was intended to bring an end to the war and lead to free and fair elections.

The peace process negotiated and signed in 2007 in Ouagadougou resulted in a power-sharing agreement between the government and the rebel forces and this enabled the official end to the conflict. The economic, social, and political implications of these peace agreements made possible the return of the administration to the north, the economic and school activity recovery in affected regions, thanks to implementation of the Disarmament, Demobilization and Reintegration (DDR) and, the organization of elections at the nearest feasible date. All these consequences related to civil war could have led households to change their consumption behavior and therefore, adopt solutions that involve family workforce including child labor.

3 Data, descriptive statistics and methods

3.1 Data

Two types of data are used in this study: the first is a household living standards survey, also known as *Enquête sur le Niveau de Vie des Ménages (ENV)*. It was administered jointly by the Côte d'Ivoire National Institute of Statistics and the World Bank between June and August 2008. The ENV 2008 is a representative survey that contains characteristics for every person in a household. It covers all the socio-economic aspects of each individual in a household living in Côte d'Ivoire. The ENV 2008 was specifically designed to evaluate the welfare impact of war on individuals and households. The second type of data is a conflict events data from the

⁴ In particular the new Electoral Code restricted the right to vote, affecting the large population of foreign origin living on the territory of Côte d'Ivoire and presidential candidacy nominations to only Ivorian nationals with complete Ivoirian parenthood.

⁵ Called Forces Armées des Forces Nouvelles consisted of a coalition of four former rebel groups

Armed Conflict Location Events Data (ACLED)⁶. ACLED dataset is used to identify areas affected by conflicts. It is a public collection of political violence data for developing states. The ACLED data contains information on dates and locations of violence, the event types, the groups involved, fatalities and changes in territorial control. Information is recorded on battles, deaths, riots, and recruitment activities of rebels, governments, militias, armed groups, and protesters. The main sources of data are reports from war zones, humanitarian agencies, and research publications. Areas affected by Ivorian conflict are areas for which the ACLED data report at least one conflict event from September 2002 to March 2007. We consider conflict events at *département* level. Figure fig 1 shows the total number of reported conflicts per year for the period starting from 2002 to 2007. The conflict intensity reached its peak in 2003 with 183 conflict events. Figure fig 2 shows the total number of fatalities per year. Between 2002 and 2004, a total of 424 conflict events and 2,154 fatalities were recorded by ACLED.

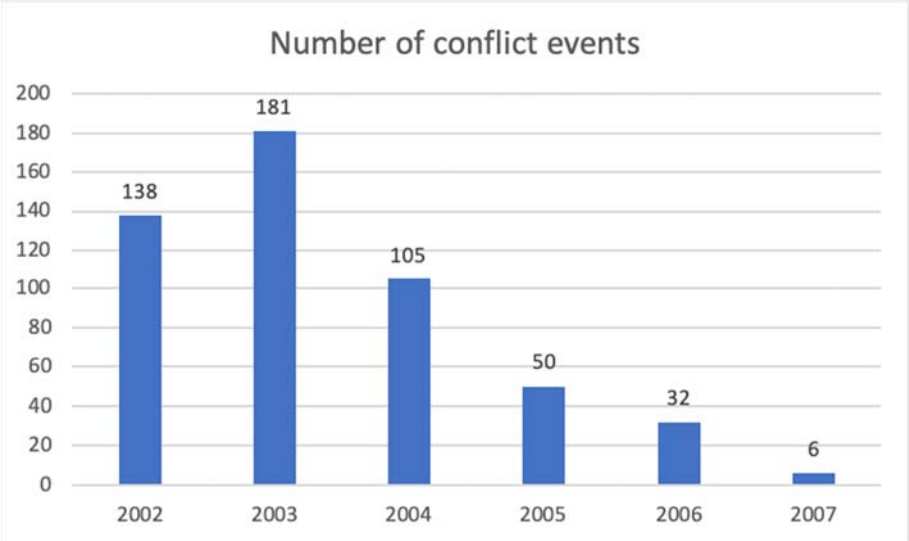


Figure 1: Incidence of conflict events. Source : Authors' calculation

⁶ ACLED data are available on <http://www.acleddata.com>

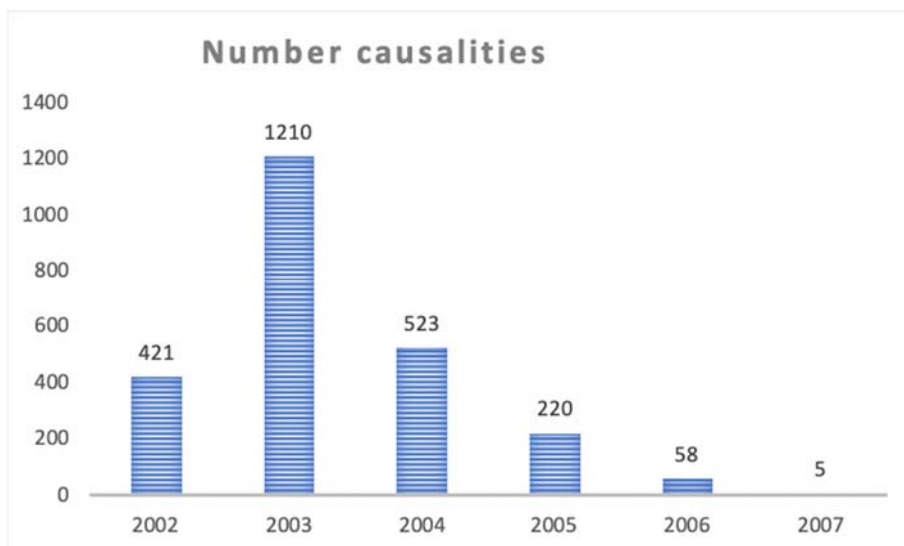


Figure 2: Fatalities of conflict events. Source: Authors' calculation

Figure 3 shows maps of Côte d'Ivoire with areas affected by the conflict from September 2002 to March 2007 at *département* level. Darker shades are the most affected areas in term of frequency of conflict events. As Fig.3 shows, many areas in the country were impacted by violence, but the western, central, and some of the southern parts of the country were most affected⁷

⁷ The “No data” category in the legend stands for no reported incidents in the dataset and is treated as zero exposure to conflict in the analysis. The category (19, 186) includes 8 departments, some of which had relatively low-intensity conflict (between 19 and 42 events) and some with relatively high-intensity conflict, such as Abidjan in the south (186 events), Bouaké in the center (55 events), and the province of Guiglo in the west (53 events).

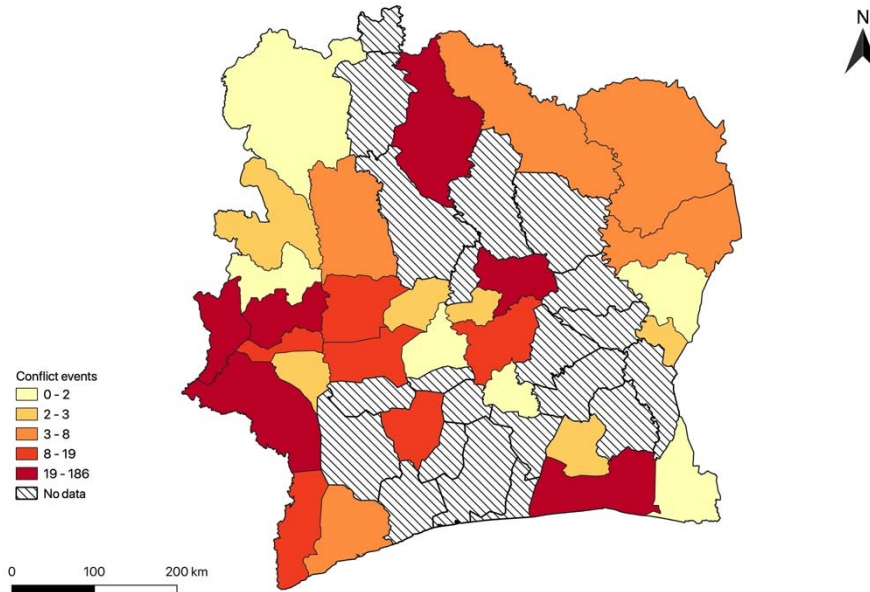


Figure 3: Map of conflict events from 2002 to 2007. Source: Author based on ACLED

Information on school attendance and working are collected for each individual aged 10-14 years old from household survey⁸. We consider that a child is working, that is, participating in economic activities, if he/she is declared to be “self-employed” or “paid-employed” during the last week or last 12 months preceding the survey⁹. About 90% of the working children are in the first category (self-employment), which corresponds to unpaid family work. Furthermore, 85% of working children do so at the request of their parents.

The educational system of Côte d'Ivoire consists of 6 years of compulsory primary education. The official age for primary school is between 6 and 12 years old. However, to account for repeat years, the maximum age for primary education is set at 14 years old. The second outcome variable concerns school attendance. We consider that a child is enrolled in school if he/she declares to be enrolled in the year of the survey (2008). We consider only those who are enrolled in normal school. They represent 96.93% of the study sample. Those who are enrolled in Franco-Arab and Koranic schools are excluded from the sample (3.07%). For those who are enrolled in school, we find that more than 87.46% are from public schools, 11.80% private schools, and 0.74% other schools (see table 7 in Appendix A). Finally, household data were merged with ACLED and our final sample consists of 6,207 children from 4,161 households.

⁸ Because Ivorian legislation prohibits children aged 15 or under from working in the labor market, children above 14 years old are excluded from our sample.

⁹ This reference period is chosen because, although the child may not have worked the week before or even several weeks before, he/she may have been employed in the past and may be just in a cyclical unemployment, waiting for an opportunity to return to work

3.2 Descriptive analysis

Table 1 presents the descriptive statistics for our sample. The average age of children interviewed is about 12 years old and most of them are boys. More than 42% of the children in our study sample are involved in economic activities and 65.67% are enrolled in school. For 65.34% of children, their biological mother lives in the household, and for 58.80% it is the biological father who lives in the household. Table 1 also shows the characteristics of the head of household with whom the child resides. The average age of head is about 48 years old; they are mostly males (80.92%), married (82.28%) and more than half of them are illiterate. Regarding the child environment, Table 1 shows that most of the households are rural dwellers (53.33%), belong to the Akan ethnic group (30.24%) and are Muslims (40.79%). In addition, the child resides, on average, in a household where most members are adults between the ages of 15 and 64. We also note that most households are close to primary schools (75.30%), more than half have access to public transports (52.95%), have access to water (93.63%), and live close to a market (81.37%).

Table 1 : Sample descriptive statistics

Variable	Description	Mean	Std.error
Agechild	Age in completed years of the child	11.86	1.42
Sexchild (%)	1 if child is a boy, 0 otherwise	52.15	0.49
School (%)	1 if child is enrolled, 0 Otherwise	65.67	0.47
Work (%)	1 if child is engaged in economic activities, 0 otherwise	42.35	0.49
Mother is present (%)	1 if biological mother is present, 0 otherwise	65.34	0.47
Father is present (%)	1 if biological father is present, 0 otherwise	58.80	0.49
Agehead	Age in completed years of the household head	47.84	12.24
Sexhead (%)	1 if head is a male, 0 otherwise	80.92	0.39
Married_head (%)	1 if household head is married, 0 otherwise	82.81	0.37
Literate_head (%)	1 if household head is literate, 0 otherwise	42.66	0.49
Rural (%)	1 if household is living in rural area, 0 otherwise	53.33	0.49
Krou (%)	1 if household is belonging to Krou ethnic group; 0 otherwise	11.37	0.31
Mandé du nord (%)	1 if household is belonging to Mandé du nord ethnic group; 0 otherwise	17.72	0.38
Mandé du sud (%)	1 if household is belonging to Mandé du sud ethnic group; 0 otherwise	07.26	0.25
Voltaïque (%)	1 if household is belonging to Voltaïque ethnic group; 0 otherwise	30.24	0.46
Non-Ivorian (%)	1 if household is a non-Ivorian; 0 otherwise	18.17	0.38
Christian (%)	1 if the household is Christian; 0 otherwise	36.89	0.48
Muslim (%)	1 if the household is Muslim; 0 otherwise	40.79	0.49
Other religion (%)	1 if the household is of another religion; 0 otherwise	25.97	0.12
Children_0-4 (%)	Proportion of children aged 0-4 in the household	10.78	0.11
Children_5-9 (%)	Proportion of children aged 5-9 in the household	13.59	0.12
Adult_15-64 (%)	Proportion of adult aged 15-64 in the household	47.38	0.16
Adult_65+ (%)	Proportion of adult aged 65+ in the household	2.25	0.06
Access_transports (%)	1 if the household has access to public transports; 0 otherwise	52.95	0.49
Primary_school (%)	1 if the household is close to a primary school; 0 otherwise	75.30	0.43
Secondary_school (%)	1 if the household is close to a secondary school; 0 otherwise	29.19	0.45
Water_source (%)	1 if the household is close to a water source; 0 otherwise	93.63	0.24
Market (%)	1 if the household is close to a consumer product market; 0 otherwise	81.37	0.39

3.3 Method

3.3.1 Econometric model

This section briefly describes the econometric model which we used to analyze the effect of conflict exposure on children's time allocation. The aim is to find an appropriate method that reflects the household decision-making process about children's time allocation between school and work. According to [Dumas \(2004\)](#), the interactions between work and schooling can be estimated in different ways. The simplest option is to introduce the work variable into schooling equation (or vice versa), to directly estimate the impact of one on the other. Because labor supply is endogenous to the school decision, this strategy raises an estimation issue. It is reasonable to assume that work and school decisions are made at the same time (at time of choice). To deal with the endogeneity issue, we can rely on the instrumental variable technique which consists of finding an instrument for the working variable, i.e. a variable that does not directly affect the schooling variable. However, finding an appropriate instrumental variable remains a challenge, and requires a priori additional information about the labor market, such as the type and level of the wages¹⁰. In practice, this additional information is often not available and most working children are unpaid.

There is an extensive literature on the modelling of household decisions. There are univariate probit and logit models ([Patrinos and Psacharopoulos, 1997](#); [Ray, 2000](#)). The disadvantage of these methods is that the possible interdependence between these two decisions is not considered. In addition, these models assume child labor as the inverse of schooling which is problematic because it ignores the possibility of a child combining work and school, or the possibility of a child neither working nor being at school ([Duryea and Arends-Kuening, 2003](#); [Guarcello et al., 2003](#)). To deal with this limitation, some of literature on child labor uses multinomial logit, bivariate and, sequential probit models, which consider the joint nature of decision-making. The multinomial logit model is appropriate if the decision-making process is considered to be simultaneous. However, there are disadvantages with this approach, because this model assumes that the choices are independent. Also known as *Independence of Irrelevant Alternatives* (IIA), this approach assumes that the inclusion or exclusion of alternatives does not affect household choices. Several methods have been proposed to test this assumption in advance. The two most common are the Hausman-McFadden test (1984) and the Small-Hsiao test (1985). The sequential (ordered) probit model is used when the hierarchical process of decision-making is considered relevant. This approach implies that the order of choices be clearly defined. In the sequential decision-making process, we consider that households first decide whether or not the child should go to school (school-only). Then, if he/she has to combine school and work (school-work) or if he/she has only to work (work-only), and finally, if he/she is to be inactive (neither work, nor school). To establish such a hierarchy, it is necessary to make assumptions about household behavior, as there is no clear priority between these different alternatives ([Wahba, 2006](#)). The priority of the alternatives will strongly depend on the characteristics and motivations of each household.

¹⁰ [Huong and Ross \(2015\)](#) investigates the impact of child labor on children's educational outcomes in rural Vietnam. To solve endogeneity issue linked to work variable, they use as an instrumental variable the average wage of unskilled female workers within a commune

However, the sequential probit model may be invalid and may potentially bias the results if we consider that the household decision-making process is simultaneous rather than prioritized. In this context, the bivariate probit model seems to be the appropriate approach for estimating the school and work decisions jointly. In this model, the school and work equations are simultaneously estimated. In addition, the assumption of Independence of Irrelevant Alternatives (IIA), which is a constraint in a sequential (ordered) model is relaxed in a bivariate probit model. Since parents' decisions regarding the allocation of their children's time are likely to consider different alternatives that may or may not be simultaneous, we use a bivariate model. It overcomes the constraints associated with prioritized or sequence assumptions in household decision-making processes. Moreover, this approach has been widely used in empirical studies dealing with the determinants of child labor and school attendance (Canagarajah and Coulombe, 1999; Nielsen, 1998; Duryea and Arends-Kuenning, 2003; Guarcello et al., 2003; Wahba, 2006)

Following Cameron and Trivedi (2005), the bivariate probit model allows the modelling of the households' decisions as follows: Let us define Cw_i^* and Sc_i^* as two latent variables underlying the working and schooling decisions, respectively. Parental utility from allocating child i 's time on school and work is:

$$Cw_i^* = h_{i1}(\cdot) + u_{i1} \quad (1)$$

$$Sc_i^* = h_{i2}(\cdot) + u_{i2} \quad (2)$$

where Cw_i^* and Sc_i^* are the corresponding observed dependent variables such that:

$$\begin{cases} Cw_i = 1 \text{ if } Cw_i^* > 0 \text{ and } Cw_i = 0 \text{ otherwise} \\ Sc_i = 1 \text{ if } Sc_i^* > 0 \text{ and } Sc_i = 0 \text{ otherwise} \end{cases} \quad (3)$$

$[u_1, u_2]$ the error terms are assumed to be orthogonal to the predictors. We assume that the $[u_1, u_2] \sim N(0, V)$ and N stand for the bivariate normal distribution where V is a symmetric matrix with typical elements $\rho_{kl} = \rho_{lk}$ for $k, l = \{u_{i1}, u_{i2}\}$ and $kl \neq 0$, and $\rho_{kl} = 1$, for all k .

The fact that the two decisions are linked implies that there exists μ_j such as:

$$\begin{cases} u_{i1} = \mu_i + \varepsilon_{1i} \\ u_{i2} = \mu_i + \varepsilon_{2i} \end{cases} \quad (4)$$

In other words, the error term of each model consists of a unique part to each model ε_j and a second common to both μ_j .

ρ is the correlation coefficient of the errors between u_{i1} and u_{i2} in the decision-making process, it represents the unobserved correlation between a child's activities. If error terms u_{j1} and u_{j2}

are uncorrelated, i.e. $\rho = 0$, the two equations can be estimated separately. When $\rho \neq 0$, the household faces 4 alternative choices, the choice probabilities for child i are:

$$p_{10i} = \Pr[Cw_i = 1, Sc_i = 1] = \Phi[h_{i1}(\cdot) > 0, h_{i2}(\cdot) < 0, \rho]$$

$$p_{11i} = \Pr[Cw_i = 1, Sc_i = 0] = \Phi[h_{i1}(\cdot) > 0, h_{i2}(\cdot) > 0, \rho]$$

$$p_{01i} = \Pr[Cw_i = 0, Sc_i = 1] = \Phi[h_{i1}(\cdot) < 0, h_{i2}(\cdot) > 0, \rho]$$

$$p_{00i} = \Pr[Cw_i = 0, Sc_i = 0] = \Phi[h_{i1}(\cdot) < 0, h_{i2}(\cdot) < 0, \rho]$$

Where $\Phi(\cdot)$ is standardized bivariate normal distribution function and p_{10i} , p_{11i} , p_{01i} , p_{00i} represent respectively the probability that child participates in work-only (work without school), the probability that he/she combines school and work, the probability that he/she is only enrolled in school (school-only), and the probability that he/she is inactive (neither work nor school). The probit bivariate model is used to calculate the marginal effects required to obtain the relative magnitude of some effects¹¹.

The index function h_{ij} (with $j = 1, 2$) for child i has the following form:

$$h_{ij}(\cdot) = \alpha_j + \beta_j X'_{ij} + \eta X'_{hj} + \delta_j Conflict_d \quad (5)$$

Where α is the constant, X' is a vector of individual child characteristics and X' is a $j \times j$ h_j

vector of household variable. $Conflict_d$ refers to conflict events over the 2002-2007 period. The outcome variable $h_{ij}(\cdot)$ is the work and school activities measured in 2008. δ_j measures the average effect conflict event on children's time allocation.

The identification of the Bivariate Probit parameters is done under certain conditions. According to [Maddala \(1983\)](#), the parameters of the first equation are identifiable under the condition of having an exclusion relation on the exogenous variables, that is the equation of participation in the labor market should include at least an exogenous variable that is not included in the school participation equation. However, [Wilde \(2000\)](#) dealing with the question of whether exclusion restrictions on the exogenous regressors are necessary to identify multiple equation probit models with endogenous dummy regressors demonstrates that no additional restrictions on the parameters are needed to achieve the identification of the multivariate Probit model with endogenous dummy regressors. Identification only requires the existence of one varying exogenous regressor.

¹¹ Marginal effects on the joint probabilities are calculated at the mean value of continuous explanatory variables. For dummy explanatory variables, marginal effects on the 3 (joint) outcomes are computed by taking the difference in the joint probabilities evaluated at the 2 values of the dummy variable

3.3.2 Estimation strategy

I use the spatial and temporal variation in potential conflict exposure to infer the average effect of violent conflicts on the allocation of children's time. Since conflicts do not occur randomly across space and over time, but rather are driven by political and economic causes, these driving factors could themselves be related to the allocation of children's time between school and work. For instance, a weak local labor market reduces the potential outside income of the local population, thereby reducing the opportunity costs of fighting, but it may also reduce the households' ability and willingness to invest in education and the quality of local public service delivery. Not controlling for the underlying causes of conflict (weak institutions, ethnic tensions, economic shocks, etc.) leads to an overestimation of the disruptive effects of conflict on the allocation of children's time. I address the factors behind the general dynamics of conflict by controlling for fixed effects (Unfried and Kis-Katos, 2020). The fixed effects at *département* level control for all time-invariant differences in local social and economic conditions and the local capacity to deliver education. Since many of these factors may also be related to the likelihood of conflict (such as ethnic composition, local institutions, geography, access to infrastructure), taking these effects into account should move us closer to measuring a causal effect.

4 Results

4.1 Impact on allocation of children's time

Table 2 presents the results the bivariate probit model as well as the average marginal effects¹². Each regression controls for *département* fixed effects. Though we report results for several control variables, we only discuss the average effect of conflict on household decision-making in school and work for children aged 10 to 14. Table 2 show that coefficient rho (ρ) indicating the correlation between residuals of equations (2) and (3) is -0.3055 and statistically significant (at the 1% level) which justifies my choice of specification. This negative coefficient implies that the school and work decisions are affected in opposite directions by omitted variables included in the residual term. In addition, the p-value associated with the Chi-square statistic is null, so that we reject the null hypothesis that the coefficients are jointly equal to 0. The first 4 columns show the marginal effects from the bivariate probit regression outcomes when the conflict variable is a dummy, takes a value of 1 if a *département* had at least one conflict event, zero otherwise. Table 2 shows that the coefficient associated with conflict exposure is positive and statistically significant at the 1% level for work-only and work-school, but negative and statistically significant at the 1% level for school-only. This suggests that a child aged between 10 and 14 in *départements* that have experienced at least one conflict event has a 20.13% probability of being involved only in economic activities, a 21.81% probability of combining economic activity and schooling, and a 37.82% probability of not attending school. This result means that, overall, a child has a 42% probability of working and a 16% probability of not

¹² We do not present coefficients of the bivariate probit estimations, indicating the direction of the effect of the explanatory variables. These coefficients are not directly interpretable

going to school if he/she had lived in *départements* that had experienced at least one conflict event. However, if there is significant variation in the conflict count across *départements*, the dummy conflict indicator may not adequately explain the allocation of children's time across departments. As a robustness check, the next 4 columns report the marginal effects of conflict on allocation of children's time when the conflict intensity variable is measured as the actual number of conflict events. The results suggest that an increase in the conflict intensity by one additional event of conflict increases the probability of working by 15.39% and decreases that of schooling by 5.54%.

The above results can be explained by two reasons: Firstly, household labor allocation. Households in *départements* that have experienced at least one conflict event tend to replace dead, injured, or physically and mentally disabled adult workers with children in order to compensate for the unexpected reduction in the financial resources available. This implies, depending on the needs of the household, that the child may be fully involved in economic activities, combines economic activities and school, or be removed from school. As is widely reported in the development economics literature, children are used as a form of economic security mechanism (Basu and Van, 1998; Rodríguez and Sánchez, 2012). They are an adjustment variable for general household well-being in the absence of social assistance programs. This result is consistent with those found by Rodríguez and Sánchez (2012) in the case of the Colombian armed conflict where they show that exposure to armed conflict increases the risk of school drop-out and involves a trade-off between child labor and schooling. The second reason goes beyond economics—the possible psychological impact of conflict on children. There is a relationship between the traumatic experiences of children and educational outcomes (Akresh and de Walque, 2008). Children who go through traumatic experiences have lower educational outcomes in general and may leave school in the long term.

Table 2: Marginal effects of bivariate probit regression

	War intensity: dummy (1 there is at least one war event)				War intensity: actual number of conflict events			
	Work	Work-School	School	Inactive	Work	Work-School	School	Inactive
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Conflict	0.2013*** (0.0476)	0.2181*** (0.0472)	-0.3782*** (0.0829)	-0.0413 (0.0470)	0.0752*** (0.0202)	0.0787*** (0.0200)	-0.1341*** (0.0313)	-0.0198 (0.0156)
Agechild	0.0240*** (0.0029)	0.0103*** (0.0037)	-0.0385*** (0.0045)	0.0042 (0.0028)	0.0240*** (0.0029)	0.0103*** (0.0037)	-0.0385*** (0.0045)	0.0042 (0.0028)
Sexchild	-0.0934*** (0.0082)	0.0474*** (0.0104)	0.1236*** (0.0124)	-0.0776*** (0.0081)	-0.0934*** (0.0082)	0.0474*** (0.0104)	0.1236*** (0.0124)	-0.0776*** (0.0080)
Sexhead: Male	0.0402*** (0.0139)	-0.0540*** (0.0207)	-0.0396 (0.0245)	0.0534*** (0.0123)	0.0402*** (0.0139)	-0.0540** (0.0207)	-0.0396 (0.0245)	0.0534*** (0.0123)
Agehead	0.0005 (0.0004)	0.0011** (0.0005)	-0.0011* (0.0006)	-0.0006 (0.0004)	0.0005 (0.0004)	0.0011* (0.0005)	-0.0011* (0.0006)	-0.0006 (0.0004)
Rural	0.1518*** (0.0109)	0.1541*** (0.0139)	-0.2707*** (0.0170)	-0.0351*** (0.0106)	0.1518*** (0.0109)	0.1541*** (0.0139)	-0.2707*** (0.0170)	-0.0351*** (0.0106)
Married_head	-0.0051 (0.0143)	0.0361** (0.0170)	-0.0008 (0.0223)	-0.0302** (0.0145)	-0.0051 (0.0143)	0.0361** (0.0170)	-0.0008 (0.0223)	-0.0302** (0.0145)
Krou	-0.0373** (0.0150)	0.0013 (0.0215)	0.0571** (0.0258)	-0.0212* (0.0161)	-0.0373** (0.0150)	0.0013 (0.0215)	0.0571** (0.0258)	-0.0212 (0.0161)
Mandé du nord	0.0568*** (0.0200)	-0.0189 (0.0208)	-0.0754*** (0.0272)	0.0375* (0.0176)	0.0568*** (0.0200)	-0.0189 (0.0208)	-0.0754*** (0.0272)	0.0375** (0.0176)
Mandé du sud	-0.0034 (0.0192)	0.0223 (0.0257)	-0.0025 (0.0303)	-0.0164 (0.0176)	-0.0034 (0.0192)	0.0223 (0.0257)	-0.0025 (0.0303)	-0.0164 (0.0176)
Voltaïque	0.0819*** (0.0197)	-0.0155 (0.0204)	-0.1079*** (0.0250)	0.0415** (0.0176)	0.0819*** (0.0197)	-0.0155 (0.0204)	-0.1079*** (0.0250)	0.0415** (0.0176)
Non-Ivorian	0.0630*** (0.0169)	-0.0387** (0.0178)	-0.0809*** (0.0227)	0.0566*** (0.0164)	0.0630*** (0.0169)	-0.0387** (0.0178)	-0.0809*** (0.0227)	0.0566*** (0.0163)
Christian	-0.0487*** (0.0109)	0.0081 (0.0150)	0.0708*** (0.0178)	-0.0301** (0.0111)	-0.0487*** (0.0109)	0.0081 (0.0150)	0.0708*** (0.0178)	-0.0301*** (0.0111)
Muslim	0.0064 (0.0140)	-0.0333* (0.0178)	-0.0002 (0.0221)	0.0271** (0.0138)	0.0064 (0.0140)	-0.0333* (0.0178)	-0.0002 (0.0221)	0.0271** (0.0138)
Literate_head	-0.0850***	0.0165	0.1222***	-0.0538***	-0.0850***	0.0165	0.1222***	-0.0538***

	(0.0091)	(0.0124)	(0.0149)	(0.0090)	(0.0091)	(0.0124)	(0.0149)	(0.0090)
Children_0-4	0.1869**	0.0269	-0.2840**	0.0701	0.1869**	0.0269	-0.2840**	0.0701
	(0.0818)	(0.1043)	(0.1304)	(0.0762)	(0.0818)	(0.1043)	(0.1304)	(0.0762)
Children_5-9	0.1488*	0.0236	-0.2267*	0.0543	0.1488*	0.0236	-0.2267*	0.0543
	(0.0789)	(0.1007)	(0.1264)	(0.0727)	(0.0789)	(0.1007)	(0.1264)	(0.0727)
Children_10-14	0.1261	0.1668	-0.2352*	-0.0578	0.1261	0.1668	-0.2352*	-0.0578
	(0.0833)	(0.1044)	(0.1329)	(0.0760)	(0.0833)	(0.1044)	(0.1329)	(0.0760)
Children_15-64	0.0628	-0.0320	-0.0834	0.0526	0.0628	-0.0320	-0.0834	0.0526
	(0.0727)	(0.0923)	(0.1163)	(0.0669)	(0.0727)	(0.0923)	(0.1163)	(0.0669)
Mother_present	-0.0435***	0.0292**	0.0557***	-0.0414***	-0.0435***	0.0292**	0.0557***	-0.0414***
	(0.0104)	(0.0125)	(0.0155)	(0.0101)	(0.0104)	(0.0125)	(0.0155)	(0.0101)
Father_present	-0.0736***	0.0363**	0.0972***	-0.0599***	-0.0736***	0.0363**	0.0972***	-0.0599***
	(0.0118)	(0.0143)	(0.0175)	(0.0115)	(0.0118)	(0.0143)	(0.0175)	(0.0115)
Access_transport	-0.0146	-0.0154	0.0260*	0.0040	-0.0146	-0.0154	0.0260*	0.0040
	(0.0092)	(0.0120)	(0.0144)	(0.0090)	(0.0092)	(0.0120)	(0.0144)	(0.0090)
Primary_school	-0.1462***	0.0905***	0.1858***	-0.1301***	-0.1462***	0.0905***	0.1858***	-0.1301***
	(0.0128)	(0.0113)	(0.0149)	(0.0117)	(0.0128)	(0.0112)	(0.0150)	(0.0117)
Secondary school	-0.0495***	0.0049	0.0738***	-0.0292**	-0.0495***	0.0049	0.0738***	-0.0292***
	(0.0102)	(0.0144)	(0.0174)	(0.0102)	(0.0102)	(0.0144)	(0.0174)	(0.0102)
Water_source	0.0210	-0.0205	-0.0243	0.0239	0.0210	-0.0205	-0.0243	0.0239
	(0.0160)	(0.0237)	(0.0273)	(0.0154)	(0.0160)	(0.0238)	(0.0273)	(0.0154)
Market	0.0162	-0.0085	-0.0215	0.0138	0.0162	-0.0085	-0.0215	0.0138
	(0.0110)	(0.0148)	(0.0183)	(0.0103)	(0.0110)	(0.0148)	(0.0183)	(0.0103)
<i>Département</i> FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation		6,202				6,202		
Rho (ρ)		-0.3055***				-0.3055***		
		(0.0256)				(0.0256)		
Prob>chi2		0.0000				0.0000		

Note: The reference category of ethnic and religion are Akan group and other religion respectively. *Significant at 10%, **Significant at 5%, ***Significant at 1%

4.2 Mechanism and Robustness Check

4.2.1 Mechanism

The estimated coefficients of the average effect of conflict on allocation of children's time show an expected sign. These results are based on a strong hypothesis: all households in the departments in which conflicts were reported by ACLED were similarly exposed to conflict events. However, this assumption does not reveal the heterogeneous impact of victim status due to conflict on household choices about schooling and child labor. In other words, there is a possibility of selection of victim status due to conflict across households which could be largely hidden by the total number of conflict events in a *département*. Conflict exposure may be specific to the characteristics of each household in which the child is living. In this section, I investigate victim status due to conflict at the household level as one channel by through which children's time is negatively affected. I first create a measure of victims which captures their direct exposure to conflict. Based on the ENV 2008 through its questions, which refer to a wide variety of war-related experiences, I construct a victim indicator which takes the value of 1 for a household being a direct victim, 0 otherwise. A direct victim is a person who, as a result of the armed conflict, reports having lost his or her economic activity, job, or property, and has difficulty in accessing health care, housing, and food. In addition, a direct victim is a person who declares having had his or her property destroyed and having relatives who have died as a result of the armed conflict. With this definition it is possible that self-reported victim indicators may produce subjective biases related to a particular ethnic group, specific household characteristics, or other factors. For example, overestimation bias may occur if some heads of households attribute their experience of post-conflict hardship to the conflict itself, or in the case of victim compensation, some households are more likely to report economic forms of victim status. Conversely, it may be an underestimate if belonging to a specific ethnic group leads the household to underestimate its war-related trauma. It is therefore important to address this issue. The simplest way to determine the extent of this bias is to regress the victim indicator on a comprehensive set of characteristics of the heads of households, including ethnicity and religion, rural residence, age, marital status, education, household composition, and gender (Dillon, 2012; Dabalen and Paul, 2014; Minoiu and Shemyakina, 2014). Formally, I estimate the following specification:

$$Victim = \beta_0 + \eta X'_h + \varepsilon_h \quad (6)$$

where victim status is the conflict-related victim index, X_h are household characteristics and ε_h is the error term. If the determinants of the conflict-related victim status are not statistically significant, this implies that there is no correlation between being a direct victim of conflict and household observable characteristics. Overall, the estimated results reported in Table 3 are not consistent with any bias generated by any particular variable except for variables such as age, area of residence, and proximity to a water source. Older heads of household and those who are close to a water source are more likely to report being conflict-affected. By contrast, rural households are less likely to report to be victims. By including these controls in most of our specifications such as household head's age, the proximity to a water source, and the place of residence, we are able to mitigate the extent of this bias linked to the victim indicator.

Table 3: Determinants of the self-reporting of victim status

VARIABLES	Coefficient
Sexhead: Male	0.1179** (0.0596)
Agehead	0.0008 (0.0017)
Rural	-0.1104** (0.0498)
Married_head	-0.0174 (0.0609)
Krou	0.0105 (0.0687)
Mandé du nord	-0.1075 (0.0759)
Mandé du sud	-0.1007 (0.0864)
Voltaïque	-0.0404 (0.0720)
Non_Ivoirien	-0.0021 (0.0634)
Christian	0.0536 (0.0506)
Muslim	-0.0046 (0.0614)
Literate_head	-0.0291 (0.0422)
Children_10-14	0.4973 (0.3572)
Children_0-4	0.4850 (0.3549)
Children_5-9	0.5027 (0.3432)
Adult_15-64	0.4624 (0.3134)
Access_transport	-0.0106 (0.0402)
Primary_school	-0.0078 (0.0448)
Secondary_school	0.0388 (0.0473)
Water_source	0.2205*** (0.0718)
Market	-0.0003 (0.0507)
Constant	-0.6951* (0.3800)
Fixed Effect	Yes
Observations	6,168
Wald chi2(77)	798.24
Prob > chi2	0.0000
Pseudo R2	0.1240

Note: Dependent variable is the victim status indicator. Robust standard errors in parentheses *Significant at 10%, **Significant at 5%, ***Significant at 1%. Regressions are at the household level.

To examine household victims as a possible mechanism of the impact of conflict on children's time allocation, we estimate the following equation:

$$h_{ij}(\cdot) = \alpha_j + \beta_j X'_{ij} + \eta X'_{hj} + \delta_j Victim_d \quad (7)$$

where α_j is the constant, X'_{ij} is a vector of individual child characteristics and X'_{hj} is a vector of household characteristics. $Victim_d$ refers to direct exposure to conflict. The outcome variable $h_{ij}(\cdot)$ refers to work and school activities measured in 2008. δ_j measures the average effect of victim status on children's time allocation. Results are reported in Table 4. The validity of the bivariate probit model rho (ρ) as well as marginal effects are also presented. The coefficient estimates are statistically significant at the 1% for work-only, work-school, and school-only. The coefficients are positives for work-only and work-school, suggesting that children in households which were direct victims of the conflict are more likely to participate exclusively in economic activities (4.02%) or to combine economic activity and education (4.22%). By contrast, children have a 7.28% probability of not attending school if their parents were direct victims of the conflict. These results mean that a child in a household which was directly affected by the conflict has an 8.24% probability of working and a 3.06% probability of not attending school. These results are consistent with the shock impact mechanisms discussed in the literature which infer that destruction of economic assets, in particular, theft of livestock, job loss, and burning of crops, is one of the main channels through which wars increase the deterioration of children's well-being (Justino et al., 2014; Justino and Verwimp, 2013; Bundervoet et al, 2009).

Table 4: Marginal effects of bivariate probit regression

	Victim status indicator: 1 if victimized, 0 otherwise			
	Work	Work-School	School	Inactive
Conflict	0.0402*** (0.0086)	0.0422*** (0.0111)	-0.0728*** (0.0142)	-0.0096 (0.0088)
Agechild	0.0242*** (0.0029)	0.0106** (0.0037)	-0.0390*** (0.0045)	0.0041 (0.0028)
Sexchild	-0.0922*** (0.0082)	0.0481*** (0.0104)	0.1221*** (0.0125)	-0.0780*** (0.0081)
Sexhead: Male	0.0389*** (0.0139)	-0.0558*** (0.0208)	-0.0369 (0.0245)	0.0538*** (0.0123)
Agehead	0.0005 (0.0004)	0.0011** (0.0005)	-0.0011* (0.0006)	-0.0006 (0.0004)
Rural	0.1534*** (0.0109)	0.1567*** (0.0139)	-0.2743*** (0.0171)	-0.0359*** (0.0106)
Married	-0.0045 (0.0142)	0.0366** (0.0170)	-0.0019 (0.0223)	-0.0303** (0.0145)
Krou	-0.0371** (0.0150)	0.0017 (0.0216)	0.0569** (0.0258)	-0.0215 (0.0162)
Mandé du nord	0.0593*** (0.0201)	-0.0164 (0.0208)	-0.0792*** (0.0272)	0.0364** (0.0176)
Mandé du sud	-0.0013	0.0248	-0.0064	-0.0171*

	(0.0193)	(0.0257)	(0.0303)	(0.0175)
Voltaïque	0.0835***	-0.0137	-0.1105***	0.0407*
	(0.0198)	(0.0205)	(0.0250)	(0.0175)
Non-Ivorian	0.0636***	-0.0378**	-0.0820***	0.0562***
	(0.0169)	(0.0179)	(0.0227)	(0.0164)
Christian	-0.0492***	0.0075	0.0718***	-0.0301***
	(0.0108)	(0.0150)	(0.0178)	(0.0111)
Muslim	0.0069	-0.0325*	-0.0012	0.0268*
	(0.0140)	(0.0179)	(0.0221)	(0.0138)
Head_literate	-0.0848***	0.0163	0.1223***	-0.0539***
	(0.0091)	(0.0124)	(0.0149)	(0.0090)
Children_0-4	0.1816**	0.0240	-0.2758**	0.0702
	(0.0819)	(0.1042)	(0.1307)	(0.0763)
Children_5-9	0.1430*	0.0192	-0.2173*	0.0550
	(0.0790)	(0.1004)	(0.1268)	(0.0727)
Adult_15-64	0.0573	-0.0369	-0.0740	0.0536
	(0.0728)	(0.0919)	(0.1165)	(0.0669)
Children_10-14	0.1218	0.1639	-0.2281*	-0.0576
	(0.0833)	(0.1042)	(0.1331)	(0.0760)
Mother_present	-0.0432***	0.0291**	0.0554***	-0.0413***
	(0.0103)	(0.0125)	(0.0155)	(0.0101)
Father_present	-0.0747***	0.0352**	0.0993***	-0.0598***
	(0.0118)	(0.0143)	(0.0175)	(0.0115)
Access_transport	-0.0139	-0.0147	0.0249*	0.0038
	(0.0092)	(0.0120)	(0.0144)	(0.0090)
Primary_school	-0.1450***	0.0910***	0.1848***	-0.1309***
	(0.0128)	(0.0112)	(0.0150)	(0.0117)
Secondary_school	-0.0499***	0.0045	0.0747***	-0.0293**
	(0.0101)	(0.0144)	(0.0175)	(0.0102)
Water_source	0.0172	-0.0257	-0.0166	0.0251
	(0.0162)	(0.0241)	(0.0275)	(0.0154)
Market	0.0158	-0.0089	-0.0209	0.0140
	(0.0110)	(0.0148)	(0.0183)	(0.0103)
<i>Département</i> FE	Yes	Yes	Yes	Yes
Observation		6,202		
Rho (ρ)		-0.3033***		
		(0.0256)		
Prob>chi2		(0.0000)		

Note: Robust standard errors in parentheses. *Significant at 10%, **Significant at 5%, ***Significant at 1%.

4.2.2 Robustness Checks

The results presented so far could be biased by internal migration, and thus not accurately capture the true causal effects of the conflict. For example, exposure to violent conflict can lead to internal displacement so that members of a household that has moved join another household. In this context, all characteristics of the host household (including those related to the household head) could be systematically affected by the exposure to the conflict. This might lead to a concern about the extent to which household composition can evolve over time, and in particular to the endogeneity of household composition with respect to the exposure to the conflict. In this section we examine how the likelihood of being exposed to the conflict correlates with the relationship of the child to the household head. Due to internal displacement, many children have been entrusted to other households. Children's time use is a function of the group of people that the children are co-residing with, and if this group changes in response to exposure to the choc, then our analysis is blurring two things: the direct effect of the treatment, and the influence of correlated changes in household composition. I address this issue by analyzing the effect of conflict-related victims on the time allocation of entrusted children and children of the household head. To do so, equation 7 is estimated according to the child's relation with the head of household. Children who are entrusted to the household (i.e. not a direct parental relation) represent 30.88% of our sample. Results reported in Table 5 show that the time allocation of children, whether they are entrusted or not, is mainly devoted to economic activities and less to school attendance. These results are broadly in line with previous results. They suggest that household composition with respect to the conflict exposure does not affect the results.

Table 5: Children's time allocation by type of relationship with

	Entrusted children				Children of the head			
	Work	Work-School	School	Inactive	Work	Work-School	School	Inactive
Victim	0.0553*** (0.0156)	0.0509*** (0.0162)	-0.0771*** (0.0251)	-0.0292 (0.0203)	0.0370*** (0.0100)	0.0428*** (0.0148)	-0.0759*** (0.0176)	-0.0039 (0.0095)
Agechild	0.0277*** (0.0055)	0.0037 (0.0055)	-0.0425*** (0.0082)	0.0112* (0.0065)	0.0201*** (0.0033)	0.0161*** (0.0048)	-0.0374*** (0.0056)	0.0012 (0.0029)
Sexchild	-0.1461*** (0.0154)	0.0430*** (0.0160)	0.2392*** (0.0224)	-0.1361*** (0.0180)	-0.0648*** (0.0095)	0.0414*** (0.0135)	0.0779*** (0.0155)	-0.0545*** (0.0087)
Sexhead: Male	0.0147 (0.0226)	-0.0256 (0.0237)	-0.0270 (0.0352)	0.0379 (0.0255)	0.0288 (0.0248)	0.0008 (0.0393)	-0.0447 (0.0455)	0.0151 (0.0232)
Agehead	-0.0004 (0.0006)	0.0013* (0.0006)	0.0009 (0.0009)	-0.0017** (0.0008)	0.0018*** (0.0005)	0.0015* (0.0008)	-0.0034*** (0.0009)	0.0001 (0.0005)
Rural	0.1779*** (0.0219)	0.1318*** (0.0225)	-0.2461*** (0.0307)	-0.0636* (0.0248)	0.1427*** (0.0125)	0.1692*** (0.0179)	-0.2942*** (0.0213)	-0.0177 (0.0114)
Married_head	0.0180 (0.0215)	0.0124 (0.0221)	-0.0260 (0.0335)	-0.0045 (0.0262)	-0.0528** (0.0221)	0.0654** (0.0248)	0.0561 (0.0319)	-0.0687*** (0.0217)
Krou	-0.0103 (0.0277)	0.0487 (0.0325)	0.0185* (0.0432)	-0.0570 (0.0312)	-0.0502*** (0.0173)	-0.0252 (0.0285)	0.0926*** (0.0331)	-0.0172 (0.0191)
Mandé du nord	0.0693* (0.0385)	-0.0195 (0.0314)	-0.1049* (0.0481)	0.0551 (0.0407)	0.0491* (0.0230)	-0.0190 (0.0275)	-0.0630* (0.0338)	0.0329* (0.0194)
Mandé du sud	0.0213 (0.0348)	0.0295 (0.0388)	-0.0284 (0.0491)	-0.0224 (0.0391)	-0.0186 (0.0223)	0.0204 (0.0335)	0.0178 (0.0392)	-0.0197 (0.0189)
Voltaïque	0.0844* (0.0379)	-0.0308 (0.0297)	-0.1276*** (0.0442)	0.0739* (0.0420)	0.0705*** (0.0231)	0.0027 (0.0272)	-0.0994*** (0.0320)	0.0262 (0.0183)
Non-Ivorian	0.0306 (0.0341)	-0.0446 (0.0272)	-0.0633 (0.0455)	0.0773* (0.0400)	0.0626** (0.0192)	-0.0334 (0.0236)	-0.0770*** (0.0275)	0.0479*** (0.0176)
Christian	-0.0385* (0.0204)	0.0311 (0.0225)	0.0663* (0.0319)	-0.0589** (0.0256)	-0.0586*** (0.0122)	-0.0143 (0.0196)	0.0966*** (0.0220)	-0.0237** (0.0118)
Muslim	0.0346 (0.0296)	0.0305 (0.0303)	-0.0476 (0.0431)	-0.0176 (0.0335)	-0.0103 (0.0155)	-0.0630*** (0.0227)	0.0433 (0.0267)	0.0300** (0.0145)
Literate_head	-0.0630*** (0.0178)	0.0108 (0.0187)	0.1011*** (0.0272)	-0.0489** (0.0218)	-0.0950*** (0.0104)	0.0153 (0.0162)	0.1373*** (0.0184)	-0.0576*** (0.0094)
Children_10-14	0.2362* (0.1326)	0.1348 (0.1370)	-0.3419* (0.1998)	-0.0291 (0.1566)	-0.0716 (0.1060)	0.1134 (0.1585)	0.0552 (0.1831)	-0.0970 (0.0942)
Children_0-4	0.2332	0.1061	-0.3430*	0.0037	0.0262	-0.0390	-0.0213	0.0342

	(0.1343)	(0.1341)	(0.2026)	(0.1544)	(0.1050)	(0.1589)	(0.1814)	(0.0946)
Children_5-9	0.1898	-0.0467	-0.3060*	0.1629	-0.0217	-0.0057	0.0350	-0.0076
	(0.1221)	(0.1311)	(0.1838)	(0.1495)	(0.1033)	(0.1545)	(0.1795)	(0.0911)
Adult_15-64	0.0815	-0.0494	-0.1372	0.1051	-0.1279	-0.0701	0.2230	-0.0250
	(0.1094)	(0.1155)	(0.1648)	(0.1321)	(0.0970)	(0.1454)	(0.1685)	(0.0858)
Mother_present	-0.0516***	0.0183	0.0872***	-0.0539**	-0.0145	-0.0259	0.0334	0.0070
	(0.0168)	(0.0207)	(0.0286)	(0.0214)	(0.0142)	(0.0200)	(0.0224)	(0.0118)
Father_present	-0.0159	-0.0128	0.0227	0.0060	-0.0412	-0.0807**	0.0981***	0.0238
	(0.0277)	(0.0296)	(0.0452)	(0.0380)	(0.0261)	(0.0352)	(0.0381)	(0.0182)
Access_transport	0.0139	-0.0104	-0.0238	0.0202	-0.0231**	-0.0298*	0.0480***	0.0049
	(0.0172)	(0.0183)	(0.0261)	(0.0210)	(0.0107)	(0.0157)	(0.0179)	(0.0096)
Primary_school	-0.0829***	0.0777***	0.1529***	-0.1478***	-0.1615***	0.0877***	0.1938***	-0.1200***
	(0.0222)	(0.0165)	(0.0277)	(0.0251)	(0.0152)	(0.0151)	(0.0185)	(0.0132)
Secondary_school	-0.0386**	0.0093	0.0636**	-0.0343	-0.0522***	0.0041	0.0783***	-0.0302***
	(0.0188)	(0.0209)	(0.0302)	(0.0236)	(0.0118)	(0.0194)	(0.0222)	(0.0111)
Water_source	-0.0212	-0.0196	0.0288	0.0120	0.0318*	-0.0240	-0.0361	0.0284
	(0.0329)	(0.0431)	(0.0464)	(0.0462)	(0.0175)	(0.0294)	(0.0344)	(0.0145)
Market	0.0145	-0.0319	-0.0260	0.0434	0.0117	-0.0032	-0.0161	0.0076*
	(0.0215)	(0.0247)	(0.0341)	(0.0246)	(0.0123)	(0.0190)	(0.0223)	(0.0108)
<i>Département</i> FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rho			-0.2741***				-0.3123***	
			(0.0451)				(0.0321)	
Observation			1,914				4,290	

Note: Robust standard errors in parentheses. *Significant at 10%, **Significant at 5%, ***Significant at 1%.

In the case of the Ivorian conflict, an important source of disparity is the location of the conflict between the territories controlled during the conflict by the government in the south, and those controlled by the rebel forces in the centre, north and west (CNO). In this section, we look at how the country's partition affects our results. Table 6 presents estimation results of equation 7. In the governmental-controlled zone, children in households who were directly affected by the conflict are more likely to be engaged exclusively in economic activities (4.05%) and are 4.22% more likely to combine economic activity with education. However, they are 7.28% more likely to be out of school if their parents were directly affected by the conflict. More generally, these results mean that children in a household which was directly affected by the conflict have a 10.78% probability of working and a 3.36% probability of not attending school. These results are consistent with those obtained previously. For the the rebel-controlled zone, Table 6 shows that children are 2.52% more likely to be involved exclusively in economic activities and 2.60% more likely to be out of school if they are in a household directly affected by the war. However, these coefficients are not statistically significant. When we consider the children who combine economic activities and schooling, we find that this is 5.37% more likely if their household is directly affected by the war. This coefficient is statistically significant at the 1% level. Overall, this section shows that there is heterogeneity by area of residence in the time allocation of children.

Table 6: Time allocation by type of conflict zone

	Rebel (CNO) zone				Government zone			
	Work	Work-School	School	Inactive	Work	Work-School	School	Inactive
Conflict	0.0252 (0.0270)	0.0537*** (0.0193)	-0.0260 (0.0229)	-0.0528*** (0.0186)	0.0405*** (0.0069)	0.0673*** (0.0116)	-0.1009*** (0.0148)	-0.0069 (0.0086)
Agechild	0.0334*** (0.0077)	-0.0065 (0.0061)	-0.0266*** (0.0062)	-0.0003 (0.0049)	0.0167*** (0.0026)	0.0149*** (0.0042)	-0.0365*** (0.0053)	0.0049 (0.0030)
Sexchild	-0.1243*** (0.0219)	0.0733*** (0.0172)	0.0904*** (0.0174)	-0.0394*** (0.0146)	-0.0671*** (0.0072)	0.0299** (0.0117)	0.1133*** (0.0144)	-0.0761*** (0.0086)
Sexhead: Male	0.0968** (0.0427)	-0.0974** (0.0380)	-0.0589 (0.0392)	0.0596*** (0.0230)	0.0262** (0.0117)	-0.0463* (0.0228)	-0.0278 (0.0274)	0.0478*** (0.0127)
Agehead	0.0009 (0.0011)	0.0022** (0.0009)	-0.0011 (0.0009)	-0.0020** (0.0007)	0.0005 (0.0003)	0.0005 (0.0006)	-0.0010 (0.0007)	0.0001 (0.0004)
Rural	0.2955*** (0.0263)	0.0572*** (0.0206)	-0.2656*** (0.0241)	-0.0870*** (0.0180)	0.0966*** (0.0090)	0.1843*** (0.0142)	-0.2467*** (0.0177)	-0.0342*** (0.0106)
Married	-0.0110 (0.0406)	0.1077*** (0.0262)	0.0111 (0.0321)	-0.1078** (0.0337)	0.0002 (0.0122)	0.0147 (0.0193)	-0.0054 (0.0256)	-0.0095 (0.0142)
Krou	0.0650 (0.0665)	0.1218* (0.0641)	-0.0944** (0.0382)	-0.0924*** (0.0248)	-0.0094 (0.0111)	0.0303 (0.0202)	0.0044 (0.0231)	-0.0253* (0.0133)
Mandé du nord	0.1648*** (0.0494)	-0.0596* (0.0339)	-0.1202*** (0.0353)	0.0150 (0.0294)	0.0101 (0.0159)	0.0012 (0.0235)	-0.0189 (0.0319)	0.0076 (0.0171)
Mandé du sud	0.0302 (0.0503)	0.1638*** (0.0471)	-0.0857*** (0.0319)	-0.1083*** (0.0182)	0.0079 (0.0167)	0.0446 (0.0280)	-0.0332 (0.0330)	-0.0193 (0.0169)
Voltaïque	0.2214*** (0.0430)	-0.0018 (0.0323)	-0.1680*** (0.0285)	-0.0517** (0.0236)	0.0426** (0.0166)	0.0181 (0.0238)	-0.0795*** (0.0288)	0.0189 (0.0175)
Non-Ivorian	0.1971*** (0.0558)	-0.0188 (0.0404)	-0.1362*** (0.0309)	-0.0422 (0.0285)	0.0170 (0.0121)	-0.0443** (0.0176)	-0.0193 (0.0241)	0.0465*** (0.0151)
Christian	-0.0642** (0.0324)	0.0262 (0.0312)	0.0507* (0.0287)	-0.0126 (0.0237)	-0.0514*** (0.0094)	-0.0161 (0.0155)	0.1020*** (0.0195)	-0.0345** (0.0112)
Muslim	-0.0011	-0.0364	0.0073	0.0302	0.0212	-0.0244	-0.0310	0.0342**

	(0.0351)	(0.0282)	(0.0283)	(0.0222)	(0.0131)	(0.0197)	(0.0262)	(0.0152)
Head_literate	-0.1549***	0.0808***	0.1208***	-0.0467***	-0.0635***	-0.0110	0.1211***	-0.0466***
	(0.0262)	(0.0242)	(0.0255)	(0.0163)	(0.0082)	(0.0135)	(0.0165)	(0.0098)
Children_10-14	0.6438**	0.3005*	-0.5820***	-0.3623***	0.0577	0.0135	-0.1120	0.0408
	(0.2107)	(0.1687)	(0.1717)	(0.1386)	(0.0726)	(0.1196)	(0.1519)	(0.0847)
Children_0-4	0.4865**	0.1032	-0.4196**	-0.1702	0.1578**	-0.0217	-0.2848*	0.1487*
	(0.2084)	(0.1644)	(0.1700)	(0.1353)	(0.0720)	(0.1195)	(0.1495)	(0.0857)
Children_5-9	0.3883**	0.0095	-0.3230**	-0.0749	0.1080	0.0004	-0.2006	0.0922
	(0.1978)	(0.1526)	(0.1613)	(0.1262)	(0.0701)	(0.1164)	(0.1465)	(0.0822)
Adult_15-64	0.1818	0.1314	-0.1719	-0.1413	0.0525	-0.1280	-0.0505	0.1260*
	(0.1832)	(0.1400)	(0.1491)	(0.1154)	(0.0634)	(0.1069)	(0.1324)	(0.0761)
Mother_present	-0.0764**	0.0113	0.0595**	0.0056	-0.0287***	0.0362***	0.0412**	-0.0487***
	(0.0304)	(0.0234)	(0.0227)	(0.0188)	(0.0088)	(0.0135)	(0.0176)	(0.0105)
Father_present	-0.0858**	0.0239	0.0657**	-0.0038	-0.0565***	0.0284*	0.0940***	-0.0659***
	(0.0347)	(0.0258)	(0.0265)	(0.0209)	(0.0100)	(0.0158)	(0.0196)	(0.0121)
Access_transport	-0.0522**	-0.0118	0.0458**	0.0183	-0.0085	-0.0171	0.0221	0.0036
	(0.0231)	(0.0185)	(0.0195)	(0.0156)	(0.0073)	(0.0121)	(0.0150)	(0.0086)
Primary_school	-0.2699***	0.1687***	0.1891***	-0.0879***	-0.0875***	0.0690***	0.1413***	-0.1229***
	(0.0269)	(0.0171)	(0.0172)	(0.0190)	(0.0116)	(0.0128)	(0.0185)	(0.0127)
Secondary_school	-0.0511*	0.0036	0.0429	0.0046	-0.0444***	0.0079	0.0814***	-0.0449***
	(0.0305)	(0.0237)	(0.0262)	(0.0194)	(0.0084)	(0.0160)	(0.0194)	(0.0103)
Water_source	0.0953**	-0.0241	-0.0819*	0.0107	-0.0020	-0.0129	0.0087	0.0063
	(0.0437)	(0.0363)	(0.0434)	(0.0273)	(0.0144)	(0.0264)	(0.0299)	(0.0177)
Market	0.0714***	0.0135	-0.0632***	-0.0217	0.0055	-0.0198	-0.0022	0.0165
	(0.0259)	(0.0214)	(0.0227)	(0.0185)	(0.0102)	(0.0173)	(0.0220)	(0.0111)
Observation			1,833				4,369	

Note: Robust standard errors in parentheses. *Significant at 10%, **Significant at 5%, ***Significant at 1%.

5 Conclusions

This paper uses household level data from Côte d'Ivoire and pairs it with the 2002-2007 conflict data taken from the Armed Conflict Location and Event Database (ACLED) to examine the association between armed conflict and allocation of children's time between school attendance and work. I first measure the intensity of armed conflict by the conflict events by *département*, which we qualify to as an indirect measure of conflict exposure. Second, we use conflict-related victim status as a direct measure of conflict. Based on a bivariate probit model which has the advantage of considering the simultaneity of household decisions in the allocation of children's time, my results suggest that the Ivorian armed conflict caused an increase in child labor and a decrease in schooling for children aged 10-14 years old. Individuals who lived in conflict areas are more likely to be engaged in economic activities and less likely to be enrolled in school. These findings are broadly consistent with the literature which shows increases in child labor in response to exposure to shocks (Beegle et al., 2006; Rodríguez and Sánchez, 2012; Di Maio and Nandi, 2013). I find that household victim status is one of the mechanisms driving these results. The armed conflict in Côte d'Ivoire, by affecting households, led to a drop in their income, which had a negative impact on the allocation of children's time and could hamper the country's long-term economic development. The decrease in children's school attendance due to conflict-related victim status in favor of their early entry into the labor market might have negative welfare consequences by reducing future adult wages and productivity. Since household victim status appears to be a channel associated with the increase in the incidence of child labor and the decrease in school enrollment in the case of Côte d'Ivoire, it is therefore essential to promote interventions targeting conflict-affected areas to restore economic well-being and implement special protection for children during conflict.

However, some limitations of this study must be noted. Firstly, by taking the current *département* of residence as the *département* in which events occurred it is possible that the current location of individuals may differ from the location where the conflicts took place. The estimation strategy assumes that individuals have not moved since the beginning of the conflict. Therefore, selective movement of individuals affected by the conflict might bias the results. Unfortunately, the data used in this study do not contain information on individuals' movement history. Secondly, since the household survey was conducted one year after the conflict, the results found are to be taken with caution. The drop-in school enrollment may be temporary if disarmament, demobilization and reintegration of rebel forces, and redeployment of the administration's policies are implemented. A catch-up effect in terms of schooling could follow. Thirdly, the child labor measure in this study is not explicit. The number of hours worked and information with respect to the allocation of children's time would have been more relevant, because it would have captured the effect of the conflict on the intensity of child labor.

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Appendix A: DESCRIPTIVE STATISTIC OF CHILD STATUS

Table 7: Children status in school and work

Status of the child at work	Proportion (%)	Obs
Paid work	10.64	255
Unpaid work	89.36	2,142
Decision to work from parent	84.34	1,605
Decision to work from child himself	15.66	298

Type of education	Proportion (%)	Obs
Classic education	96.92	3,928
Non-classic education	3.08	125
Public school	11.80	478
Other school	0.74	30