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Armed Conflict Exposure, Human Capital Investments and Child Labor: Evidence from Colombia[1]

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Abstract

Using a unique combination of household and violence data sets and a duration analysis methodology, this paper estimates the effect that exposure to armed conflict has on school drop-out decisions of Colombian children between the ages of six and seventeen. After taking into account the possible endogeneity of municipal conflict related events through the use of instrumental variables, we find that armed conflict reduces the average years of schooling in 8.78% for all Colombian children. This estimate increases to 17.03% for children between sixteen and seventeen years old. We provide evidence that such effect may be induced mainly through higher mortality risks, and to lesser extent due to negative economic shocks and lower school quality; all of which induce a trade-off between schooling and child labor.

JEL code: I21, I29, O12
Keywords: Armed conflict, School drop-out, Duration Analysis, Colombia.

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EXPOSICIÓN AL CONFLICTO ARMADO, INVERSIÓN EN CAPITAL HUMANO Y TRABAJO INFANTIL: EVIDENCIA DE COLOMBIA

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Resumen

Utilizando una combinación de datos única con información de hogares y violencia a nivel municipal este trabajo estima el efecto de la exposición al conflicto armado sobre las decisiones de deserción estudiantil de niños y jóvenes colombianos entre los seis y los diecisiete años. A través de la metodología de modelos de duración, y corrigiendo la posible endogeneidad del conflicto municipal por medio de variables instrumentales, se encuentra que el conflicto reduce el promedio de años educativos alcanzado por estos individuos en un 8,78%. Este estimativo se incrementa a un 17,03% para jóvenes entre 16 y 17 años de edad. Se muestra que este efecto es inducido en primer lugar por una disminución en la expectativa de vida de los individuos generada por el conflicto y, en una menor medida, por los efectos negativos del conflicto en la actividad económica y la calidad educativa de los colegios a los que los niños asisten. Para jóvenes entre doce y diecisiete años expuestos al conflicto parece existir un *trade-off* entre deserción y trabajo infantil.

Código JEL: I21, I29, O12.

Palabras clave: conflicto armado, deserción escolar, análisis de duración, Colombia.

1 Introduction

There is no controversy on the importance of education on the economic wellbeing of individuals and nations.[2] Hence, not surprisingly, one of the main concerns in the education literature is to understand which factors may influence the quantity of education attained by students. The research on the subject is immense and often concentrates on how personal, family and school characteristics affect students' education attainment.[3] However, little attention has been given to the effect that exposure to violence or armed conflict may have on schooling investment decisions of households notwithstanding its high prevalence in developing countries. In a recent study, Harbom and Wallensteen (2007) report that a total of 232 armed conflicts have been active in 148 locations since the end of World War II. According to the same authors, 32 armed conflicts in 23 different locations were present in 2006. Such a high incidence of violent conflicts imply that estimating its effect on students' schooling attainment is necessary to determine all the social costs violence entail and incorporate proper policies that directly deal with the problem.

Theoretically, violence could reduce the quantity of education attained by individuals through different channels. Among them we find the destruction of schools' infrastructure, fear of sending children to school, incorporation of youths into the armed groups, negative economic shocks to households and forced displacement. Empirically, the evidence found in the literature is mixed. Earlier studies which used macro-level data found negligible impacts of armed conflicts on outcomes of interest including education attainment or literacy rates (Miguel and Roland (2006) and Chen et al. (2007)). On the contrary, studies that have used micro-level data such as Barrera and Ibañez (2004), Shemyakina (2006), Dueñas and Sanchez (2007), Akresh and de Walque (2008) and Akbulut-Yuksel (2008) have consistently found important and long term negative effects of conflict on education outcomes.

The main objective of this paper is to understand the relationship between armed

[2] On the national sphere, studies such as Barro (1991) and Mankiw et al. (1992) have shown the importance of education on economic growth rates. At the individual level, surveys from Glewee (2002) and Hoffman (2001) present how education can impact worker's income and other outcomes such as health, fertility and innovation in agriculture.

[3] For a comprehensive review on the subject for developing countries please refer to Glewwe (2002) and Glewwe and Kremer (2006).

conflict and education investments of individuals in Colombia contributing to the existent empirical literature in several respects. First, we believe this country provides a unique setting in which to study this relationship given that it has being suffering from one of the longest internal conflict in the world. Guerrilla and paramilitary groups, active since the sixties, have committed all kind of violent attacks affecting not only the State armed forces and national infrastructure but also the civil population sector through homicides, kidnaps, population displacement or forced recruitment. All these actions against the civil population could certainly change households' decisions, one of which is of course human capital accumulation.

Second, unlike earlier studies, we take into account the intertemporal nature of schooling drop-out decisions and carry out a duration analysis approach. Specifically, we are able to combine two exceptional data sets. The first provides detailed information on education investment decisions of households and the second contains armed conflict reports by event at the municipality level in Colombia between 1990 and 2003. With this information we are able to construct students' past education history and analyze through a duration analysis methodology how the exposure to conflict and violent actions affects their drop-out decisions.

Third, in our empirical analysis we acknowledge the possible endogeneity between violence and schooling drop-out rates that emerges directly due to the participation of children in armed actions and indirectly as being school drop-out an expression of poverty and social exclusion that according to some literature could lead to rebellion.[4] As of the direct channel, estimates suggest that there are at least 300,000 children under 18 directly involved in armed conflicts in countries such as Angola, Burma, Democratic Republic of Congo, Lebanon, Liberia, Sierra Leone and Sri Lanka.[5] In Colombia according to Human Rights Watch (HRW - 2004) at least one of every four irregular war combatants is under eighteen. Hence, it is expected that areas with higher drop-out rates could have higher rates of violent actions if children join the armed groups. To adequately control for both channels we incorporate into the analysis an instrumental variables approach. The instruments used are lagged government deterrence measures, under the key identifying assumption that they do not directly influence current households' schooling decisions.

[4] See Collier (2004) for a review of this approach.

[5] Newshour Extra with Jim Leher special for students "Lesson: Children at war", PBS.

Specifically, the instruments chosen are the average of two year lagged homicide capture rates at the state (departamento) level and antinarcotics army operations at the municipality level.

We find that violent attacks in Colombian municipalities where students reside increases the probability of school drop-out. The result is significant both under a non-parametric as well as a parametric approach where we control for a rich set of family and community variables including household migration. Our estimates under this last approach suggest that, on average, the conflict in Colombia has reduced average education of students residing in conflict areas in 0.49 years. The effect differs however according to the age of children. While there does not seem to be a significant effect on the education investments of younger students; violence has negatively affected the attainment of older individuals. Thus, had Colombia undergone no violence, the average educational attainment of children between twelve and fifteen years of age would have been 0.73 years higher. Similarly, for children between sixteen and seventeen the presence of armed conflict has reduced their education in 1.4 years. This effect is significant and it amounts to 17.03% of the average education this children now have.

Finally, we also provide evidence of some of the possible channels through which violence could affect schooling outcomes. Biprobit estimates suggest that for students older than twelve higher mortality risks, negative economic shocks and reductions in school quality may all be the driving mechanisms through which armed conflict reduces human capital investments and increase child labor. These last results relate our findings to two recent research advances.

The first one studies the effect of exogenous changes in life expectancy on educational investments. Theoretically, Soares (2005) and Estevan and Baland (2007) develop models that suggest a positive relationship between life expectancy and schooling. Moreover the latter authors prove that indeed higher mortality of youngsters induces inefficient levels of child labor. Empirical studies such as Lorentzen et al. (2005) and Jayachandran and Lleras-Muney (2008) have found that increases in life expectancy are associated with higher human capital investments. Armed conflict and the premature deaths it causes is just another channel thorough which life expectancy is altered.

The second related research evaluates the economic impact of conflict. Studies such as Abadie and Gardeazabal (2003) and Alesina et al. (1996) have found that conflict

has a negative effect on economic growth at a national level. Similarly, Deininger and Okidi (1999) and Verwimp and Bundervoet (2008) show there exists negative effects of civil conflict on households' consumption growth. In parallel, authors such as Skoufias and Parker (2006) and Duryea et al. (2007) have shown how families buffer negative economic shocks by sending children into the labor market. In this paper we take from both literatures and argue that conflict in Colombia's municipalities have increased the probability for negative economic shocks at the municipal level that could increase the need of children's work.

The remainder of the paper is organized as follows. Section 2 presents the existent literature on armed conflict and education investments. The empirical methodology and the data used in the paper are presented in section 3 and 4 respectively. Results are presented in section 5 while section 6 presents evidence on the possible transmission channels. Finally section 7 concludes.

2 Related Literature

The theoretical literature on the possible effects of armed conflicts in education investment decisions of households is scarce or almost null.[6] The empirical evidence is somewhat larger. Some studies have used macroeconomic statistics or cross country data with mixed findings. For instance, Miguel and Roland (2006) under an IV methodology find no impact of US bombings on Vietnam's literacy rates through 2002. Conversely, Chen et al. (2007) using cross country information and an event data methodology observed that, as a result of war, countries experience a substantial drop in secondary school enrollment but no significant effect for primary education.

Nonetheless, analyzing macro-level information could erroneously lead to the conclusion that there are no medium-term negative educational impacts due to armed conflicts. This is clearly shown for educational outcomes in the study of Akresh and de Walque (2008) for Rwanda. Using two nationally representative cross-sectional household surveys the authors initially show that average schooling outcomes in the country did improve

[6] However, as previously mentioned, there exist several models such as Soares (2005) and Estevan and Baland (2007) linking life expectancy and human capital investments. Given the higher mortality risks that armed conflicts have on the population such models could provide some theoretical support for the relationship between violence and education.

after the 1994 genocide.[7] However, when they concentrate on the educational outcomes of school-age children that were directly exposed to the conflict the situation is very different. Using a difference in difference approach the authors find that on average, the exposed children achieved 0.5 years of education less than the non exposed ones and are 15% less likely to complete fourth grade.

Similarly, using micro-level information from Tajikistan, Shemyakina (2006) evaluates the impact of conflict on educational investment. Using a linear probability model the author finds that the civil war in Tajikistan between 1992 and 1998 reduced the enrollment rates for girls but not for boys. Likewise, under a difference in difference specification, she finds that the probability of completion of mandatory schooling was significantly reduced for women but not for men. The author suggests some possible channels through which violence could affect educational outcomes but none are empirically tested in her work. Evidence from a developed country is found by Akbulut-Yuksel (2008). Following a methodology similar to Akresh and de Walque's (2008), she provides evidence that German children that were school-aged during WWII had 0.3 fewer years of education in adulthood. Results also suggest that an important driving mechanism of this impact was the destruction of schools and the absence of teachers.

For Colombia, two papers study the possible effects of violence on schooling investments. Barrera and Ibañez (2004) develop a theoretical model that identifies three different channels through which violence can affect investments in education. According to the authors, violence might directly affect household's utility; it could induce negative economic shocks to the family due to the destruction of physical capital and creation of uncertainty; and finally it may also reduce education's rate of return. Using a probit model, the authors find a negative relationship between the probability of school enrollment and contemporaneous homicide rates but are not able to test any of the suggested channels. Dueñas and Sanchez's (2007) develop a theoretical model in which violence affects wages and education costs and estimate the effect of violence on school drop-out decisions for the poorest households for the Colombian eastern region. Using information on approximately 300,000 children and youngsters, a duration model confirms that the activities of illegal armed groups increase the risk of dropout for all individuals with much

[7] Specifically, between 1992 and 2000 the fraction of people with no education in the country decreased from 30% to 24% and the proportion of people with some primary school increased from 64% to 69%.

larger negative effect for the poorest of the poorest households.

We follow this last paper in the idea of using a dynamic behavior model estimated under a Duration Analysis methodology. However, we incorporate a nationally representative data set for Colombia. Moreover, and in contrast with the literature above presented, we are able to provide evidence on three possible mechanisms through which conflict might reduce educational investments in Colombia and increase child labor.

3 Estimation Strategy

Our primary interest in this paper is to determine how armed conflict present in the municipality where the child resides affects her schooling attainment. There could be several methodologies, depending on the available data, under which the estimation of the impact of armed conflict on school drop-out decisions could be obtained. As shown in the last section, the most common strategies used in the literature are the estimation of linear probability, probit models and a difference in difference approach. However, it should be noted that estimation of drop-out schooling decisions of households using these methodologies may not be the most adequate for every situation. That is the case because, on the one hand, household's decisions on human capital accumulation are dynamic and as such its analysis should incorporate this factor in an explicit manner. On the other hand, the information on schooling attainment obtained from household surveys may be right censored as some of the students that are currently enrolled may decide to drop-out of school in the future. Again, empirical estimation of drop-out decisions should incorporate this into the analysis in order to obtain consistent estimates.

Hence, a richer methodology in order to study the intertemporal decision of human accumulation is that of Duration Analysis.[8] For the drop-out decision case, duration analysis can be directly applied if we analyze the dependent variable as the time elapsed until student i decides to drop-out of school. Specifically, when we observe student i in period t she may be either attending school or have dropped-out. Constructing the past history of that student in either case is simple. In the former case we have a censored observation and the construction of past schooling outcomes would be based on the time

[8] This methodology is commonly applied in questions such as unemployment spells (Bruce(1990)), teachers´ turnover (Dolton and van der Klaau (1999)) or the time elapsed for fugitives to get apprehended (Miles (2005)).

the student entered the schooling system until time t. In the latter case, that is when student i is out of the schooling system without completing it, we can construct the dependent variable until the date when she reported to have dropped-out of school.

Once this past history of schooling attendance for student i is constructed a duration analysis methodology can be applied. As detailed by Wooldridge (2001), recent survival analysis focuses on hazard functions which allow the approximation of the probability of exiting the schooling system within a short interval of time conditional on being in the system until that moment. The hazard can be estimated using either constant or time varying covariates. Given that we are interested on estimating how exposure to armed conflict during schooling time affects drop-out decisions the latter estimation of the hazard function is needed. Following the same author, the proportional hazard with time-varying covariates will be given by:

$$\lambda\left[t; X(t)\right] = \lim_{h \downarrow 0} \frac{P\left[t \leq T < t + h | T \geq t, X(t+h)\right]}{h}$$

where t represents time and $X(t)$ represents the covariate path up through time of the vector of regressors $x(t)$ at time t: $X(t) \equiv \{x(s) : 0 \leq s \leq t\}$.[9] We will follow Jenkins' (2004) discrete time estimation methodology and calculate the impact of armed conflict on schooling drop-out risk under a nonparametric approach using the Kaplan-Meier estimator of the survival function as well as a parametric approach with both a normal and a logistic hazard functions. The parametric model will include duration dependence and take into account possible frailty, or unobserved heterogeneity, at the municipality level.[10]

It should be noted that, given the high participation of children in war, our empirical analysis will take into account the possible endogeneity of the armed conflict measures. As stated by Rubio (2001) Colombian municipalities with a relatively young population and high levels of inequality have a higher probability of suffering violent attacks. Moreover, as is well known both guerrillas and paramilitary groups in the country purposely recruit children and send them to combat. According to Human Rights Watch (2003), more than

[9] For the purpose of this analysis the regressors will include armed conflict data as well as personal, school and community characteristics.

[10] While *continuous* time duration models normally assumes either a Weibull or a Log-logistic hazard function; for *discrete* time models the two leading cases are logistic and complementary log-log hazard functions. Hence, in all estimations presented in this paper we use the logistic function.

11,000 children fight in Colombia's armed conflict. If there is any type of peer pressure to leave the school and join the irregular forces our variable of interest could clearly be endogenous.

In order to solve such endogeneity problem an instrumental variable approach was undertaken using two different available instruments: the average of two year lagged antinarcotics operations at the municipality level and of homicide captures at the state level interacted with municipal population. The former variable was chosen because as is well known, all three irregular groups (FARC, ELN and Paramilitary) use drug trafficking as a major source of income. It is expected then that higher number of antinarcotics operations in a given municipality will necessarily imply a higher presence of the army and lower levels of income for the armed groups. Hence, the possibility for irregular armed groups to perpetrate attacks should diminish. Similarly, homicide captures will be a proxy for the efficiency and strength of the law enforcement in each municipality. For both variables, the two year lags were chosen given that the effect of the rule of law on violence in a particular zone takes time and probably more than one year of State presence is necessary to reduce armed conflict.

It should be stated that the identification assumption used in the paper is hence that lagged deterrence measures should not be directly related with current schooling investment decisions at the household level. Even though this is a highly plausible assumption, as in every instrumental variable problem, the endogeneity of our conflict measure as well as the validity of the instruments can only be tested empirically and hence the results presented will include evidence on their relevance and possible exogeneity.[11]

3.1 Data

The information used in this paper at the household level comes from the Encuesta de Calidad de Vida 2003 (ECV 2003), which is a national survey that follows the same methodology implemented by the World Bank's LSMS surveys and is conducted by the Colombian Bureau of Statistics (Departamento Administrativo Nacional de Estadística). The survey's objective is to measure the Colombian socioeconomic conditions, poverty and access to social programs. The 2003 survey interviewed 24,090 households between March and May 2003 in 128 municipalities.

[11] It is worth noting that this IV approach could also partially alleviate any omitted variable concerns.

In order to evaluate the effect of violence on school drop-out decisions we use information on individuals between six and seventeen years of age who, under the structure of the Colombian education system, should be enrolled in school. In total, there is information on 19,288 individuals from 11,142 households who after taking into account internal migration have resided in 235 municipalities.[12] As observed in Table 1, almost 10% of these individuals, amounting to 2,035, have dropped out of the system. As expected, drop-out rates increase with age, reaching to 42% for seventeen year old children.

TABLE 1 should go here

Interestingly, Table 2 shows that there is no significant difference between the drop-out rate of girls and boys. The same table also shows that 73% of the children live in urban areas, 26% are attending a school grade that do not correspond to their age (they are overaged) and 7% worked during the week previous to the survey. It should be noted that the ECV 2003 has two distinct questions of labor force participation depending on the age of the person. For younger children (aged 5-11) it is asked whether the child worked in household chores or whether she helped an adult of the household in her work. For older individuals (above 12 years of age) the survey asks the standard labor force participation questions. Table 2 shows that while less than 5% of children who work in household chores drop-out of school; the percentage of working youngsters that drop-out reaches almost 15%.

TABLE 2 should go here

As for family characteristics we find that the average education of the household head is 7.2 years of schooling for children who are attending school and drops to 4.1 years for children out of the education system. Similarly, the difference in the average monthly per capita income in households of children who drop-out and those who don't reaches to almost 45%. The survey also includes detailed information on family's wealth captured by the ownership of different types of assets, the quality of the house and access to public services. With this information and using principal components analysis we constructed a

[12] Even though in 2003 the ECV was applied in only 128 municipalities it contains detailed information on migration of households and hence we were able to establish their history of residence. It was determined that the interviews households had resided in 235 municipalities.

variable that captures household's wealth. This variable has positive values ranging from zero to fifteen, where fifteen indicates the richest household. As expected, the children belonging to wealthier families have lower drop-out rates. Finally, the survey includes information on household migration, giving us the exact moment it occurred as well as the location of origin. As shown in the Table, 16% of the children in the survey belong to a migrant household. Furthermore, migrant children have a higher probability of being out of the education system than non migrants.

The ECV 2003 survey also includes a specific question on the precise moment of the drop-out decision for each individual. This question allows us the construction of the academic history of each student so as to carry out the duration analysis methodology described in section 3. Specifically, we expanded the data base so that for each individual there will be as many observations as her years of school attendance. Assuming that children start school at six (age defined by the Colombian law) we estimate her years of school attendance according to her last grade approved and her enrollment or drop-out information.[13] For each one of these expanded observation we created a drop-out dummy variable equal to zero if the individual is attending school in that year and equal to one the year she decided to drop-out of school. This will be our dependent variable and as in all duration analysis studies it will be right censored.[14] The expanded data set contains 120,330 observations and is matched with the individual and household characteristics that are assumed to be invariant over time. It should be kept in mind that the implicit assumption taken here is that individuals that are currently in school have never dropped out from the education system.

The data at the municipal level is obtained from several sources.[15] As for the intensity of civil conflict within Colombian municipalities it should be mentioned that this conflict

[13]For instance, and individual with age 15 that in 2003 is attending school and has completed the ninth grade will have ten observations starting in 1994. Similarly, a 12 year old individual that dropped out of school in the year 1999 and had completed only 2 years of education will have an academic history of three observations that started in 1997 and ended two years later.

[14]Even though the question was asked to every individual that reported being out of the education system, 30 of them did not answer it or did not remember the exact drop-out date. In order to lose as less observations as possible, we reckon the drop-out year of these individuals based on their age and their completed years of education. All regressions include a dummy variable indicating if the year of drop-out was reckoned. Results are maintained when these individuals are not taken into account.

[15]Data was collected from Departamento Nacional de Planeación (DNP), Departamento Administrativo Nacional de Estadistica (DANE), Policía Nacional, Departamento Administrativo de Seguridad (DAS) and Centro de Estudios sobre Desarrollo Economico (CEDE) among others.

is one of the longest ongoing domestic confrontations in the world surpassed in length only by the Israeli-Palestinian and the Indian-Pakistani conflicts. The main irregular armed groups are two guerrilla organizations known as the Revolutionary Armed Forces of Colombia (FARC) and the National Liberation Army (ELN) both of which originated in communist ideas in the early sixties; and one rightwing paramilitary group known as the United Self-Defense Forces of Colombia (AUC) with almost twenty five years of existence and which is now under a peace process with the government. All three groups perpetrate attacks against infrastructure and the civil population, kidnap both by extortive or political reasons, engage in drug trafficking and have direct armed contact with the State army.

Our measure of civil conflict in this paper will be the total number of the offensive actions (attacks against infrastructure and the civil population and clashes with governmental forces) undertaken by the guerrillas, paramilitary groups or common criminality in each municipality and year. Table 3 shows that, between 1992 and 2003, the average municipal attack rate in the country reached 6.6 per 100,000 individuals. However, this rate varies significantly across time and municipalities with an average standard deviation of 15 attacks. The same Table also presents descriptive statistics of the instruments used in our empirical estimations. As discussed, we use government deterrence measures that should explain the presence of attacks but in principle should not be related with schooling investment decisions at the household level. Two available deterrence measures were utilized: Antinarcotics Operations at the municipality level and the Homicide Captures at the state level. As can be observed in Table 3 there is substantial variation in both deterrence measures. Finally, this information is complemented with the per capita income tax and poverty measures at the municipality level, whose mean and standard deviation are presented as well in Table 2.

TABLE 3 should go here

The combination of both data sets will let us know for every youngster in the ECV 2003 the number of attacks she was exposed to in each year while she should have been attending school and the deterrence actions implemented by the government in her municipality. Thus, these data features will allows us to carry out the duration analysis methodology so as to determine how violence affects the risk of schooling drop-out.

4 The Impact of Armed Conflict on Drop-Out Schooling Decisions

School enrollment rates in Colombia have been continuously increasing during the last decade in spite of the ongoing domestic conflict.. Estimates from the Ministry of Education for the year 2005 indicate that primary gross enrollment rates were close to 110% while secondary enrollment rates increased from 72% to 88% during the mentioned decade. Similarly, drop out rates have decreased for every school grade. Figures from the Ministry of Education revealed that between 2000 and 2003 drop-out rates in preschool and primary education fell in two percentage points; while the reduction in secondary education was close to 1 percentage point.

A first glance at these macro figures could erroneously lead to conclude that the Colombian domestic conflict has not been harmful to schooling outcomes. A closer look at the data however provides a completely different story. Descriptive statistics show a positive correlation between armed conflict and drop-out rates. Accordingly, for individuals between six and seventeen years of age, the average drop out-rate in municipalities that experienced a higher than average rate of attacks is 17.6%; while the same rate in more peaceful municipalities reaches 9.5%. These differences are also evident when one examines the average education attainment of children in these municipalities. As can be observed in Table 4, average years of education are 0.7 higher for seventeen year old children residing in the less violent municipalities compared to those residing in more violent ones.

TABLE 4 should go here

A similar conclusion can be derived under the standard methodologies used in the related literature. The models in Table 5 present the results of a probit model estimation of the effect of 2003 attacks rate in the municipality on school enrollment status in that year. As Model I shows, the probability of not being enrolled in school significantly increases with the contemporaneous attack rate in the municipality. Furthermore, as shown in Model II, this effect appears to be larger for poorer households. These may be however misleading estimates on the impact of violence on education decisions. As previously stated, there are at least two problems that should be addressed: the dynamic

framework of education decisions and the possible reverse causality between school drop-out rates and violence.

4.1 Non-parametric Estimation Results

In order to incorporate the dynamic effect of violence on schooling decisions we use a duration analysis framework. Preliminary evidence of the impact of violence on school investment decisions under a non parametric approach is presented in Graphs 1 and 2. They both present the Kaplan-Meier estimator which calculates the survival function $S(t)$ for school attendance, displaying the probability of remaining in school past time t. The first graph divides the kids according to whether they reside or not in a municipality with higher than average conflict attacks. As expected, the probability of staying enrolled decreases in time for both groups. Nevertheless, the survival function decreases in time at a much higher rate for children that are subject to higher intensity of civil conflict while attending school. A log rank test, with null hypothesis that the survival functions of the two groups are the same, is rejected with a Chi2 value of 297.92.[16]

GRAPH 1 should go here

Graph 2 allows us to establish whether there might be different survival functions depending on children's family characteristics. The graph displays four different survival curves in which we first differentiate between households in the first and fifth quintile in our wealth measure. We further disaggregate them into households that live in municipalities with higher than average rate of attacks. It is apparent that the survival function for wealthier kids is always above that of poorer children. But, as in the previous graph, the survival function of individuals residing in municipalities with higher than average attacks is always beneath that of individuals residing in more peaceful municipalities. Again, a log rank test allows us to reject the null hypothesis of equality in the survival functions of each group with a Chi2 of 19.02.

GRAPH 2 should go here

[16] Cleves et al. (2004) point out that these tests compare the overall survival functions across groups but do not test their equality at a specific time point.

4.2 Parametric Estimation Results

The evidence above presented however, does not take into account all the differences observed in the descriptive statistics between children that have dropped out of the education system and those who have not. Previous literature has established the importance that individual and family characteristics play in the determination of human capital investments. To account for such characteristics, Table 5 presents the results of the estimation of a discrete time duration model under a normal and a logistic hazard functions following Jenkins (2004).

TABLE 5 should go here

As can be observed, all the controls used in the estimations have the expected signs. In Colombia boys have a significantly higher probability of dropping out of school than girls do. Similarly, children belonging to poorer households, those who are overaged or those that reside in a household where the head has a low level of education have higher drop-out risk Likewise, children that have migrated at some point in their lives are at a significantly higher risk of dropping out of school than those who have always resided in the same place.[17] Finally, children living in municipalities with lower levels of land inequality and higher levels of per capita local taxes (measure of local wealth) exhibit lower drop out risk.

Models (1) and (4) in the same table may suggest that after controlling for personal and family characteristics, armed conflict has either a positive but small or no effect at all on the drop-out risk of Colombian students under a normal and a logistic distribution respectively. However, these estimates ignore the possible simultaneity problems between attacks and drop-out decisions of students. In order to consider this possibility, we undertook an instrumental variables approach using as appropriate instruments the average of two year lagged government's deterrence measures. The lower panel of Models (2), (3), (5) and (6) in Table 6 presents the first stage results of this estimation strategy. Both instrumental variables have the expected sign and are highly significant as can be

[17] This finding is particularly relevant given that Colombia is the second country with the highest number of displaced population and suggests specific policies that should be implemented for these children.

observed in the t-statistics and the F-test presented. Deterrence actions taken in the previous two years such as antinarcotics operations that cut down drug trafficking revenues for the irregular groups and homicide captures at the state level that discourage criminal activities bring violence down in the municipality. Moreover an endogeneity test in which the null hypothesis states that the armed conflict measure is exogenous is clearly rejected at a 1% confidence level. Finally, the Sargan test performed for the normal distribution results indicates that given that one of the instruments is exogenous we can not reject the hypothesis that the other one is also exogenous under any standard confidence levels.

The preliminary evidence presented under the non-parametric approach is corroborated using parametric discrete time duration analysis and controlling for the armed conflict endogeneity. In all specifications the coefficient of interest implies that students that live in a municipality with higher civil conflict rates will have higher risk of exiting the education system.[18] Models (3) and (6) in Table 6 include the interaction of the instrumented attacks variable with household's wealth. However, none is statistically significant suggesting that once we control for households characteristics the impact of conflict does not vary depending on the wealth of each household but rather affects all children in the same magnitude. This result contrast with those found in the literature by Akresh and de Walque (2008) who report that wealthier children were the most affected ones in the Rwandan genocide.

The coefficients in the regressions allow us to intuitively understand the effect of violence on schooling investment decisions. Using the results from the hazard Model (4) in Table 6 we estimate the survivor function $S(t)$ for each student in its academic history. Specifically, if we denote $p(s)$ as the probability of exiting the schooling system in period t, then the survivor probability for all the academic history of each child will be given by: $S(t) = \prod_{s=1}^{t}(1-p(s))$. Using this probability it is possible to estimate the expected average education attained by each child in our sample. Furthermore, we can also estimate the counterfactual average education attainment if no armed conflict took place.

TABLE 7 should go here

[18] Bootstrap standard errors are reported in Table 5 in order to take into account the instrumental variable approach.

As shown in Table 7, the coefficients obtained suggest that the civil conflict in Colombia has reduced the average education of students residing in conflict areas by 0.49 years. Even though this effect is similar for all children irrespective of their gender or level of household wealth, it greatly differs according to the age of children. While there does not seem to be a significant effect on the educational investments of younger students; violence has negatively affected the attainment of older individuals. We estimate that if no violence occurred in Colombia, the average educational attainment of children residing in conflict areas between twelve and fifteen years of age would be 0.74 years larger. Similarly, for children between sixteen and seventeen the presence of armed conflict has reduced their education in 1.4 years. This effect is significant and it amounts to 17.03% of the average education this children now have.[19]

5 Likely Pathways from Conflict to School Drop-out

Theoretically, there are several factors that could be driving the results previously found. Civil conflicts may increase the drop-out risk of students through a reduction in returns to schooling, through negative economic shocks affecting the family, through the destruction of fiscal capital such as schools or roads, through migration of teachers, through a reduction in life expectancy or simply due to the fear that parents may have of sending their children to school. Understanding the pathways through which armed conflict influence schooling investment decisions is necessary in order to design the proper policy responses. In this section we investigate three possible channels related with three distinct literatures: the first one that establishes the negative consequences that violence brings to economic conditions, the second one that links economic shocks to children's labor participation and finally the third one that connects life expectancy and human capital accumulation.

Previous studies such as Abadie and Gardeazabal (2003) and Alesina et al. (1996) have established the negative consequences that armed or civil conflicts may have on the economies of the affected regions. Similarly, Deininger and Okidi (1999) and Verwimp and Bundervoet (2008) prove there exists negative effects of civil conflict on households'

[19]It is interesting to note that Akresh and de Walque (2008) estimate that boys and girls exposed to the Rwandan genocide completed 0.5 and 0.3 less years of education. Akbulut-Yuksel (2008) finds the same negative impact for German children under WWII.

consumption growth. By the same token, Colombian households residing in municipalities with higher levels of violence could experience negative economic shocks which could in turn force some children to work and leave school. Even though no previous study has directly evaluated the effect of violence or internal conflicts on the probability of children's work, there is a vast literature relating economic shocks with children's employment and schooling. For Mexico, Skoufias and Parker (2006) found that unemployment of the household head induce larger labor force participation of girls. For Brazil, Duryea et al. (2007) found that negative economic shocks reduce school enrollment and increase children's labor force participation. Similarly, Jacoby and Skoufias (1997) and Beegle et al. (2006) within a credit constraint framework find that income fluctuations affect school attendance and labor supply for youths in Indonesia and Tanzania respectively.

A second possible transmission channel tested in this paper is related with a somewhat younger literature that studies the relationship between life expectancy with human capital accumulation decisions. The literature suggests that lower life expectancy is translated into smaller returns to educational investments that induce a trade-off for parents between education investments and child labor. Theoretically, Soares (2005) and Estevan and Baland (2007) develop models that suggest a positive relationship between life expectancy and schooling. Moreover the latter authors prove that indeed higher mortality of youngsters induces inefficiently high levels of child labor. Empirical studies such as Lorentzen et al. (2005) and Jayachandran and Lleras-Muney (2008) have found that increases in life expectancy are associated with higher human capital investments. Armed conflict and the premature deaths it causes is just another channel thorough which life expectancy is altered.

Finally, it is reasonable to assume that armed conflict will not only change the expected returns to education through life expectancy but also through the quality of education that children living in conflict areas may receive. For instance, Hanushek et al. (2008) show that indeed drop-out decisions are related to school quality in the sense that students attending a low-quality school are less likely to remain in school compared to those if attending high-quality schools. Even though there is no study in the literature linking directly school quality and armed conflict, it is reasonable to think that the number and quality of teachers, the infrastructure available and even the attendance rate in conflict areas will be lower. For instance, as previously mentioned, Akbulut-Yuksel (2008)

showed that under WWII the number of schools and teachers were negatively affected by the conflict. Hence, it could also be the case that armed conflict in Colombia reduces the quality of education imparted in schools and in turn reduce the returns to education of children.

The empirical strategy we implement to determine the channels from armed conflict to drop-out decisions and child labor is depicted in Diagram 1. To test these three channels we use a bivariate probit regression model in which the dependent variables are whether the child works and whether she drops-out of school. Given that the ECV 2003 only reports information of working activities for the past week we are not able to carry out a duration analysis. However, in order to capture the long term effect that violence may have during the child's schooling time we construct the average conflict each child has been exposed to during this period and instrument it using the lagged homicide captures rate at the state level.[20]

DIAGRAM 1 should go here

Estimation results are presented in Model 1 of Tables 8 and 9 using information for children younger and older than twelve years of age in 2003 respectively. For both groups of age we observe that children tend to work more the older they are and the poorer their family is. Similarly, boys have a higher probability to be engaged in working activities than girls. It is estimated that a boy between five and eleven has almost 2% higher probability than a girl of working; while for older boys this effect increases to 4%. Moreover, boys have a higher probability of dropping out of school. This might explain the higher education achievements of Colombian girls and is consistent with previous studies made for Colombia such as Attanasio et al. (2006).

TABLES 8 & 9 should go here

Looking at the coefficient of interest, we find that average exposure to violence during schooling time has no significant effect on schooling or work in household chores for children between five and eleven years old. On the contrary, for children older than twelve armed conflict during school increases both the probability of work and drop-out.

[20] In this case the measure of armed conflict exposure and hence the instrument used are different from the ones in the duration analysis approach. In this case the conflict variable is the average exposure to conflict of each child during her schooling years.

Both Tables also explore the three possible channels above explained through which armed conflict could increase labor and reduce educational investments. As expected, no effect of these channels could be found for children younger than twelve. However, for older children, as can be observed in Table 9 results are very different. For the economic shock hypothesis we use the growth in the commerce and industry tax at the municipal level during the child's school time in order to capture the economic shock channel stemmed by conflict in the municipality the child lives. As can be observed in Model (2) economic activity in the municipality is negatively influenced by the exogenous variations of armed conflict. Moreover, the higher the growth in economic activity (measured by the change of industry and commerce tax revenues) the lower the probability that children older than twelve years of age drop-out of school and enter into the labor force. Similarly, the lower panel of Model (3) shows that armed conflict increases the homicide rate in the municipality where the child lives and hence will decrease also life expectancy of its inhabitants. In addition, the instrumented higher homicide rate increase child work and drop-out decisions. Finally, as can be observed in Model (4), the effect of armed conflict on quality of education measured through a standardized high school graduation exam (ICFES) turns out to be negative and significant. More importantly, it appears that a lower level of school quality induces children to leave school and start working.[21]

Given the importance of understanding the magnitude of these transmission channels, the marginal effect for each of them was estimated.[22] Of all the three possible channels we find that the strongest effect comes from the decrease in life expectancy and hence in the returns to education. It is estimated that an increase in one standard deviation on the homicide rate (5.02) will increase the probability that a child engages in work activities and drop out of school by almost 4%. The effects of changes in one standard deviation in the other two possible transmission channels are both close to 2%.[23]

[21] It must be stressed out that these regressions are not IV regressions. Our objective is to understand the channels through which armed conflict affects schooling and labor decisions. Model (1) and the duration analysis results prove that indeed conflict affects our variables of interest. Models (2) - (4) provide evidence of how violence affecting economic activity, life expectancy and school quality influences schooling investments and labor participation. We also run models (first stage) where the driving mechanisms –namely economic shocks, homicide rate and quality of education- were directly affected by homicide captures and the main results are maintained. These are available upon request.

[22] These were estimated using the mfx command in Stata.

[23] The standard deviation for these two channels is 0.0012 for the growth in Industry and Commerce Tax in the municipality and 0.02 for the quality of education channel.

For the first two possible channels (economic shock and life expectancy) the policy implications are clear. Estevan and Baland (2007) prove that even though higher young adult mortality rates induce a trade-off between education and child labor, conditional cash transfers could in principle restore child labor to its efficient level. Similarly, the studies relating child labor and economic shocks suggest that mechanisms that help smooth households' income could in principle reduce child labor and increase school attendance. The absence of a complete insurance market in Colombia for deaths or economic shocks appears to be indeed a driving mechanism. Hence, in either the economic shock channel or the changes in expected returns to education channel, conditional cash transfers could be a useful policy tool to reduce drop-out rates in conflict areas.[24]

6 Conclusions

The main purpose of this paper is to establish the effect that armed conflicts may have on households' schooling investment decisions in Colombia. Estimating such effect is imperative given the high incidence of armed conflicts in developing countries and the importance that education has on the wellbeing of individuals. Additionally, as the real costs that violence entails in the development of nations is rightly assessed, policy makers would better implement the appropriate measures to offset its negative effects.

Even though previous studies have dealt with this question before, this study complements the existing literature in several respects. As mentioned, we use unique data sets that allow the construction of the education history of children and their exposure to conflict. Moreover, we take into consideration the intertemporal characteristic of schooling investment decisions and hence take a duration analysis approach. In addition, we correct for the possible endogeneity problems. We find that under both a non parametric and a parametric methodology violent attacks significantly increases the risk of school drop-out for children between ages six and seventeen. This effect is stronger for children older than twelve years of age for whom a trade-off between child labor and schooling emerges. We are able to identify at least three channels through which this effect takes

[24] Another alternative explanation for the increase in child labor and the reduction of educational investments could be that children in Colombia are leaving school in order to work in the illicit drugs business for instance as coca growers. However, evidence from Angrist and Kuegler (2007) suggests this may no be an important channel given that even though younger boys in coca regions do tend to increase labor force participation the effect on school attendance is not robust.

place, namely negative economic shocks, lower life expectancy and lower school quality.

These results put on evidence the major impact that armed conflicts around the world may be causing on economic development through a decrease in human capital accumulation. The policy recommendations that stem from this paper are clear. Countries suffering civil conflict should design measures to reduce school drop-out particularly in the most affected areas. Conditional cash transfers for school attendance and employment opportunities for parents would reduce labor participation and drop out risk of children. In addition, according to HRW many of the children that today are participating in the Colombian war join the armed groups through their own will and many times they do it in order to receive some payment. Hence, direct conditional transfers to families could diminish children participation in war and hence the people directly involved in the conflict. Lastly, once the conflict is over government policy should directly target individuals that were school aged during the conflict period and design special programs that allow them to attain at least the human capital levels had they accumulated in the absence of conflict.

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TABLES

Table 1: Descriptive Statistics

Child's Age	Child's Schooling Status		Total No. of Children
	In School	*Drop-out*	
6	98.21%	1.79%	1,623
7	98.47%	1.53%	1,696
8	97.88%	2.12%	1,652
9	97.73%	2.27%	1,719
10	97.48%	2.52%	1,668
11	95.92%	4.08%	1,569
12	93.33%	6.67%	1,738
13	89.51%	10.49%	1,620
14	85.30%	14.70%	1,565
15	81.32%	18.68%	1,429
16	75.78%	24.22%	1,445
17	57.35%	42.65%	1,564
Total No. of Children	**17,253**	**2,035**	**19,288**

Source: ECV 2003

Table 2: Descriptive Statistics

Characteristics	Child's Schooling Status		Total No. of Children
	In School	*Drop-out*	
Male	89.39%	10.61%	9,526
Female	89.51%	10.49%	9,426
Rural	80.33%	19.67%	4,828
Urban	92.67%	7.33%	14,124
Single	90.22%	9.78%	18,797
Other status	17.56%	82.44%	155
Not Over-aged	88.99%	11.01%	14,211
Children aged 5-11 engaged in Domestic Work	94.82%	5.18%	6,137
Children aged 12-17 engaged in Income Generating Work	84.59%	15.41%	863
Head of Household's Education	7.14	4.12	19,288
Household Income	95,356	52,593	19,288
Wealth Index	8.73	6.37	19,288
Non-Migrants	91.05%	8.95%	16,073
Migrants	81.46%	18.54%	3,215
Municipal per capita Taxes (Millons)	0.10	0.06	19,288
Unsatisfied Basic Needs Index (Poverty Rate)	28.28	39.18	19,288

Source: ECV 2003, Departamento Nacional de Planeación (DNP) and CEDE.

Table 3: Descriptive Statistics

Year	Municipalities	Attacks Rate		Antinarcotics Operations Rate		Homicide Capture Rate (State Level)	
		Mean	*Std. Dev*	*Mean*	*Std. Dev*	*Mean*	*Std. Dev*
1992	1,075	6.53	13.83	2.20	7.23	0.30	0.40
1993	1,075	3.06	9.04	1.21	4.82	0.25	0.20
1994	1,075	5.03	11.69	1.29	5.99	0.24	0.15
1995	1,075	2.91	7.61	1.35	5.14	0.25	0.19
1996	1,075	3.30	8.93	1.05	4.12	0.26	0.21
1997	1,075	4.47	9.93	0.73	3.65	0.25	0.25
1998	1,075	4.79	10.92	0.47	2.30	0.32	0.43
1999	1,075	6.01	13.31	0.64	4.98	0.32	0.32
2000	1,075	7.80	16.84	0.41	2.22	0.41	0.73
2001	1,075	8.16	19.64	0.34	1.91	0.39	0.61
2002	1,075	12.27	23.91	0.34	1.63	0.38	0.48
2003	1,075	16.58	35.04	0.08	0.75	0.29	0.19

Source: Departamento Nacional de Planeación (DNP), Policía Nacional, Departamento Administrativo de Seguridad (DAS) and CEDE.

Table 4
Average Grade Approved According to Place of Residence

Age	Average Grade Approved		Difference
	High Violence	Low Violence	
5	1.48	1.67	0.20
6	1.93	1.99	0.06
7	2.61	2.82	0.21
8	3.44	3.73	0.29
9	4.24	4.62	0.39
10	5.15	5.55	0.40
11	5.76	6.36	0.60
12	6.60	7.18	0.58
13	7.31	7.97	0.66
14	8.12	8.78	0.67
15	8.81	9.42	0.61
16	9.10	9.95	0.84

Source: ECV 2003, Departamento Nacional de Planeación (DNP) and CEDE.

Table 5

Logit Regression: Dependent Variable Not Enrolled in School for Children Aged 6-17 in 2003

COEFFICIENT	(1) Not Enrolled	(2) Not Enrolled
Attacks in 2003 (in log)	0.0952***	0.2307***
	[0.0149]	[0.0289]
Attacks in 2003*Wealth		-0.0257***
		[0.0049]
Age	0.2259***	0.2276***
	[0.0073]	[0.0074]
Male	0.0577*	0.0603**
	[0.0297]	[0.0297]
Head Education	-0.0391***	-0.0408***
	[0.0045]	[0.0045]
Log (Home per capita income)	-0.0098***	-0.0111***
	[0.0034]	[0.0034]
Wealth	-0.0881***	-0.0534***
	[0.0090]	[0.0108]
Urban	-0.0349	0.0092
	[0.0493]	[0.0501]
Single	-1.3557***	-1.3562***
	[0.1084]	[0.1092]
Number of children	0.0134	0.0119
	[0.0094]	[0.0095]
Over-age	0.0404***	0.0379***
	[0.0106]	[0.0107]
Head gender	-0.043	-0.048
	[0.0334]	[0.0335]
Overcrowding	-0.3232***	-0.3351***
	[0.0886]	[0.0891]
Log (Municipal Taxes)	-0.0507	-0.0605*
	[0.0315]	[0.0318]
Poverty Rate	0	-0.0005
	[0.0015]	[0.0016]
Migration	0.2600***	0.2642***
	[0.0342]	[0.0342]
Constant	-2.1323***	-2.3083***
	[0.1969]	[0.2002]
Observations	20,148	20,148

All regressions include state fixed effects.

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 6

Duration Analysis: Dependent Variable is Drop-out of School status for Children Aged 6-17

COEFFICIENT	*Normal Hazard Function*			*Logistic Hazard Function*		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Dropout	**Dropout**	**Dropout**	**Dropout**	**Dropout**	**Dropout**
Attacks (in log)	0.0023***	0.0382***	0.0446	-0.0362	0.6607*	-0.3315
	[0.0006]	[0.0117]	[0.0341]	[0.0351]	[0.3700]	[0.8666]
Attacks(in log)*Wealth			-0.0012			0.0985
			[0.0030]			[0.0730]
Age	0	0.0002	0.0002	-0.3308***	-0.3234***	-0.3316***
	[0.0004]	[0.0005]	[0.0005]	[0.0429]	[0.0493]	[0.0612]
Male	0.0019***	0.0019	0.0020**	0.2344***	0.2378***	0.2271***
	[0.0007]	[0.0012]	[0.0010]	[0.0545]	[0.0536]	[0.0492]
Head Education	-0.0003***	-0.0003	-0.0003**	-0.1000***	-0.1002***	-0.0869***
	[0.0001]	[0.0002]	[0.0001]	[0.0099]	[0.0130]	[0.0112]
Log (Home per capita income)	-0.0002**	-0.0002	-0.0002	-0.0179***	-0.0178**	-0.0182**
	[0.0001]	[0.0001]	[0.0001]	[0.0062]	[0.0089]	[0.0081]
Wealth	-0.0026***	-0.0027***	-0.0014	-0.2298***	-0.2288***	-0.3435***
	[0.0002]	[0.0006]	[0.0040]	[0.0177]	[0.0260]	[0.0849]
Urban	-0.0071***	-0.0062**	-0.0053	-0.0544	-0.0433	-0.0593
	[0.0014]	[0.0031]	[0.0033]	[0.0988]	[0.1210]	[0.1502]
Single	-0.0732***	-0.0753***	-0.0752***	-1.4569***	-1.4861***	-1.5260***
	[0.0033]	[0.0098]	[0.0106]	[0.1201]	[0.1830]	[0.1547]
Number of children	0.0014***	0.0013***	0.0012***	0.0572***	0.0573**	0.0466**
	[0.0002]	[0.0004]	[0.0003]	[0.0160]	[0.0223]	[0.0216]
Over-age	0.0084***	0.0082***	0.0082***	0.7644***	0.7579***	0.7653***
	[0.0005]	[0.0014]	[0.0014]	[0.0444]	[0.0531]	[0.0641]
Head gender	0.0007	0.0004	0.0003	-0.075	-0.0797	-0.0691
	[0.0008]	[0.0012]	[0.0013]	[0.0610]	[0.0759]	[0.0765]
Overcrowding	0.0018	0.0008	0.0004	-0.3189*	-0.3219	-0.4146*
	[0.0021]	[0.0043]	[0.0036]	[0.1682]	[0.2361]	[0.2176]
Log (Municipal Taxes)	-0.0018	-0.0132***	-0.0120***	-0.4289***	-0.6325***	-0.5664***
	[0.0012]	[0.0041]	[0.0040]	[0.0905]	[0.1469]	[0.2123]
Poverty Rate	-0.0008***	0.0017***	0.0015**	0.0387**	0.0846**	0.0623
	[0.0002]	[0.0006]	[0.0007]	[0.0167]	[0.0357]	[0.0466]
ln(Event)	0.0149***	0.0139**	0.0140**	3.5430***	3.5164***	3.5213***
	[0.0014]	[0.0069]	[0.0069]	[0.2163]	[0.3581]	[0.4533]
Migration	0.0027***	0.0029*	0.0030**	0.1477**	0.1505*	0.1578**
	[0.0010]	[0.0017]	[0.0014]	[0.0675]	[0.0817]	[0.0756]
Instruments First Stage						
Antinarcotics Operations		-0.1511***	-0.0823***		-0.1511***	-0.0823***
		[0.0057]	[0.0130]		[0.0057]	[0.0130]
Homicide Captures		-0.2035***	-0.2023***		-0.2035***	-0.2023***
		[0.0046]	[0.0050]		[0.0046]	[0.0050]
*Antinarcotics Operations*Wealth*			-0.0091***			-0.0091***
			[0.0015]			[0.0015]
*Homicide Captures *Wealth*			-0.0005**			-0.0005**
			[0.0002]			[0.0002]
F-Test		1160.98	822.44		1160.98	822.44
Endogeneity Test -Chi~2 (1)		47.83	14.87		47.83	14.87
Observations	120,156	120,156	120,156	120,156	120,156	120,156
Number of Municipalities	235	235	235	235	235	235

All regressions include controls for duration dependence and possible frailty, or unobserved heterogeneity, at the municipality
Bootstrap Standard errors are reported in brackets for models 2, 3, 5 and 6 (*** p<0.01, ** p<0.05, * p<0.1).

Table 7
Predicted Impact of Armed Conflict on Human Capital Accumulation

Category	Number of Children	Predicted Average Schooling with Violence	Predicted Average Schooling without Violence	Average Difference
All Children	18,891	5.651	6.147	-0.496***
		(0.020)	(0.021)	(0.007)
Children Aged 6-11	9,948	3.963	4.061	-0.097***
		(0.016)	(0.017)	(0.002)
Children Aged 12-15	6,237	7.200	7.935	-0.735***
		(0.029)	(0.025)	(0.011)
Children Aged 16-17	2,706	8.284	9.695	-1.411***
		(0.056)	(0.041)	(0.029)

Standard errors in parenthesis
Authors' calculations based on Model 5 of table 5.

Table 8

IV Biprobit Model: Dependent Variables is Work and School Drop-out Status for children aged 6-11

COEFFICIENT	(1)		(2)		(3)		(4)	
	Work	Dropout	Work	Dropout	Work	Dropout	Work	Dropout
Attacks while in school (in log)	0.0281	0.4831						
	[0.2755]	[0.6130]						
Industry and Commerce Tax Growth Rate			-6.3688	-109.4019				
			[62.3944]	[138.8119]				
Homicide Rate					0.0012	0.0206		
					[0.0118]	[0.0262]		
Relative ICFES score							-0.6217	-10.678
							[6.0899]	[13.5485]
Age	0.1068***	0.1090***	0.0962	-0.0733	0.1050***	0.0776**	0.1091***	0.1480**
	[0.0101]	[0.0238]	[0.0988]	[0.2200]	[0.0150]	[0.0344]	[0.0290]	[0.0650]
Male	-0.0753***	-0.0235	-0.0757***	-0.0298	-0.0753***	-0.0233	-0.0754***	-0.0257
	[0.0264]	[0.0635]	[0.0264]	[0.0643]	[0.0264]	[0.0635]	[0.0263]	[0.0637]
Head Education	-0.0063*	-0.0370***	-0.0063*	-0.0368***	-0.0063*	-0.0370***	-0.0063*	-0.0370***
	[0.0037]	[0.0101]	[0.0037]	[0.0101]	[0.0037]	[0.0101]	[0.0037]	[0.0101]
Wealth	-0.0619***	-0.1091***	-0.0617***	-0.1060***	-0.0620***	-0.1102***	-0.0620***	-0.1102***
	[0.0089]	[0.0213]	[0.0092]	[0.0219]	[0.0089]	[0.0213]	[0.0089]	[0.0213]
Urban	0.0137	0.0392	0.0166	0.0891	0.0125	0.0176	0.0124	0.0165
	[0.0547]	[0.1288]	[0.0658]	[0.1510]	[0.0540]	[0.1279]	[0.0540]	[0.1280]
Number of children	-0.0207**	0.0400**	-0.0210**	0.0351*	-0.0207**	0.0404**	-0.0207**	0.0405**
	[0.0089]	[0.0180]	[0.0094]	[0.0193]	[0.0089]	[0.0179]	[0.0089]	[0.0179]
Over-age	-0.0488***	-0.0263	-0.0397	0.1308	-0.0472***	0.002	-0.0508*	-0.0606
	[0.0151]	[0.0400]	[0.0852]	[0.1902]	[0.0176]	[0.0442]	[0.0288]	[0.0681]
Head gender	-0.0269	-0.2419***	-0.0265	-0.2359***	-0.0264	-0.2343***	-0.0268	-0.2400***
	[0.0305]	[0.0686]	[0.0305]	[0.0685]	[0.0305]	[0.0686]	[0.0304]	[0.0685]
Overcrowding	-0.2476***	-0.3605	-0.2486***	-0.3771	-0.2471***	-0.3515	-0.2468***	-0.3467
	[0.0844]	[0.2353]	[0.0859]	[0.2383]	[0.0841]	[0.2345]	[0.0840]	[0.2343]
Migration	-0.0255	0.2822***	-0.0225	0.3330***	-0.0257	0.2774***	-0.0257	0.2777***
	[0.0390]	[0.0793]	[0.0443]	[0.0898]	[0.0396]	[0.0809]	[0.0395]	[0.0808]
Constant	0.4125	-1.9150**	0.56	0.6181	0.3998	-2.1330**	0.8053	4.8319
	[0.3388]	[0.7501]	[1.1501]	[2.5615]	[0.4538]	[1.0059]	[3.5468]	[7.8937]
First Stage								
Captures	-0.0990***	-0.0990***						
	[0.0044]	[0.0044]						
Instrumented Attacks Rate			-.0044***	-.0044***	23.4057***	23.4057***	-0.0452***	-0.0452***
			[.0006]	[.0006]	[2.1157]	[2.1157]	[0.0010]	[0.0010]
Observations	10,087	10,087	10,087	10,087	10,087	10,087	10,087	10,087

All regressions include municipal fixed effects.

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table 9

IV Biprobit Model: Dependent Variables is Work and School Drop-out Status for children aged 12-17

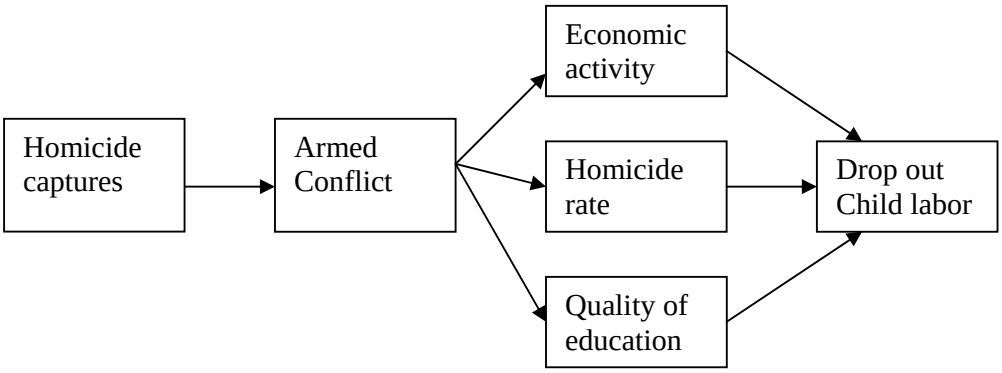
COEFFICIENT	(1)		(2)		(3)		(4)	
	Work	Dropout	Work	Dropout	Work	Dropout	Work	Dropout
Attacks while in school (in log)	3.6366***	3.5486***						
	[0.4639]	[0.4409]						
Industry and Commerce Tax Growth Rate			-452.585***	-441.631***				
			[66.4691]	[59.8195]				
Homicide Rate					0.2463***	0.2404***		
					[0.0362]	[0.0326]		
Relative ICFES score							-26.1910***	-25.5572***
							[3.8466]	[3.4617]
Age	0.3198***	0.3788***	0.3029***	0.3622***	-0.0795	-0.0108	0.3261***	0.3849***
	[0.0162]	[0.0136]	[0.0150]	[0.0131]	[0.0522]	[0.0468]	[0.0167]	[0.0146]
Male	0.5674***	0.1158***	0.5381***	0.0872**	0.6502***	0.1966***	0.5571***	0.1057***
	[0.0469]	[0.0363]	[0.0488]	[0.0364]	[0.0513]	[0.0382]	[0.0488]	[0.0363]
Head Education	-0.0214***	-0.0332***	-0.0165**	-0.0284***	-0.0229***	-0.0346***	-0.0188**	-0.0307***
	[0.0069]	[0.0055]	[0.0074]	[0.0053]	[0.0074]	[0.0053]	[0.0074]	[0.0053]
Wealth	-0.1214***	-0.1499***	-0.1185***	-0.1471***	-0.0842***	-0.1136***	-0.1154***	-0.1440***
	[0.0145]	[0.0120]	[0.0146]	[0.0121]	[0.0154]	[0.0129]	[0.0146]	[0.0121]
Urban	0.0664	-0.0545	0.0224	-0.0975	-0.018	-0.1368**	-0.0192	-0.1380**
	[0.0843]	[0.0687]	[0.0825]	[0.0674]	[0.0832]	[0.0679]	[0.0833]	[0.0680]
Single	-0.0882	-1.3640***	0.2157	-1.0675***	0.7306***	-0.5651***	0.0986	-1.1818***
	[0.1263]	[0.1191]	[0.1444]	[0.1275]	[0.1732]	[0.1526]	[0.1427]	[0.1262]
Number of children	0.015	0.0314***	0.0062	0.0228**	0.0406***	0.0564***	0.008	0.0246**
	[0.0130]	[0.0113]	[0.0142]	[0.0116]	[0.0155]	[0.0127]	[0.0142]	[0.0116]
Over-age	-0.0182	-0.0391**	0.0462***	0.0236*	0.3379***	0.3083***	0.0359**	0.0136
	[0.0176]	[0.0157]	[0.0143]	[0.0128]	[0.0412]	[0.0373]	[0.0148]	[0.0132]
Head gender	-0.0225	-0.0638	0.0897*	0.0457	-0.0024	-0.0442	0.0789	0.0351
	[0.0511]	[0.0411]	[0.0508]	[0.0401]	[0.0515]	[0.0407]	[0.0507]	[0.0400]
Overcrowding	-0.0771	-0.2612**	0.0258	-0.1607	-0.3454**	-0.5230***	0.002	-0.1840*
	[0.1267]	[0.1043]	[0.1301]	[0.1072]	[0.1361]	[0.1157]	[0.1298]	[0.1071]
Migration	0.046	-0.0291	0.3234***	0.2417***	-0.1615**	-0.2316***	0.086	0.01
	[0.0600]	[0.0502]	[0.0529]	[0.0444]	[0.0810]	[0.0728]	[0.0581]	[0.0508]
Constant	-8.5559***	-6.5913***	-4.3559***	-2.4930***	-13.9528***	-11.8575***	11.0258***	12.5165***
	[0.5822]	[0.5187]	[0.3094]	[0.2636]	[1.3876]	[1.2353]	[2.3346]	[2.1088]
Instruments First Stage								
Captures	-0.0438***	-0.0438***						
	[0.0036]	[0.0036]						
Instrumented Attacks Rate			-0.0080***	-0.0080***	14.7630***	14.7630***	-0.1388***	-0.1388***
			[0.0006]	[0.0006]	[4.4561]	[4.4561]	[0.0029]	[0.0029]
Observations	9,668	9,668	9,668	9,668	9,668	9,668	9,668	9,668

All regressions include municipal fixed effects.

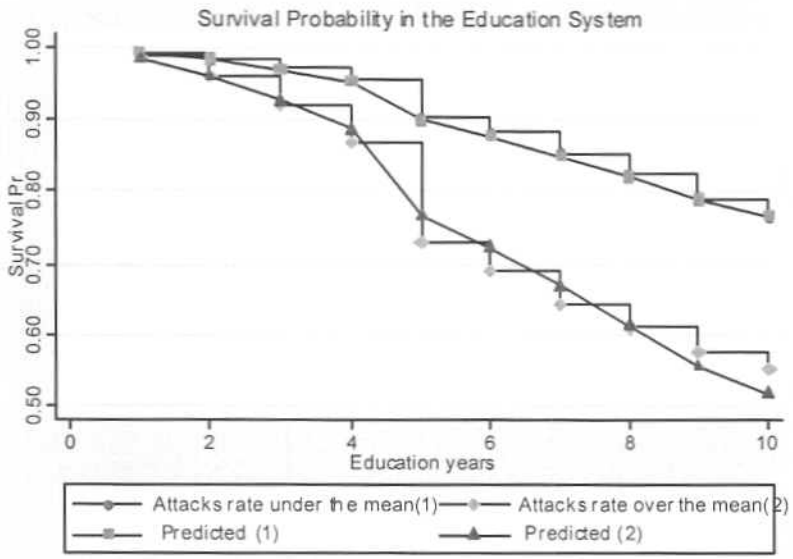
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

DIAGRAMS

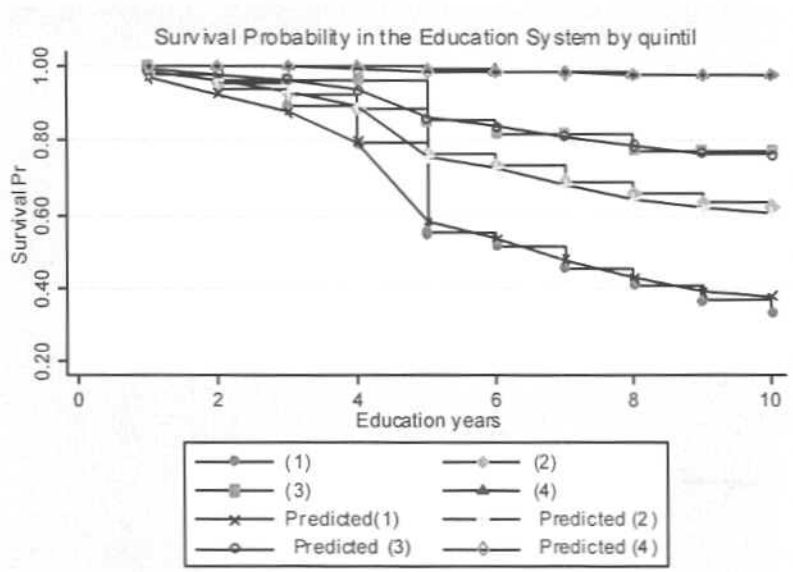
Diagram 1 – Likely transmision channels



Graph 1



Graph 2



(1) Quintil 1 and high violence level
(2) Quintil 1 and low violence level
(3) Quintil 5 and high violence level
(4) Quintil 5 and low violence level