Vulnerability and Children's Time Allocation in Haiti: Evidence from the 2010 Earthquake

Rafael Novella[*] and Claire Zanuso[**]

[*]Inter-American Development Bank
[**]DIAL, Université Paris-Dauphine

December 15, 2014

Abstract

A series of factors predisposes many children to poverty, vulnerability, school dropout, unemployment and social exclusion. In many of these dimensions, Haiti ranks among the poorest countries in the Latin American and Caribbean region and worse than those of Africa with similar levels of GDP per capita. This paper analyses the effect of socioeconomic vulnerability on children's time allocation in Haiti. In particular, we study the household decision about the time allocation of 10-17 years old children to schooling, working and household chores activities. The use of a recent and rich dataset of households in Haiti allow us to account for the damages caused by the January 2010 earthquake on individual, household and community characteristics, including socioeconomic vulnerability. Our results suggest that vulnerability is associated to lower investments in children's human capital.

Keywords : child labor, school attendance, natural disasters, Haiti

JEL Classification: J13, J22, O54, P46

1 Introduction

Children represent a large proportion of human capital in developing countries. In Haiti, half of the population is under 21 years old. Illiteracy rates are still high (around 25 percent) and many children are not in school or dedicate only few hours to studying because they need to contribute to household income or work in the household. Poor households contain more children than average. The school census 2010-2011, enumerates more than 16.000 schools, 12 percent are public and 88 percent private institutions. The large share of non-public education provision makes it difficult to assure quality of education in Haiti as non-public schools, very heterogeneous, largely ignore government regulations, accreditation standards. In line with declared government priorities, public resources devoted to the education sector have increased, but at 2.5 percent of GDP of 2006/07, public education spending appear relatively low compared to the LAC average of 5 percent and still compares poorly with the Low Income Countries (LIC)'s average (3.2 percent of 2006/07 GDP) and by Sub Saharan Africa Standards (average of 3.4 percent of 2006/07 GDP). For instance, total allocation to the sector is 2 percent point lower than Ethiopia (4.6 percent) and more than 3 percent points lower than in Uganda (5.2 percent). Dictatorship, military intervention, natural disasters, and lack of stability have been determining factors in Haiti's social and economic development history. The island ranks 168 among 187 countries in the Human Development Index of the United Nations Development Programme [1]. The country is the poorest in LAC, and among the poorest in the world in terms of per capita gross domestic product (GDP) ($1,575 purchasing power parity (PPP) in 2013). In 2012 almost 60 percent of the population was poor, and one person in four was living below the extreme poverty (Herrera et al., 2014). The country face challenges similar too many African societies in terms of human capital

Little research has been done on Haiti in this area, likely because of lack of data. This paper is mainly based on information extracted from the first nationwide survey about living conditions and labor market after the 2010 earthquake and consists of around 5,000 households interviewed in 2012(Herrera et al., 2014). We study the household decision about the time allocation of 10-17 years old children to schooling, working and household chores activities, taking into account for the damages caused by the January 2010 earthquake according to individual, household

---

[1]http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf

and regional characteristics, including socioeconomic vulnerability. The concept of vulnerability encompasses a variety of definitions. In general, vulnerability means the potential to be harmed. The severity of a disaster depends on both the physical nature of the extreme event and the social nature of the human populations affected by the event. Here are some important human factors that tend to influence disaster severity. A core point here is that different people, even within the same region, have different vulnerability to natural hazards. For instance, in the case of the 2010 earthquake, we observe that the average destruction score for vulnerable housing in strong to very strong intensity zones is 1.5 (on a scale from 0 to 9), which is a higher score than for permanent housing in the destructive to violent areas (1.2).

Although a cross-sectional data, the 2012 household survey of Haiti includes retrospective questions corresponding to the period just before the 2010 earthquake. When a phenomenon of this magnitude happens, the risk of measurement error associated to recall is reduced. To try to identify the lasting effect of the household's socioeconomic vulnerability at the time of the earthquake on current children's time allocation, we adopt a control function approach, where we account for changes in household' and child's 'characteristics between the 2010 earthquake and the time of interview (2012). In addition, we control for regional (Commune) fixed-effects to account for unobservable characteristics, such as services supply (schools, roads, etc.) and labor market conditions. Finally, we are able to disentangle the vulnerability component of the total destruction effect of the earthquake by controlling for its physical impact (i.e. peak ground acceleration) and the observed damage suffered by the house just after the earthquake. That is, we are able to control by the earthquake's intensity and calculate the marginal effect of physical damage.

Our main results show that living in more vulnerable households at the time of the 2010 earthquake make children less likely to attend school and more likely to work and being idle 2 years after the earthquake. These results are also reflected in the extensive margin, in terms of the allocation of hours, where living in more vulnerable households make children allocate fewer hours less to leisure and larger hours to household chores. Gender differences, favoring boys against girls, appear in the probability of being idle and attending school and in the number of hours allocated to household chores and leisure.

This paper contributes to the literature on the effect of natural disasters on economic wellbeing.

3

In addition, it brings empirical evidence from a country where academic studies are very scarce and who has been severely affected for many economic and political negative shocks.

The use of cross-sectional data, however, imposes some restrictions in the identification of the causal effect of vulnerability on children's time allocation. For instance, we are not able to control for all the household's and child's characteristics changing between the earthquake and the time of interview. We are neither able to control for unobserved household's and child's characteristics that might affect the decision about children's time allocation (e.g. household's preferences for schooling and child labor or child's readiness for education).

The paper is organized in 7 sections. Section 2 gives an overview of living conditions in the aftermath of the earthquake and provides a discussion of intensity and damage measures. Section 3 describes data and basic demographic characteristics. Section 4 discusses the connection between child labor and school attendance and outcomes and presents the general framework used to evaluate the situation for children in Haiti. Section 5 presents the empirical strategies to identify the mentioned effects. This is followed by a presentation of the results in Section 6. Finally, Section 7 concludes the paper and gives suggestions for future research.

2   The 2010 Earthquake

With a population of 10.4 million people [2], Haiti is one of the most densely populated countries in Latin America. The earthquake that rocked Haiti on 12 January 2010 was one of the four greatest killers recorded worldwide since 1990. It smacked headlong into the metropolitan area of Port-au-Prince, home to over one in five Haitians[3], destroying public buildings and housing as it went. However, the rest of the country was not spared

Despite the immediate response from the international community, with rescue teams and pledges of financial assistance and support for reconstruction and development, things are still far from back to normal. Haiti is one of the most vulnerable developing countries when it comes to natural disasters and the most exposed country in the region. The earthquake's repercussions were much more dramatic here than in other countries hit by stronger earthquakes. For example, an earthquake of the same magnitude hit Christchurch, New Zealand's second-largest city, that same year with no fatalities. Other recurring factors in addition to the country's vulnerability

---

[2]Based on available population projections of the Haitian Institute of Statistics and Informatics (IHSI), 2012.
[3]All data in this paper are from ECVMAS 2012, unless otherwise indicated.

Figure 1: 2010 Earthquake intensity
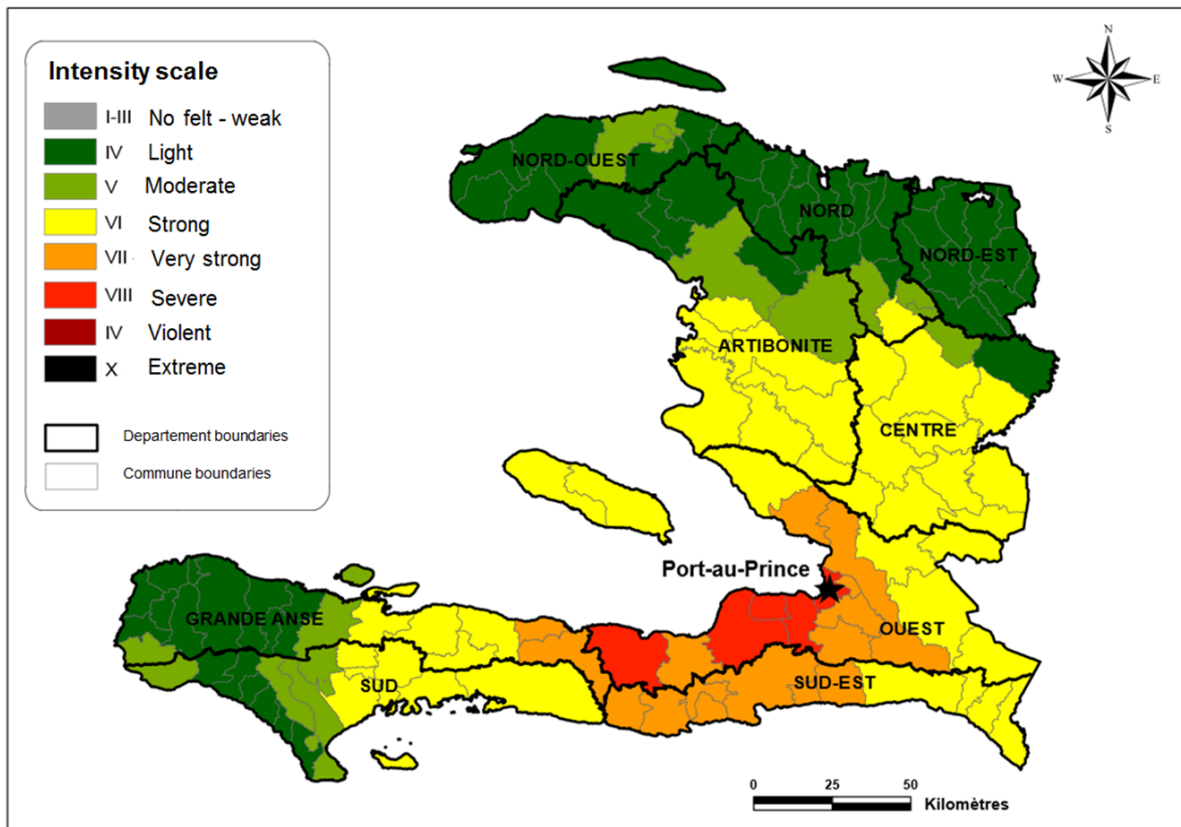
to natural shocks have contributed to Haiti's economic deterioration, with chronic political and institutional instability and a poor education system top of the list.

Material and human damage was huge in the area hit by the earthquake, but did not affect all the households in the same way (Herrera et al., 2014). The earthquake may well be a natural phenomenon, but the disaster was also the result of massive social inequalities and vulnerabilities that magnified the quake's effects among the most disadvantaged. These vulnerabilities are still there, if not worse, following the earthquake such that the next shock will hit an even more vulnerable population. In Haiti, three times more makeshift dwellings than permanent buildings were destroyed in the hardest hit areas. Moreover, makeshift housing in the least-affected areas suffered greater damage than permanent buildings in the hardest hit areas.

In 2012, more earthquake victims were living outside the camps than in them where a large proportion of the aid was concentrated. Most of the households had ceased receiving aid even though their situation had not improved. A full 80 percent of the population reported that aid had stopped before mid-2012. Reconstruction aid reached just 7 percent of the households

Figure 2: Housing destruction score based on earthquake intensity and building vulnerability
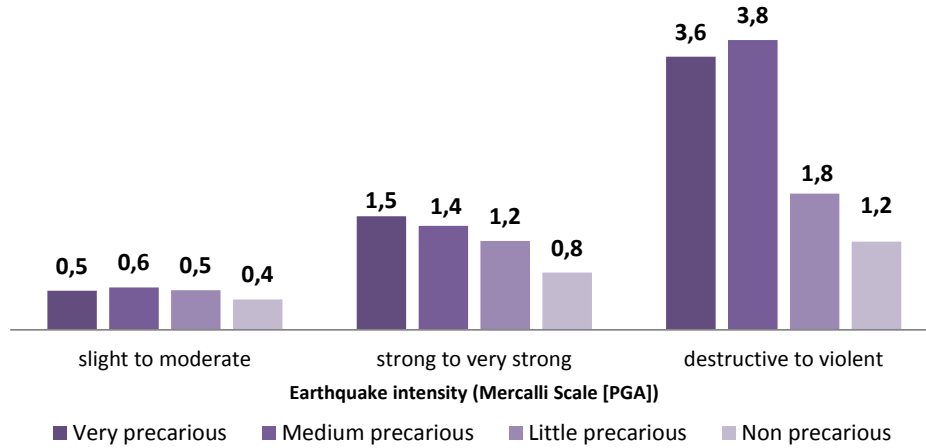
Note: Only covers households that have not changed housing since the earthquake.

that suffered extensive damage to their housing. Most of the rubble clearing work had been done by the people themselves and some of the debris had still not been cleared. All in all, the aid provided by the institutions was short-term emergency aid that did nothing to sustainably improve the population's living conditions in the long term.

3 Data

The data used in this paper comes from the national representative Post Earthquake Living Conditions Survey (ECVMAS) conducted in late 2012.[4] It was the first national socioeconomic survey to be taken since the earthquake, which consists of a sample of 4,950 households including 23,775 individuals. The data set covers the entire country and is representative at department

---

[4]The Haitian Statistics and Data Processing Institute (IHSI) worked with DIAL and the World Bank to survey a sample of 5,000 households representative of the entire population.

level and Metropolitan area, other urban area and rural level.

The 2012 Haiti ECVMAS questionnaire was a variation on the 1-2-3 Survey, whose methodology was developed by Dial laboratory researchers to measure the informal economy and poverty. Two major adjustments were made to this generic framework. The first tailored the questionnaire to Haitian circumstances. The second change was made to include the upheavals caused by the earthquake. Analysis of household living conditions is not restricted to material and monetary considerations, which is why a section on the different – subjective and non-monetary – dimensions of welfare was included. Specific earthquake-related issues were also considered, such as the disaster's direct impact, household response strategies, aid received, and residential and employment pathways (before and after the earthquake).

The ECVMAS survey results paint a detailed and recent picture of the people of Haiti (Herrera et al., 2014). While 22 percent of the total population lives in metropolitan area of Port-au-Prince, the capital, slightly over half (52 percent) lives in rural areas; the rest reside in other urban areas. They are mainly young.

The ECVMAS variables used in this paper come mainly from the modules on socio-demographic characteristics, education and labor (including domestic work). This paper exploits also the 2010 earthquake intensity variation observed for each Primary Sampling Unit (PSU) [5].

An advantage of using large scale representative household surveys is that we have comparable information for children who do not work. In contrast to the majority of other reduced form analyses of child work, we utilize data on hours of work rather than restrict our analysis to participation. This paper also differs from most existing analyses in taking account of the simultaneity of child work and household living standards. Existing work has tended to concentrate on the participation decision. However, the data on hours of work of children exhibit substantial variation, with many children working less than 15 hours a week. From a policy perspective, participation at 10 hours a week is rather different from participation at 40 hours a week.

The sample used in this paper is restricted to 4,175 children aged between 10 and 17 years old (18 percent of the population), with complete information in the relevant variables for this analysis, living in the capital, other urban and rural areas of Haiti. Table 1 below shows basic descriptive statistics (national averages and standard error) of the main variables used in the

---

[5]In the metropolitan area of Port-au-Prince and in the camps 16 households were randomly selected per PSU, 8 households for the rest of the country.

regression analysis for the selected sample.

Table 1: Descriptive statistics

	2010		2012	
	mean	(Std. Err.)	mean	(Std. Err.)
Earthquake damage score	-	-	1,5522	(0,0018)
Peak ground acceleration	-	-	0,1668	(0,0001)
Age	-	-	13,5592	(0,0016)
Sex (male=1)	-	-	0,5048	(0,0004)
Relation to hh head=son\daughter (yes=1)	-	-	0,6724	(0,0003)
Relation to hh head=close relative (yes=1)	-	-	0,1212	(0,0002)
Relation to hh head=other relative (yes=1)	-	-	0,1734	(0,0003)
Relation to hh head=domestic employee (yes=1)	-	-	0,0114	(0,0001)
Relation to hh head=other relationship (yes=1)	-	-	0,0217	(0,0001)
Live in the same house (yes=1)	-	-	0,7842	(0,0003)
Hh has received any type of assitance (yes=1)	-	-	0,7242	(0,0003)
Number of negative economic schock	-	-	2,0862	(0,0007)
Members living in a temporary camp (%)	-	-	0,0789	(0,0002)
Has any hh member suffered physical damage (yes=1)	-	-	0,0993	(0,0002)
Child was economically active (yes=1)	0,0792	(0,0002)	0,2311	(0,0003)
Household size	6,4746	(0,0019)	6,6337	(0,0019)
Durable goods	3,0487	(0,0015)	3,6909	(0,0015)
House ownership (yes=1)	0,7173	(0,0003)	0,7508	(0,0003)
Metropolitan area (yes=1)	-	-	0,1978	(0,0003)
Other urban area (yes=1)	-	-	0,2666	(0,0003)
Rural (yes=1)	-	-	0,5356	(0,0004)

Note: Sample weights used. The sample size corresponds to 4,175 children 10-17 years old.

The first two indicators shows low damage and intensity of the 2010 earthquake in an average national house, however, as it was mentioned above, the earthquake directly affect mainly the metropolitan region of Port-au-Prince. Although, most of children in our sample of 10-17 years old are son or daughter of the household head (67 percent), an important proportion (17 percent) are living with a household head with whom they are weakly biologically related (daughter/son in law, aunt/uncle, nephew/niece, cousin, or other relative). According to the Hamilton's rule (Hamilton, 1964), a longer biological relationship with the decision-maker in the household put

children at higher risk of receiving less resources. If this is the case, we might expect 2 of each 3 children in the sample to be less likely to attend school and more likely to work.

In our sample, 78 percent of children keep living in the house where they lived in January 2010 when the earthquake happened. Table 1 also shows the high incidence of aid to household in Haiti after the earthquake: 72 percent of the households where the children in our sample live received any type of assistance after earthquake. On top on the earthquake, the average number of negative economic shocks received by the household in the last 12 months is 2, which might also affect the current decision of the household about children's time use. Eight percent of the children in our sample have a household member that lives in one of the shelters built after the earthquake. This variable is considered in the analysis because living in a shelter might be a household strategy to keep receiving the additional services around them.

Table 1 shows that from January 2010 until mid-2012, the labor market participation of children increased in around 8 percentage points. This might be the simple effect of age but also the effect of the earthquake on household strategies for recovering their previous levels of welfare. Moreover, it is possible to see some improvements in the socioeconomic conditions of children in average households.

As the bottom variables in Table 1 show children in our sample are mainly located in rural areas (54 percent) and urban areas different to Port-au-Prince (27 percent). Given the geographical variation of the earthquake intensity and the distribution of our sample across regions, the regression analysis below incorporates regional controls.

4   Child Labour and School Attendance

As Basu and Van (1998) mention, the allocation of children's time to non-labor activities (education or leisure) represents a luxury good for poor households, which can be consumed only once their income rises beyond a certain threshold. Sending children to work, in contrast to sending them to schools, carries negative consequences both for the children's future wellbeing and, through the positive externalities of education on growth, for the growth of the society as a whole (Basu and Van, 1999).

Standard human capital theory offers a suitable framework to study the allocation of children's time between schooling and labor. It predicts that when the net returns to human capital

investment are lower than the returns to investments in other assets, children's schooling is likely to be displaced by children's labor. The poverty and capital market explanations offer a theoretical framework to examine how an external negative shock might affect the allocation of children's time between schooling and labor.

According to the poverty explanation, the low net returns to human capital investment are mainly determined by two factors: high schooling costs, due to either direct costs (e.g. transportation to/from school, school fees, materials and uniforms) or indirect costs (e.g. opportunity costs of studying); and, poor quality education. In turn, under the capital market explanation (Cigno and Rosati, 2005), imperfections in physical capital markets (e.g. credit constraints or high interest rate on borrowing) and in human capital markets (e.g. parents may not fully receive the return on investments in children's education because children are likely to receive it as adults), in addition to the degree of altruism of the decision-taker in the household, drive the final decision about the child's time allocation. This theoretical model predicts that when physical capital markets are perfect and there is full control over the income of children, the decision-taker is indifferent between sending their children to school and investing in other assets, at the margin. In contrast, when physical capital markets are perfect but intergenerational transfers between parents and children are not guaranteed, only altruistic parents send their children to school. When capital markets are imperfect, which characterizes most developing countries, this model predicts that even altruistic parents may sacrifice investments in children's education.

4.1 Evidence from Haiti

Right after its independence (in 1804), the importance of education was recognized and the first Constitution, promulgated in 1805, noted explicitly that "education shall be free. Primary education shall be compulsory. State education shall be free at every level". These principles were never put into practice. Private education system has grown by default and continuously, from 20 percent in the 1959-1960 to 75 percent in 1995-1996 (Salmi, 2000). In 1997, the Ministry of National Education, Youth and Sport (MENJS)[6] set out a national education and training plan (PNEF)[7] to reform the education system in Haiti. The reformed Haitian education system

---

[6]Ministère de l'Education Nationale de la Jeunesse et des Sports

[7]Le Plan National d'Education et de Formation, 1998

is used as a frame of reference here, even if some parts of the country, especially in rural areas, the traditional educational system still operates (Lunde, 2010). In the reformed system, education comprises three core levels : (i) pre-school for 3-5 year olds, not compulsory (ii) primary education for 6-14 years old, and (iii) secondary education for 15-18 year olds (see Fig.A.1). The legal age to admission to school is 6 years and, in the reformed system children who undergo normal progression complete primary at the age of 14.After completing 9 years of primary school, students can continue on to secondary, for a cycle of 4 years. After completed the final year of secondary school (Philo), students can apply to university. Students can also integrate some vocational or technical training centers after secondary or even primary education for some of them. These centers are heterogeneous and largely unregulated (Lunde, 2010).

The Haitian education sector was one of the sectors most severely affected by the 2010 earthquake, suffering great losses in terms of both infrastructure and manpower. More than four thousand schools (4,268) were affected by the earthquake (GTEF, 2011). Today, private education represents about 65 percent of primary and secondary school enrollment. One of the highest proportion of private school enrollment in the world. This situation reflects the historical lack of well-developed and functioning system of public schools. Overall, public resources devoted to education are meager in Haiti compared to many other countries in the LAC region.

Prior to the earthquake, the country had already one of the poorest education systems in the world. The education offered to Haitian children was inadequate in terms of quality, quantity and accessibility (Lunde, 2010).

5 Identification Strategy

There are several channels through which the 2010 earthquake in Haiti might impact the household decision about children's time allocation. At the one hand, the earthquake represents a negative income shock for many households, affecting the production factors (labor, capital and infrastructure), increasing transportation and transaction costs and destroying markets. The earthquake might also have affected the composition of the households (because of deaths, migration, incorporation of extended family members, etc.) which, in turn, might affect the incentive to invest in children's human capital. The earthquake might also affect the allocation of children's time through its impact on physical (e.g. permanent injuries, handicap) and

mental health (e.g. stress, depression). It also might have affected children's time allocation through its negative impact on services infrastructure (e.g. roads, schools). On the other hand, the earthquake might have positively affected children's time allocation through the increase of international aid, which promptly arrived to the country after the earthquake. Because the earthquake might have affected the decision about children's time allocation through any (or all) of these channels, the use of the earthquake's intensity as an instrumental variable (IV), to deal with the potential endogeneity of household vulnerability, would be invalid.

Even though the 2012 household survey of Haiti is not a longitudinal dataset, it includes retrospective questions about the household and individuals conditions just before the 2010 earthquake. This feature allows us to control for time-variant and time-invariant characteristics that might affect the current decision about children's time allocation. The risk of measurement error in these variables due to recall is reduced because of the importance of such event. We adopt a control function approach, in which we try to control for the indirect effects that the earthquake might have had in the channels discussed above. Ideally, the inclusion of variables accounting for initial conditions (pre-earthquake) and their change over time (at the time of the interview, when the decision about children's time allocation is also taken) at child and household level will wash away all the unobserved components that might have affected both the initial household vulnerability and the decision about children's time.

The final damage impact of an earthquake might be decomposed into the intensity of the movement (peak ground acceleration) and how the house received the impact. The data we use allow us to control for the physical impact of the earthquake (i.e. peak ground acceleration) and the damaged caused by it. Conditional on the first one, the marginal effect of the second measure give us the additional effect of how the house reacted to the intensity of the movement, i.e. vulnerability. In other words, if two households faced the same peak ground acceleration but the damaged caused by the earthquake in household A is larger than in household B, we can say that household A was more vulnerable than B at the time of the earthquake.

Below, we estimate the following equation using a Linear Probability Model (LPM):

$$Y_{iht=1} = \alpha_0 + \beta v_h + \alpha_1 m_{iht=0} + \alpha_2 n_{iht=1} + \alpha_3 p_{ih} + \alpha_4 c + \epsilon_{iht} \qquad (1)$$

Where Y corresponds to the decision of household h, in time t=1 (after the earthquake and at the moment of the interview, in mid-2012) about the participation of child i in any of these activities: "neither school nor work", "school only", "work only" or "school and work together". In an alternative specification, Y corresponds to the number of hours a child devotes to studying, market work, domestic work or leisure. m and n correspond to time-variant child and household characteristics before (2010) and after the earthquake (2012), respectively; and, p corresponds to time-invariant child and household characteristics. Commune fixed-effects, c, are also included to control for unobserved characteristics at commune level. The indicator of vulnerability, measured after the earthquake and at household level, is represented by v. Finally, the error term is assumed to be uncorrelated with v.

Furthermore, as Edmonds (2007) mentions, using univariate models (instead of bivariate probit, multinomial logit/probit, or hierarchical choice model) is the common practice in this literature. Is part of the further research agenda to compare the estimations of LPM with other specifications.

6 Results

This section includes two sets of regressions. Both correspond to the estimation of equation (1) using OLS. The first set (Table 2) includes the household decision about children's time allocation in terms of "neither school nor work", "school only", "work only" and "school and work". The second set (Table 3) corresponds to the estimation of the number of hours for studying, work activities, household chores and leisure.

Our main variable of interest is our measure of household vulnerability, measure through the physical damage caused by the earthquake. After accounting for time variant and invariant child and household characteristics and Commune fixed-effects, the lasting effect of vulnerability on children's time allocation is significant. First, more vulnerability at the time of the earthquake is associated to a larger probability of being idle and working-only and to lower probability of attending school. These suggest that living in a more vulnerable household has long lasting negative effects on the investment in children's human capital.

Table 2: LPM school/work decision

	Idle	School only	Work only	School & work
Earthquake damage score	0.003*	-0.003*	0.002*	-0.002
	(0.002)	(0.002)	(0.001)	(0.001)
Peak ground acceleration	-0.210	0.202	-0.047	0.056
	(0.191)	(0.191)	(0.098)	(0.103)
Age	0.010***	-0.009***	0.002	-0.003
	(0.003)	(0.003)	(0.002)	(0.002)
Sex (male=1)	0.056	-0.069	0.020	-0.006
	(0.050)	(0.050)	(0.032)	(0.034)
Age*sex	-0.006*	0.007**	-0.001	-0.000
	(0.004)	(0.004)	(0.002)	(0.003)
Relation to hh head=close relative (yes=1)	0.029**	-0.018	-0.004	-0.007
	(0.013)	(0.013)	(0.007)	(0.008)
Relation to hh head=other relative (yes=1)	0.030**	-0.028**	0.015**	-0.017**
	(0.012)	(0.012)	(0.007)	(0.007)
Relation to hh head=domestic employee (yes=1)	0.120**	-0.106**	0.037	-0.051
	(0.048)	(0.045)	(0.032)	(0.037)
Relation to hh head=other relationship (yes=1)	0.048	-0.044	0.077***	-0.080***
	(0.032)	(0.030)	(0.028)	(0.028)
Live in the same house (yes=1)	0.015	-0.013	-0.002	-0.000
	(0.012)	(0.012)	(0.008)	(0.008)
Hh has received any type of assitance (yes=1)	-0.006	0.003	-0.000	0.003
	(0.009)	(0.009)	(0.006)	(0.007)
Number of negative economic schock	-0.003	0.005	-0.001	-0.001
	(0.004)	(0.004)	(0.002)	(0.002)
Members living in a temporary camp (%)	-0.019	0.020	0.014	-0.016
	(0.015)	(0.016)	(0.010)	(0.011)
Has any hh member suffered physical damage (yes=1)	-0.006	0.001	0.010	-0.005
	(0.013)	(0.013)	(0.008)	(0.009)
Child was economically active, 2010 (yes=1)	0.043***	-0.024	0.068***	-0.087***
	(0.016)	(0.016)	(0.021)	(0.022)
Child was economically active, 2012 (yes=1)	-0.090***	-0.886***	0.146***	0.829***
	(0.009)	(0.009)	(0.013)	(0.013)
Household size, 2010	-0.006*	0.005	-0.006***	0.008***
	(0.004)	(0.004)	(0.002)	(0.002)
Household size, 2012	0.007*	-0.005	0.006***	-0.007***
	(0.004)	(0.004)	(0.002)	(0.002)
Durable goods, 2010	-0.005	0.007*	0.005**	-0.006***
	(0.004)	(0.004)	(0.002)	(0.002)
Durable goods, 2012	-0.015***	0.013***	-0.010***	0.012***
	(0.004)	(0.004)	(0.002)	(0.002)
House ownership, 2010 (yes=1)	-0.031**	0.027*	0.012	-0.008
	(0.015)	(0.015)	(0.010)	(0.010)
House ownership, 2012 (yes=1)	0.022	-0.017	-0.021**	0.015
	(0.015)	(0.015)	(0.009)	(0.010)
Constant	0.065	0.920***	0.004	0.011
	(0.057)	(0.057)	(0.028)	(0.030)
Observations	4175	4175	4175	4175
R-squared	0.11	0.72	0.22	0.80

*Note: All regressions include Commune fixed-effects. Robust standard errors in parentheses. *p<0.1, **p<0.05, ***p<0.01.*

Similarly, when looking at the intensive margin, Table 3 shows that household vulnerability at the time of the 2010 earthquake increases the allocation of children's time to household chores (in particular for girls) and reduced the time for leisure. Once more, this evidence suggests that

higher vulnerability negatively affects children development.

Table 3: LPM number of hours

	Hours studying	Hours working	Hours hh chores	Hours leisure
Earthquake damage score	-0.095	0.019	0.264***	-0.188*
	(0.085)	(0.031)	(0.069)	(0.111)
Peak ground acceleration	-16.446*	2.463	-10.149	24.132**
	(8.612)	(3.754)	(6.419)	(11.057)
Age	-0.093	0.083*	0.728***	-0.718***
	(0.100)	(0.042)	(0.097)	(0.143)
Sex (male=1)	-1.524	-1.023	5.739***	-3.191
	(1.821)	(0.956)	(1.593)	(2.560)
Age*sex	0.120	0.095	-0.761***	0.546***
	(0.135)	(0.078)	(0.119)	(0.193)
Relation to hh head=close relative (yes=1)	-0.757	-0.026	-0.348	1.131*
	(0.471)	(0.250)	(0.425)	(0.668)
Relation to hh head=other relative (yes=1)	-1.365***	0.021	1.655***	-0.311
	(0.448)	(0.215)	(0.389)	(0.602)
Relation to hh head=domestic employee (yes=1)	-4.768***	0.447	7.466***	-3.145
	(1.087)	(0.797)	(1.774)	(2.208)
Relation to hh head=other relationship (yes=1)	-3.671***	2.035*	1.931**	-0.295
	(1.174)	(1.233)	(0.831)	(1.654)
Live in the same house (yes=1)	-0.530	-0.052	0.484	0.099
	(0.531)	(0.248)	(0.422)	(0.691)
Hh has received any type of assitance (yes=1)	-0.985***	-0.237	0.076	1.145**
	(0.376)	(0.184)	(0.332)	(0.531)
Number of negative economic schock	0.714***	-0.072	0.796***	-1.438***
	(0.173)	(0.071)	(0.133)	(0.229)
Members living in a temporary camp (%)	-0.494	0.356	-0.793	0.931
	(0.866)	(0.306)	(0.490)	(1.012)
Has any hh member suffered physical damage (yes=1)	0.767	-0.113	0.187	-0.841
	(0.566)	(0.268)	(0.427)	(0.728)
Child was economically active, 2010 (yes=1)	-1.617***	2.394***	0.408	-1.185
	(0.576)	(0.739)	(0.741)	(1.154)
Child was economically active, 2012 (yes=1)	-1.118***	14.378***	2.440***	-15.700***
	(0.397)	(0.345)	(0.443)	(0.664)
Household size, 2010	-0.045	-0.005	-0.288**	0.338*
	(0.127)	(0.059)	(0.129)	(0.190)
Household size, 2012	-0.268**	0.045	-0.023	0.246
	(0.128)	(0.062)	(0.127)	(0.191)
Durable goods, 2010	0.397**	-0.060	-0.719***	0.382
	(0.195)	(0.083)	(0.127)	(0.250)
Durable goods, 2012	0.355*	0.175*	0.305**	-0.835***
	(0.195)	(0.091)	(0.125)	(0.254)
House ownership, 2010 (yes=1)	-1.087	-0.442	0.356	1.173
	(0.725)	(0.277)	(0.497)	(0.879)
House ownership, 2012 (yes=1)	0.601	0.487*	-0.141	-0.947
	(0.702)	(0.256)	(0.452)	(0.823)
Constant	13.861***	-2.262**	3.064*	153.338***
	(2.083)	(0.902)	(1.805)	(2.903)
Observations	4175	4175	4175	4175
R-squared	0.43	0.63	0.24	0.33

Note: All regressions include Commune fixed-effects. Robust standard errors in parentheses.
*p<0.1, **p<0.05, ***p<0.01.

7   Conclusion

In January 2010, Haiti suffered a devastated earthquake that caused dramatic economic and personal losses. The effect of the earthquake in people's lives is composed by a natural factor (intensity), which is exogenous to people's behavior, and a vulnerability factor, which might be affected by individual's behavior. This paper examines the lasting effect of household's vulnerability at the time of the earthquake on the decision about children's time allocation.

It is well known in the literature that an investment in children's human capital has many positive effects on individuals' and nation lives. We find evidence that households' vulnerability is negatively associated to investments in children's human capital, which therefore, perpetuates household's poverty. For this reason, we believe that social policies should focus on attacking households' vulnerability.

Our results should be taken carefully, however. Although the richness of our data, we are not able to disentangle whether the household decision about children's time reflects the household or child unobserved characteristics (e.g. household's preferences for schooling and child labor, child's depression, stress or ability to take advantage of school). The importance of the research question from a policy point of view and the lack of empirical evidence for Haiti make relevant the analysis.

References

Basu, K. and Van, P. H. (1998). The economics of child labor. *American Economic Review*, pages 412–427.

Basu, K. and Van, P. H. (1999). The economics of child labor: Reply. *American Economic Review*, pages 1386–1388.

Cigno, A. and Rosati, F. C. (2005). *The Economics of Child Labour*. Oxford University Press.

Edmonds, E. V. (2007). Child labor. *Handbook of development economics*, 4:3607–3709.

GTEF (2011). Vers la refondation du système educatif haïtien. plan opérationnel 2010-2015, draft des recommandations du groupe de travail sur l?éducation et la formation. Technical report, Ministère de l?Education Nationale et de la Formation professionnelle (MENFP).

Hamilton, W. D. (1964). The genetical evolution of social behaviour. i. *Journal of theoretical biology*, 7(1):1–16.

Herrera, J., Lamaute-Brisson, N., Milbin, D., Roubaud, F., Saint-Macary, C., Torelli, C., and Zanuso, C. (2014). L?évolution des conditions de vie en haïti entre 2007 et 2012. la réplique sociale du séisme. Technical report, IHSI, IRD, DIAL.

Lunde, H. (2010). Haiti youth survey 2009. volume ii: Analytical report. Technical report, FAFO.

Salmi, J. (2000). Equity and quality in private education: The haitian paradox. *Compare*, 30(2):163–178.

A Appendix

Figure A.1: Haitian education system

Structure of the reformed Haitian education system		
19 years & +	**Superior**	
18 years	Final year - Philo	
17 years	1st year - Rheto	**Secondary**
16 years	2nd year	
15 years	3rd year	
14 years	9st AF	
13 years	8st AF	3rd **cycle**
12 years	7st AF	
11 years	6st AF	2nd **cycle**
10 years	5st AF	**Primary**
9 years	4st AF	
8 years	3rd AF	1st **cycle**
7 years	2nd AF	
6 years	1st AF	
5 years	Upper	
4 years	Middle	**Pre-school**
3 years	Lower	