Income shocks and child labor: evidence for the rural Dominican Republic

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Abstract:

Child labor is a social problem with economic consequences for the growth and development of countries in the short and long term, affecting children's physical and mental development because it interferes with their future wages. In paper we seek to investigate how negative income shocks and economic assets are associated with child labor and school attendance in the Dominican Republic. This issue is particularly important in rural areas, where people are more prone to suffer exogenous shocks and have fewer tools to mitigate them. We used microdata from the Encuesta Nacional de Hogares de Propósitos Multiples (ENHOGAR) for 2010. Our The empirical strategy was based on a bivariate probit for considering that the decision to allocate children's time to work and/or study are interdependent. The results show that assets positively affect the decision to allocate children towards schooling. On the other hand, negative household income shocks increase the probability of child labor. We also find evidence that in Dominican Republic, children's time does not seem to compete with his or her time in school and the presence of assets is not able to reduce the negative effects of the shocks.

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Keywords: Child labor; bivariate probit; Dominican Republic
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1. INTRODUCTION

Child labor is a social problem of great relevance in the world. According to the International Labor Organization and the International Program on the Elimination of Child Labor, 168 million children work around the world (ILO-IPEC, 2013). Among them, more than half perform hazardous work. Asia and the Pacific have the highest incidence of child labor (almost 79 million, or 9.2% of the child population). In Latin America and the Caribbean, there are 13 million children (8.8%) in this situation (ILO-IPEC, 2013).

Although traditionally child labor has been considered a consequence of poverty (CANAGARAJAH; COULOMBE, 1999; BROWN; DEARDORFF; E STERN, 2001), recent literature on the subject has pointed to its multiple determinants. Among these factors, transitional aspects such as negative income shocks experienced, particularly among the most vulnerable families, may guide the family's choice for child labor. Thus, faced with an eventuality that increases the vulnerability of the family and the absence of complete markets to assure these families in the presence of such shocks, the choice for child labor could be an answer.

The study of the relationship between negative income shocks and schooling and child labor, as well as how asset ownership or access to credit helps mitigate the effects of these shocks is one of the most discussed issues in the current economic literature on this subject.

Several authors (BANDARA and DEHEJIA; LAVIE-ROUSE, 2015; SMITH et al., 2002) have emphasized the importance of negative shocks on the probability of allocating children towards work and the reduction of schooling, in addition to the positive effect of assets for child labor. Funkhouser (1999) found that school attendance declined in Costa Rica when families suffered a negative shock in their income in the early 1980s. Similarly, Duryea (1998) analyzed the impact of negative income shocks on schooling in Brazil, finding that they increase the likelihood of the child entering the work force and dropping out of school. Fallon and Lucas (2002); and Frankenberg and Smith (2003) address the impact of economic shocks on household welfare in Mexico, Indonesia, and East Asia. Their results indicate that families that suffer from income shocks show an intensification of school dropout rates.

In general, there appears to exist evidences that income shocks are significant in explaining households' behavior in the labor market and in the allocation of children's

time, since infants can be used as insurance against unanticipated shocks in income (CAIN, 1982). In this context, the possession of economic assets (which can be used as insurance or loan guarantees) could constitute an important way of mitigating the effects of these shocks. Jacoby and Skoufias (1997) reported that in India, children living in households with a reduced number of durable goods are more likely to fail at school. On the other hand, Beegle, Dehejia and Gatti (2006) point out that transient income shocks led to an increase in child labor and that the presence of domestic assets or properties attenuated the effects of these shocks in Tanzania for 1995. Brown, Deardorff and Stern (2001) also identified a link between child labor and the possession of economic assets in households in Latin America.

The lack of coordination in the labor and credit markets can explain the emergence of child labor, as it can arise due to parents' inability to face the family crisis, sacrificing investment in children's human capital (DESSY; PALLAGE, 2001; DUMAS, 2013). Baland and Robison (2000); and Dehejia and Gatti (2005) also concluded that children are often used to compensate for negative shocks at home in the absence of household goods that serve as collateral in the credit market. According to Bandara, Dehejia and Lavie-Rouse (2015), access to credit attenuated the impacts of income shocks on child hunger in Tanzania, in 2011.

Child labor has a high social cost, in addition to reducing future levels of growth and economic development of a developing country, like Dominican Republic. This is especially important in rural areas, where households are more prone to negative shocks and have fewer tools available to mitigate them (KRUGER; SOARES; BERTHELON, 2007). According to Kassouf (2007), the factors that explain child labor in rural areas are related to the low educational infrastructure in these areas, as well as the greater ease of the children to be absorbed in rural informal activities that usually require low qualification.

In Dominican Republic, child labor still persists. About 15.99% of the population between 5 and 17 years old worked in 2010[1]. From these children and adolescents, 74.7% are male and 25.3%, female. Among the sectors that generate most employment for children, the services sector (77.4%), manufacturing (18.2%) and agriculture (3.5%) stand out. However, from the entire employed population aged 5 to 17 years, 39% are in the rural area (ONE, 2010).

[1] Our data base asks wether the child has worked on the week of reference. Only non-domestic work must be included

Although this is an important issue for the Dominican Republic, few studies have provided empirical evidence on this topic. In a descriptive analysis, Guzmán and Cruz (2009) concluded that individual and family characteristics have a strong influence on the school attendance of Dominican children in 2008. On the other hand, Lozano (2012) and Soto and Taveras (2015) attested the existence of a trade-off between school and child labor at the secondary and elementary level. ILO-IPEC (2002) and ILO-BID (2008) make a descriptive diagnosis of Dominican child labor, emphasizing the problem of sexual and commercial exploitation. Likewise, UCW (2014) examines the economic and social determinants of child labor, concluding that age, gender, orphanhood and household structure are important variables.

We are not aware of any studies that consider the interrelationship between school attendance and child labor in the rural Dominican Republic, nor of any research that has considered the potential role of income shocks on children's time (although income shocks are frequent in developing countries). In addition, this paper is particularly important since it focus on rural areas where families usually face restrictions on important markets and child labor is frequent (though underreported). Thus, this paper aims to contribute to the literature that investigates contexts in which income shocks and market failures can lead to the employment of children, as well as to provide the Dominican Republic with subsidies for understanding the behavior of families in situations of vulnerability and then promote ways to ensure the human capital accumulation of their children.

Specifically, this study seeks to: characterize child labor in rural areas of Dominican Republic in 2010; analyze the impacts of negative income shocks (loss of harvest) on the participation of children in the labor market and in school; and to evaluate the if the presence of economic assets income shocks.

In addition to this introductory section, this paper is organized as follows: Section 2 provides a brief overview of theoretical reasoning on the topic. Section 3 presents our identification strategy, method and data used. Section 4 we present our results. Section 6 concludes.

2. Market imperfections and child labor

In this subsection we present an economic model that considers the relationship between assets, credit restrictions and families' choice between children's work and schooling. This model is based on the existence of market imperfections. Among the

most widely used models to study the relationship between market imperfections and children's time allocation, we find Ranjan (1999) with adaptations made by Jafarey and Lahiri (2002).The model presented here is that developed presented by Kruger, Soares and Berthelon (2007); and Bandara, Dehejia and Lavie-Rouse (2015), which is based on the work of Jafarey and Lahiri (2002).

In this model, it is considered that the family decides to allocate children's time between work and schooling based on the level of income and assets of the parents, parents' behavior regarding intra-family decision-making, access to credit, and the possibility of imperfections and market coordination failures. In this, it is considered an economy in which parents make all the relevant decisions. It is assumed, for simplicity, that a father and a son form the family. In this context, the utility of consumption and development of the human capital of the child is represented by:

$$U(c,h)=\frac{c^{\sigma}}{\sigma}+\alpha h \quad (1)$$

Where c is the household consumption, h is the human capital of the child. σ is the elasticity of substitution, and $\alpha$is a constant parameter with 0 <σ> 1 andα> 0. The model develops three situations: a) families without assets; b) families with assets; and c) families with assets and access to credit.

Model for families without assets. In this situation, the father fully participates in the job market with resultant revenue of $f(l_p,\theta_{t-1})$.

$$f(l_p,\theta_{t-1})=w_p l_p+\theta_{t-1}+\phi_p \quad (2)$$

Where w_p and $l_p$are the wage and time worked by the parents. $\theta_{t-1}$is a random transient shock at *t-1* and ϕ_p are characteristics of families, such as parents' education, etc. λ and τ are constant parameters. It is assumed that the child divides his time between working (with salary w_c) and schooling. The human capital of children is $h=\beta e^{\sigma}{}_c$, where ß is the technological component. The term e_c is the time of the child allocated to schooling (investment in human capital), according to $e_c + l_c = t_c$, where l_c is the time allocated to work and $t_c$is the total amount of time of the child. Initially, it is assumed that families do not have assets or free access to credit. The problem of families is, then, given by:

$$\max_{e}\left[\frac{c^{\sigma}}{\sigma}+\alpha\beta e_c^{\sigma}\right] \quad (3)$$

Subject to budget constraint:

$$[illegible] \quad (4)$$

Defining λ as a multiplier of income restriction, the first order conditions for *c* and *e* are:

$$c^{\sigma-1} = \lambda \quad (5)$$

$$\varphi f'(e) e^{\sigma-1} = \lambda w_c \quad (6)$$

The second-order condition of equation (5) characterizes the decision of families to allocate the child to school or work. If $\varphi f'(e) e^{\sigma-1} > c^{\sigma-1} w_c$, the marginal value of a unit of time invested in the child's human capital is greater, then the family will send the child to school. On the other hand, if $\varphi f'(e) e^{\sigma-1} < c^{\sigma-1} w_c$, the father will send the child to work. If $e^{\sigma-1} = c^{\sigma-1} w_c$, the family will be indifferent between the two options.

It is assumed that the relation between the fathers' and child's wages is constant, so the first-order solution to the maximization problem is given by:

$$[illegible] \quad (7)$$

where*Xp* is the parent's income per job and *ε* is the error term. δ are the fixed effects of the family. According to equation (16), child labor could be affected by the parents' income and the children’s time destined for the development of their human capital. Bandara et al. (2014) notes that parental income could be affected by income shocks, so in the absence of economic assets, child labor will be the only insurance against shocks in an imperfect credit market environment. It is expected that the higher the father's income, the greater the investment in human capital and the shorter hours allocated to child labor. Income shocks, on the other hand, would increase child labor. So we expected that $\varphi, \eta < 0$ when $\lambda > 0$.

Model for families with assets. It is now assumed that families have economic assets. The holding of assets could exhibit effects of substituting wealth and child labor, depending on the asset's ability to generate income. In this case, the budget constraint is:

$$[illegible] \quad (8)$$

where*r* is the interest rate, and *α*are the family assets at time *t*. Regardless of whether the assets are monetary or not, they are sold or used to meet consumer needs in the event of a shock. Assets in the current period are considered as a function of the

assets of the previous period if the growth rate is constant. Thus, the first-order condition of families is given by:

(9)

where ρ is the fixed effects term, μ is a constant parameter and u is the error term. A higher level of assets is expected to reduce child labor $(\mu < 0)$ since parents could use the assets to minimize the effects of shocks on household consumption.

Families with assets and access to credit. Here Bandara et al. (2014) relaxes the presumption of non-access to credit, to investigate whether this access is capable of reducing child labor. With this relaxation, the budget constraint of the household is:

(10)

where*b* is the loan at an interest rate *r*. It should be noted that the model allows households with access to credit to maintain their assets. The solution of the family problem is given by:

(11)

Where is ϕ fixed effects term, ϑ is a constant parameter, and ω is error term. Models such as the one presented (see: Bandara et al. (2014)) allow us to study the relationship between economic assets, credit market and child labor. There is empirical and theoretical evidence that emphasizes the role of household assets in child labor decision making; noting that they provide households with the means to manage uncertainty, and consequently, children's work would not be necessary for such purposes. In addition, households with assets have more access to capital markets or can finance the formation of the child's human capital without a formal loan (BROWN; DEARDORFF; STERN, 2001).

3. EMPIRICAL STRATEGY

In this paper, we model two family decisions: school attendance and/or child labor. Since both decisions are taken simultaneously within the family, our empirical strategy is based on the bivariate probit method, which considers the simultaneities between decisions[2]. It is assumed that family decisions are made through a comparison of utilities: a child attends school if this is the option that provides the family with more utility. A similar comparison is made to decide towards child labor. In this case, the

[2] This econometric model was also used in the papers of Cerdas (2003), Sapelli and Torche (2004), Caccimali, Tatei and Batista (2010) and Mesquita (2011) with similar purposes.

latent variable Y^*_1 refers to the utility gain from the option for child labor and Y^*_2 to the utility gain provided by the option for school attendance. These two decisions can be expressed as:

$$Y^*_{1i} = \beta_1 X_{1i} + \varepsilon_{1i}$$
$$Y^*_{2i} = \beta_2 X_{2i} + \varepsilon_{2i} \quad (12)$$

$Y_{1i}=1$ *if* $Y^*_{1i}>0$; $Y_{1i}=0$ *otherwise*

$Y_{2i}=1$ *if* $Y^*_{2i}>0$; $Y_{2i}=0$ *otherwise*

Where *Xi* represents a vector of explanatory variables concerning characteristics of children, family and environment, which affect the two decisions (working and studying). The simultaneous choice of these alternatives implies four different and mutually exclusive results: the child only studies ($Y_{1i} = 1$ *and* $Y_{2i} = 0$), studies and works (*Y1i = 1 and Y2i = 1*), only works (*Y1i = 0 and Y2i = 1*) or neither ($Y_{1i} = 0$ *and* $Y_{2i} = 0$). It is assumed that the random errors have 0 mean, homoscedastic variance, and joint distribution as: $(\varepsilon_1, \varepsilon_2) \sim N(0,0,1,1,\rho)$ and $Cov(\varepsilon_1, \varepsilon_2) = \rho$ (following a standard normal distribution, with correlation among them represented by ρ), indicating the possibility that unobserved factors affecting one decision also affect the other. In addition to the coefficients of interest, the bivariate probit provides an estimate of the predicted probability of the four combinations described (CAMERON; TRIVEDI, 2005).

In this paper, income shocks were defined as the loss of crops of rural families and, as assets, we considered the presence of goods worth more than 520 dollars. Duryea, Lam and Levison (2007) represent the negative income shocks as the loss of the householder's job in urban area; Beegle, Dehejia and Gatti (2006) also use crop loss in rural areas; Bandara, Dehejia and Lavie-Rouse (2015) consider the presence of pests in crops, and the death of a family member. To define the presence of assets in the household, Bandara,Dehejia and Lavie-Rouse (2015) and Dumas (2013) consider the value of land; Beegle, Dehejia and Gatti (2006) suggest a range of the value of the economic assets of the family, such as radio, bicycles, fans, etc.

To examine the role of shocks and the presence of economic assets among rural families, each equation (concerning the decision of school attendance or child labor) was specified as follows:

$$Y_{ji} = \beta_0 + \beta_1 Shock_i + \beta_2 Assets_i + \beta_3 (shock * assets)_i + \beta_4 X_i + \varepsilon_i \quad (13)$$

Where Y_{ji} assumes 1 if the child worked (or were attending school) in 2010; *Shock* is a dummy variable that indicates the occurrence of crop loss in the rural household; *Assets* is also a dummy that represents the presence of household goods (goods worth over $ 520) in rural households; *shock*assets* is an interaction between shock and assets that provides an indication of the role of assets in the presence of a negative shock in the family; X_i are variables of control including individual, family and environmental characteristics; and ε_i is the error term.

The empirical strategy adopted in this paper is based on the hypothesis that the shocks suffered by the families are exogenous. Crop loss can be considered as an exogenous factor, since it relates to the phenomena of nature, independently of community, family and individual factors. However, to explain the decision between study and employment of children, control of unobserved heterogeneity should be important. This is because there may be unobserved personal and family characteristics responsible for affecting the decision between study and child labor. If this is the case, and if these unobservable characteristics are related to the explanatory variables included, our specification would suffer from omitted variable bias. Panel data could provide means of controlling this problem. However, there is no panel data available for Dominican Republic.

Thus, we believe that our results are as close as possible to causal relations, although we do not exclude the possibility that unobserved family characteristics should be important. In addition, to consider the fact that households located in certain areas may have correlated behaviors, the estimates include dummies by macro-regions and clusters by regions in the regressions. Therefore, the exogenous characteristics of families related to their location are expected to be captured.

3.1. Data base

We used the microdata of the *EncuestaNacional de Hogares de Propósitos Multiples* (ENHOGAR) 2010, prepared by the National Statistical Office (ONE) of the Dominican Republic for the 31 states of the country. The year's choice is based on the fact that this survey included a special research about women's health, education and child labor[3]. The sample is composed of 3,326 children between 5 and 17 years of age

[3] Our data base asks wether the child has worked on the week of reference. Only non-domestic work must be included

old who live in Dominican rural area, offering a considerable range of socioeconomic information about households and children.

4. RESULTS

4.1. Child labor in the rural Dominican Republic

In Dominican Republic, 21.96% of adults believe that it is reasonable for children to work as long as it does not interfere with their schooling and does not cause physical and mental harm. In addition, 61.22% of them confirmed that they had worked as children or helped their parents. This suggests that that most Dominicans do not see child labor as a social problem.

In rural Dominican, 24.96% of the children confirmed that they were responsible for some kind of domestic work at home. In addition, 15.99% of them had performed some type of work in the last seven days of reference data of the research. It is important to note that the percentage of children who study and work is 18% and children who neither study nor work add up to 4.50%. On the other hand, 2% of children only work.

People responsible for the children said that the main reasons for allowing them to work are: to complement the family income (22.85%); to take advantage of their time (7.62%); to acquire skills (6.95%); help in the family business (7.95%) and 13.25% report that children like to work and earn their own money.

Working is more common among male children (75.98%). However, it is important to remember that house tasks (housework), where girls usually have more presence, are not considered in the estimates. In Latin America, as well as in the world, girls and women work in less visible forms of work and therefore, tasks subject to underreporting, such as work at home or at other people's houses.

In Dominican Republic, attendance at school and at work is closely related to the level of household income. Children in poorer families are more likely to work (52.10% of those who work belong to the poorer class). However, the fact that 1.65% of working children belong to families in the richest class, points out the existence of other factors that influence this phenomenon.

As the data show, children’s working hours in rural areas is on average 13 hours a week. Among the interviewed children, 81.59% answered that they work during the day, 3.59% in the evening and 7.96% in both. The main working conditions are: unpaid family worker (34.32%), employee (17.32%), self-employed worker (13.88%),

domestic worker with compensation (6.24%), boss(3,43%) and domestic workers without remuneration (1.72%).

When asked about payment in cash, only 53.35% confirmed the receipt. From those who answered affirmatively, this payment was made daily (20.79%), weekly (40.17%), every 15 days (10.67%) and monthly (6.46%). It should be emphasized that the average remuneration is 12.50 dollars per week, with the payment always higher for male children. With regard the destination of the money received by the children, 18.88% of them said to keep the total earned in the work, 25.59% said they shared with their parents and 7.64% passed on all the money to their parents.

Finally, from the working children, 35.50% and 11.95% answered that they work with the purpose of helping the parents and generating or supplementing the income of the family, respectively. Similarly, 0.18% said they work to help pay a family debt. This may be an indication that a negative income shock in Dominican households may lead to a change in the allocation of children's time.

4.2 Income shocks, assets and their impacts on child labor and education

In this section we show econometrics results obtained by bivariate probit considering adjusted standard errors (by bootstrap and clusters[4] per microregion). The first specification on Table 1 do not include additional controls, with the aim of showing the effects associated with the three variables of interest (*Assets, Shock* e *Assets*Shocks*). The inclusion of controls, later, allows to identify the mechanisms by which the effects of these three variables are manifested.

The presence of household assets is statistically significant, related both to the probability of work (reducing it) and of study (raising it). Likewise, Bandara, Dehejia and Lavie-Rouse (2015) point out that in Tanzania the presence of assets is associated with lower child labor and an increase in schooling, also showing that families with economic assets will have easier access to the financial market, in the face of some adversity at home.

The occurrence of a negative income shock in the family is only statistically related to the probability of child labor (increasing its probability). Shocks, on the other hand, are not significantly associated with the decision of school attendance. This is in line with the findings of Duryea, Lam and Levison (2006) for Brazil, who find that

4 Cluster analysis aims to group sample elements according to some measure of similarity (social, geographical, economic, etc.). Such grouping is performed so that the variability within the groups is the smallest possible, while the variability between the groups is maximized.

negative shocks significantly impact the probability of the child entering the labor market. On the other hand, the absence of a significant effect of shocks on the probability of child placement in school may be an indication that the child's time does not seem to compete with his or her time in school, as Ravallion and Wodon (2000) suggest. The shock may be allocating the child to the job market, but not by taking time off from school. Moreover, the interaction between the occurrence of a shock and the presence of assets in the households (Variable *assets*shock)* was not significant neither for study nor for child labor.

Thus, assets are indeed important in this decision-making process, raising the likelihood of children's being studying and reducing their work. Shocks raise the likelihood of child labor, but assets do not seem to contribute to softening this negative effect.

The value of the coefficient ρ (rho), which measures the correlation between the error terms of the two equations, was -0.174 for this specification, significant at the 5% level (p-value equal to 0.048), indicating that there is interdependence between the decisions of child labor and school attendance. Since this coefficient is negative, the unobserved factors not included in the model contribute to increase the probability of work and reduce the probability of study and vice versa.

Table 1- Impact of the variables of interest on the decision of child labor and school attendance, Dominican Republic

Variables	Study			Work		
	Coef.	Std. Err.	Sign.	Coef.	Std. Err.	Sign.
Assets	0,450	0,083	***	-0,136	0,068	*
Shocks	0,000	0,103	ns	0,302	0,087	***
Assets*Shocks	-0,092	0,146	ns	0,111	0,112	Ns
Constant	1,282	0,058	***	-1,057	0,053	***
No. Obs.	3.326					
Athrho	-0,176	0,049				
Rho	-0,174	0,048				
Wald chi2	12,859					
Prob>chi2	0,000					

Source: research results.

Notes: Robust standard deviations toheteroskedasticity. Single asterisks (*), double (**) and triple (***) denote significance at 1%, 5% and 10%, respectively, ns indicates non-significance.

In order to verify the consistency of the estimates, as well as to investigate the mechanisms by which the effects indicated in Table 1 are manifested, Table 2 shows additional specifications, controlling for important variables.

Regarding the main variables of interest, it is verified that the fact that the rural household has assets continues to statistically increase the probability of school attendance of children and adolescents. *Assets*, however, do not appear to be significantly related to child labor, when other variables are controlled for. Thus, the beneficial effect of assets on the reduction of child labor may actually be due to other factors related to these assets, such as characteristics of families and children.

The occurrence of a negative income shock continues to increase the probability of the child being allocated to the labor market, which is not significant for the probability of studying. Thus, even when controlling for important location variables, characteristics of children, adolescents and their families, shocks seem to be important means of increasing the probability of child labor. There is, according to these results, some evidence that shocks cause children to combine both tasks (study and work), increasing workload without reducing school attendance. Again, the interaction between the occurrence of a shock and the presence of assets among the households (variable *Assets*Shock*) was not significant for the probability of study, nor child labor. Thus, there are indications that the assets are not able to reduce the effects of shocks in the rural area of Dominican Republic.

Regarding the control variables, it is noted that the child's age increases the probability of work (and reduces the probability of school attendance). That is, older children are more likely to work and to drop out of school. One of the reasons behind this result is the fact that education in the Dominican Republic is compulsory only in elementary and secondary school, (ages 4 to 14 years). Sapelli and Torche (2004) show that, for Ecuador, the probability of working for boys and girls is higher as age increases. They assume that, at an older age, the family’s opportunity cost to keep the child in school increases, emphasizing that it has a greater "substitutive" implication between the two decisions (study and work).

Likewise, the fact that the child is male enhances his chances of attending the job market. However, it is noted that the gender was not significant to explain the study decision; this can be explained, in part, by the compulsory education in the Dominican Republic. The child’s gender was also not significant in the decision to study in different African countries, Peru and Ecuador (SAPELLI; TORCHE, 2004). On the other hand, in Costa Rica, Cerdas (2003) finds that the fact that the child is male increases the chances of attending the labor market in rural areas.

Table 2 - Impact of the variables on the incidence of child labor and school attendance, Dominican Republic

Variables	Study			Work		
	Coef.	Std. Err.	Sign.	Coef.	Std. Err.	Sign.
Assets	0,335	0,077	***	-0,055	0,094	ns
Shock	0,033	0,173	ns	0,211	0,101	*
Assets * Shock	-0,111	0,192	ns	0,132	0,124	ns
Age	-0,072	0,014	***	0,105	0,009	***
Child'sgender	0,000	0,064	ns	0,736	0,072	***
Householder'sgender	0,032	0,093	ns	0,023	0,093	ns
Marital status	-0,035	0,163	ns	-0,082	0,098	ns
Mother'sschooling	0,036	0,009	***	-0,028	0,013	*
Housesize	0,042	0,056	ns	0,038	0,020	*
Members from 0 to 4 years of age	-0,292	0,085	**	-0,020	0,055	ns
Transfer	0,224	0,067	**	-0,079	0,055	ns
Water	0,122	0,052	*	-0,115	0,124	ns
Sewer	0,030	0,097	ns	-0,227	0,112	*
Themotheremigrated	0,068	0,157	ns	0,104	0,103	ns
Parentsemigrated	-0,344	0,166	*	-0,064	0,166	ns
North	0,065	0,114	ns	0,386	0,045	***
East	-0,093	0,168	ns	0,404	0,073	***
South	0,145	0,183	ns	0,532	0,235	*
Constant	1,678	0,365	***	-3,002	0,204	***
No. Obs.	3.326					
Athrho	-0,079	0,054				
Rho	-0,078	0,054				
Wald chi2	1,988					
Prob>chi2	0,016					

Source: Researchresults.

Notes: Robust standard deviations toheteroskedasticity. Single asterisks (*), double (**) and triple (***) denote significance at 1%, 5% and 10%, respectively, ns indicates non-significance.

Mother's education reduces the probability of the child labor, while raises attendance at school. The fact that the mother's schooling is associated with this beneficial effect on the children may be related both to the higher level of income of the mother, which weakens the need for supplementation of the household income, and to the awareness about the care with the children that results from the mother's knowledge and education (EMERSON; SOUZA, 2002).

The results also show that the fact that the family benefits from a conditional cash transfer program[5] raises the chances of the children being allocated to school, although it does not alter the likelihood to work. This might be related to the fact that the cash transfer programs in Dominican Republic have no direct actions to reduce child

[5] The conditional cash transfer analyzed is aimed to encourage education, food and health in children and in beneficiary families.

labor, but rather to increase school attendance. Cardoso and Souza (2005) show that, for Brazil, income transfer programs do not have significant effects on the incidence of child labor, but rather on education, since there is a change in the time allocated in the activities (school and work), considering that the benefits paid by the programs are insufficient to encourage the abandonment of the labor market.

It turns out that each new member in the family raises the child's likelihood to combine work and study. This result corroborates the finding of Araújo (2010) and Emerson and Souza (2002) for Brazil, who point out that in larger families, boys and girls are more likely to enter the labor market. Another interesting result is that the greater the number of siblings younger than four years old in the child's home, the lower the probability of school attendance of the child (not significantly affecting their probability of work). Sapelli and Torche (2004) point out that, for Ecuador, in the case of the siblings, the main behavior is likely to be that in which the child stays at home to take care of his younger siblings.

As for the water and sewage service at home, access to these items raises the probability of school attendance (decreasing the chance of work). Improvements in sanitation and better infection control may also be more beneficial for girls than for boys, because girls are more susceptible to infectious diseases, as well as working more on water and housework (DREVENSTEDT; EILEEN, 2008).

Migration of parents reduces school attendance, but not the work of boys and girls. Nurwita (2009), in a study for Indonesia, points out that the effects of migration are also felt among children, increasing labor and decreasing human capital. Likewise, Mesquita (2011) shows that the children of migrants study less in Brazil.

The fact that the household is located in the South region increases the probability of attending school (this region is the most beneficiary of transfer programs, whose basic condition is to send the children to school). On the other hand, living in the eastern and northern regions of the Dominican Republic increases children's chances of working, when compared to children living in other regions. This result is expected, since most Dominican children do jobs related to agriculture, manufacturing and services (tourism, hotels, restaurant, etc.), activities that are more developed in these regions (East and North).

Finally, the coefficient ρ (rho), which measures the correlation between the error terms of the two equations, was -0.078, significant at the 5% level (p-value equal to 0.054), indicating once more that there is interdependence between work and study of

children. Again, the fact that this coefficient is negative indicates that the unobserved factors not included in the model contribute to the increase in the probability of work and reduction in the probability of study and vice versa.

In order to observe if shocks and assets act differently between boys and girls, we proceeded to the estimation of the main model separately for each of these cases (Table B in the Appendix). The results show that the presence of assets continues to increase the chance of schooling for both boys and girls. The incidence of negative income shocks, in turn, raises the likelihood of sending boys to work, but not girls. Girls were expected to be more disadvantaged when the family faced extreme circumstances, as suggested by Duflo (2012). But this may be also a result of the under-reported work of girls. With respect to the interaction of assets with shocks, this is still not significant in any case.

We also estimated two other models, for two age groups (children 5 to 10 years old and 11 to 17 years old[6]). Results were qualitatively similar to those presented in Tables 2 and 3. Assets increase the probability of studying for the two age groups analyzed, but does not change the decision about work. In addition, negative shocks decrease the probability of study for those aged 11 to 17 years. The interaction between assets and shocks (variable *Assets*Shock*) was significant at the 1% level only for the range of 5 to 10 years, reducing the likelihood of studying. These results suggest that older children are allocated away from school when the family faces an income shock - but not younger children. We did not expect the significant and negative effect of the interaction term on the probability of school attendance of younger children, although we hypothesize that this might be due to measurement errors and under-reported child labor at this age group.

In Table 3 below shows the impacts of the marginal changes in the explanatory variables on the four probabilities of interest: neither study nor work, only work, work and study and only study. The marginal effects correspond to changes in the estimated probability given a variation of one percentage point in the explanatory variable[7]. In the case of dummy explanatory variables, the marginal effects correspond to a discrete variation from 0 to 1.

[6] See Table C in the Appendix.

[7] It is important to emphasize that the signal of the marginal effects is the same of the estimated coefficients, thus not interfering in the interpretation.

Table 3 - Marginal effects of variables on child labor decision and school attendance, Dominican Republic

Variáveis	Nem estuda nem trabalha			Só trabalha			Trabalha e estuda			Só estuda		
	Coef.	Std. Err.	Sign.	Coef.	Std. Err.	Sign.	Coef.	Std. Err.	Sign.	Coef.	Std. Err.	Sign.
Ativos	-2,929	0,009	**	-0,559	0,002	***	-0,508	0,018	ns	3,997	0,016	*
Choque	-0,544	0,015	ns	0,201	0,003	ns	3,914	0,018	*	-3,571	0,029	ns
Ativos*Choque	0,837	0,017	ns	0,319	0,004	ns	2,244	0,021	ns	-3,400	0,036	ns
Idade	0,519	0,001	***	0,230	0,000	***	1,810	0,002	***	-2,559	0,003	***
Gênero da criança	-0,871	0,006	ns	0,869	0,003	**	13,465	0,017	***	-13,463	0,018	***
Gênero do chefe	-0,318	0,008	ns	-0,021	0,002	ns	0,469	0,017	ns	-0,130	0,022	ns
Estado civil	0,412	0,014	ns	-0,045	0,003	ns	-1,558	0,019	ns	1,192	0,023	ns
Escolaridade da mãe	-0,293	0,001	***	-0,087	0,000	***	-0,461	0,002	*	0,841	0,003	**
Tamanho do domicilio	-0,424	0,005	ns	-0,017	0,001	ns	0,766	0,003	**	-0,324	0,008	ns
Membros de 0 a 4 anos	2,634	0,009	**	0,408	0,002	*	-0,796	0,010	ns	-2,246	0,015	ns
Transferência	-1,913	0,006	**	-0,425	0,001	***	-1,110	0,010	ns	3,448	0,010	***
Água	-0,952	0,004	*	-0,316	0,002	ns	-1,931	0,022	ns	3,200	0,027	ns
Esgoto	0,002	0,009	ns	-0,312	0,002	ns	-4,102	0,021	*	4,412	0,025	*
A mãe emigrou	-0,732	0,014	ns	0,022	0,003	ns	1,995	0,019	ns	-1,284	0,022	ns
Pais emigraram	3,156	0,013	*	0,434	0,003	ns	-1,675	0,031	ns	-1,914	0,035	ns
Norte	-1,039	0,009	ns	0,359	0,002	ns	7,152	0,009	***	-6,472	0,014	***
Leste	0,353	0,014	ns	0,615	0,004	ns	7,256	0,013	***	-8,224	0,029	**
Sul	-1,925	0,013	ns	0,414	0,006	ns	9,949	0,046	*	-8,438	0,063	ns

Source: Research results.
Notes: Robust standard deviations toheteroskedasticity. Single asterisks (*), double (**) and triple (***) denote significance at 1%, 5% and 10%, respectively, ns indicates non-significance.

As shown in Table 3, the presence of assets in the household decreases by 2.9 and 0.56 percentage points (p.p.) the chances of the child neither studying nor working and only working, respectively. On the other hand, assets increase the chance of the children only studying by 3.99p.p. the chances that children will only study. A negative income shock increases by 3.91p.p. the probability of child labor and school attendance. The interaction between assets and shock was not statistically significant. The results show that Dominican boys and girls tend to combine work and study in the face of a negative shock.

Among the most interesting control variables, it is worth noting that the fact that the household head is female reduces by 13.46p.p. the chance of the child only to study and increases in 13.47 p.p. the probability of the child to study and to work. The mother's years of study decrease the child's likelihood of working (0.09 percentage points), working and studying (0.46 percentage points), and neither studying nor working (0.29 percentage points). At the same time, the mother's schooling increases by 0.84p.p. the chances of just studying.

The number of members aged from 0 to 4 years in the family increases the likelihood of neither studying nor working (2.63 p.p.); and increases the chances of only working by 0.41 pp. The fact that the family belongs to some cash transfer program

reduces by 1.91p.p. the probability of neither studying nor working, 0.42 p.p. of only working and increases 3.44 p.p. the probability of studying.

Finally, residing in the North increases by 7.15 p.p. the probability to study and work and reduces by 6.47 p.p. the likelihood of only working. Similarly, living in the eastern region increases by 7.26p.p. the probability of working and studying; and decreases by 8.22p.p. the probability of just working. On the other hand, living in the South increases 9.94p.p. the likelihood of working and studying.

5. CONCLUSION

In this paper, we sought to investigate the relationship between income shocks, assets and household decision making concerning child labor and school attendance. Our focus was rural households of Dominican Republic. Our results suggest that economic assets at home improve the human capital formation of children and adolescents, and concomitantly reduce their probability of work, regardless of gender and age. With respect to the negative income shocks suffered by the families, it is observed that, regardless of the characteristics of the regions, families and children, these do not affect the schooling of boys and girls. However, negative income shocks were relevant to increasing child labor. The intensity of this effect is related in a different way to age and sex, being more damaging and accentuated in the age group from eleven to seventeen years and for the male children rather than for the female children. On the other hand, the empirical results do not seem to indicate significant effects of the interaction between shocks and assets on human capital development and child labor. Roughly, the results show that shocks lead Dominican children to combine study and work.

In general, increased schooling raises human capital, and furthermore, the participation of children in the labor market does not help the economic development of Dominican Republic. The results of this study suggest that policies to combat child labor and to develop human capital in rural areas need to consider the possession of household goods, access to credit, microcredit and the generation of equal opportunities or tools for families in rural areas to cope with economic crises. It is also necessary to consider the degree of vulnerability to shocks that different families have. In addition, it is important to generate public policies that raise awareness in Dominican society about the impact of child labor on children's education, health, and future income levels.

As limitations of this, it is mentioned that the database for child labor in the Dominican Republic is only available for one year (2010). Given this, we cannot compare and analyze the dynamic behavior of families, nor even control for unobserved factors that can affect the decision of households regarding school and child labor. In addition to purely economic assets - such as the possession of household goods -, other factors can be important mitigators of shocks, such as access to credit or a bank account. These limitations are also our main suggestions for future research and improvement of this study.

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ANNEX

Table A-Description of the variables in the bivariate probit model

Endogenous Variables	Study	It assumes value of 1 if the child is enrolled in school.
	Work	It assumes value 1 if the child worked in the market.
Exogenous Variables:		
Economic Assets:	Assets	Assumes a value of 1 if the household has goods worth more than US$ 520.
Suffered Shocks:	Crop loss	It assumes value 1 if the household suffered crop loss due to crop failure or fire.
Assets*Shock:	Assets*Shock	Interactive variable resultant of the multiplication of active variables and shocks.
Child's Characteristcs:	Age	Child's age in years.
	Child's gender	It assumes 1 if the child is male.
Domicile Characteristics:	Householder's gender	It assumes 1 if the householder is female.
	Householder's marital status	It assumes 1 if the huseholder is single or separated.
	Mother's schooling	Indicates the mother's schooling in years of study.
	House size	Total number of members in the household.
	Members from 0 to 4 years of age	Number of members aged from 0 to 4 at home.
	Transfer	It assumes value 1 if the household receives some type of monetary transfer from the government.
Basic Services:	Water	It assumes value 1 if the household has water service.
	Sewage	It assumes value 1 if the household has a sewage system.
Migration:	Mother emigrated	It assumes 1 if the mother of the child has emigrated.
	Parents emigrated	It assumes 1 if the child was left behind (father and mother emigrated).
Macro regions:	North	It assumes 1 if the child lives in the North.
	East	It assumes 1 if the child lives in the East.
	South	It assumes 1 if the child lives in the South.

Source: National Statistical Office, 2010.

Table B - Descriptive statistics of the main explanatory variables of the model, Dominican Republic, 2010

Variables	Observations	Mean	Std. Deviation	Minimum	Maximum
Study	3.326	0,934	0,248	0	1
Work	3.326	0,155	0,362	0	1
Assets	3.326	0,618	0,486	0	1
Shock	3.326	0,302	0,459	0	1
Assets*Shock	3.326	0,18	0,384	0	1
Age	3.326	10,083	3,583	5	17
Child's Gender	3.326	0,525	0,499	0	1
Householder's gender	3.326	0,296	0,457	0	1
Marital Status	3.326	0,237	0,425	0	1
Mother's Schooling	3.326	7,889	3,587	0	16
Domicile Size	3.326	5,359	1,842	1	13
Members from 0 to 4 years of age	3.326	0,41	0,685	0	5
Transfer	3.326	0,379	0,485	0	1
Water	3.326	0,288	0,453	0	1
Sewage	3.326	0,322	0,467	0	1
Mother emigrated	3.326	0,126	0,332	0	1
Parents emigrated	3.326	0,071	0,257	0	1
North	3.326	0,381	0,486	0	1
East	3.326	0,304	0,46	0	1
South	3.326	0,233	0,423	0	1

Source: Research results.

Table C - Impact of variables on child labor decision and school attendance, by sex of the children, Dominican Republic

Variables	Study						Work					
	Boy			Girl			Boy			Girl		
	Coeff.	Std. Err.	Sign.	Coeff.	Std. Err.	Sign.	Coeff.	Std. Err.	Sign.	Coeff.	Std. Err.	Sign.
Assets	0,420	0,085	***	0,275	0,123	*	0,034	0,098	ns	-0,183	0,174	ns
Shock	-0,060	0,316	ns	0,172	0,107	ns	0,231	0,104	*	0,196	0,178	ns
Assets*Shock	-0,119	0,310	ns	-0,140	0,216	ns	0,086	0,124	ns	0,184	0,218	ns
Age	-0,083	0,020	***	-0,060	0,019	**	0,126	0,013	***	0,067	0,009	***
Householder's gender	0,008	0,137	ns	0,092	0,142	ns	0,158	0,120	ns	-0,278	0,189	ns
Marital status	0,074	0,119	ns	-0,179	0,243	ns	-0,213	0,076	**	0,182	0,222	ns
Mother's Education	0,034	0,021	ns	0,041	0,013	**	-0,036	0,016	*	-0,008	0,015	ns
House Size	0,023	0,042	ns	0,066	0,086	ns	0,012	0,021	ns	0,078	0,031	*
Members from 0 to 4 years	-0,232	0,108	*	-0,358	0,099	***	-0,002	0,049	ns	-0,026	0,091	ns
Transfer	0,201	0,123	ns	0,292	0,102	**	-0,048	0,045	ns	-0,168	0,175	ns
Water	0,126	0,123	ns	0,124	0,105	ns	-0,170	0,116	ns	-0,033	0,173	ns
Sewer	-0,052	0,101	ns	0,124	0,144	ns	-0,165	0,125	ns	-0,359	0,145	*
The mother emigrated	0,044	0,352	ns	0,097	0,388	ns	0,182	0,157	ns	-0,115	0,668	ns
Parents emigrated	0,012	0,370	ns	-0,658	0,445	ns	0,063	0,216	ns	-0,415	1,999	ns
North	-0,030	0,175	ns	0,136	0,083	ns	0,458	0,065	***	0,218	0,137	ns
East	-0,242	0,154	ns	0,051	0,212	ns	0,401	0,091	***	0,378	0,061	***
South	0,141	0,308	ns	0,138	0,279	ns	0,634	0,294	*	0,305	0,141	*
Constant	1,970	0,403	***	1,343	0,471	**	-2,471	0,226	***	-2,634	0,253	***
Observations	1.747		1.579									
athrho	-0,181	0,048	0,106	0,138								
Rho	-0,179	0,047	0,106	0,137								
Wald chi2	11,862		0,829									
Prob>chi2	0,001		0,363									

Source: Research results.

Notes: Robust standard deviations to heteroskedasticity. Single asterisks (*), double (**) and triple (***) denote significance at 1%, 5% and 10%, respectively, ns indicates non-significance.

Table D- Impact of variables on child labor decision and school attendance, by age group, Dominican Republic

Variables	Study						Work					
	5 a 10			11 a 17			5 a 10			11 a 17		
	Coeff.	Std. Err.	Sign.	Coeff.	Std. Err.	Sign.	Coeff.	Std. Err.	Sign.	Coeff.	Std. Err.	Sign.
Assets	0,511	0,123	***	0,220	0,117	*	-0,136	0,181	ns	0,001	0,081	ns
Shock	0,524	0,230	*	-0,299	0,152	*	0,189	0,166	ns	0,248	0,082	**
Assets*Shock	-0,901	0,338	**	0,354	0,167	*	0,232	0,225	ns	0,052	0,131	ns
Age	0,199	0,054	***	-0,243	0,022	***	0,140	0,030	***	0,093	0,011	***
Child's gender	0,056	0,095	ns	-0,084	0,074	ns	0,508	0,092	***	0,879	0,074	***
Householder's gender	-0,115	0,129	ns	0,066	0,158	ns	-0,072	0,149	ns	0,079	0,054	ns
Marital status	-0,039	0,217	ns	0,005	0,231	ns	-0,001	0,145	ns	-0,118	0,084	ns
Mother's Education	0,039	0,021	*	0,038	0,011	**	-0,033	0,018	*	-0,025	0,013	*
House Size	0,050	0,050	ns	0,033	0,068	ns	0,035	0,018	*	0,037	0,023	ns
Members from 0 to 4 years	-0,203	0,098	*	-0,336	0,113	**	-0,025	0,084	ns	-0,004	0,051	ns
Transfer	0,127	0,103	ns	0,232	0,112	*	-0,108	0,141	ns	-0,081	0,048	*
Water	0,113	0,088	ns	0,137	0,073	*	-0,114	0,141	ns	-0,110	0,151	ns
Sewer	-0,092	0,088	ns	0,152	0,140	ns	-0,259	0,124	*	-0,227	0,120	*
The mother emigrated	0,246	2,060	ns	-0,180	0,173	ns	0,001	0,224	ns	0,149	0,149	ns
Parents emigrated	-0,161	2,057	ns	-0,489	0,189	*	-0,169	0,386	ns	0,058	0,196	ns
North	0,090	0,904	ns	0,215	0,077	**	1,101	0,083	***	0,183	0,063	**
East	-0,344	0,160	*	0,145	0,154	ns	1,042	0,114	***	0,241	0,046	***
South	0,023	0,137	ns	0,358	0,284	ns	1,169	0,161	***	0,362	0,351	ns
Constant	-0,361	0,667	ns	4,192	0,527	***	-3,644	0,346	***	-2,824	0,204	***
Observations	1.608			1.718								
athrho	0,001	0,170		-0,114	0,058							
Rho	0,001	0,170		-0,113	0,058							
Wald chi2	0,000			3,544								
Prob>chi2	0,996			0,060								

Source: Research results.

Notes: Robust standard deviations to heteroskedasticity. Single asterisks (*), double (**) and triple (***) denote significance at 1%, 5% and 10%, respectively, ns indicates non-significance