Child labor in agricultural households in Burkina Faso, Ivory Coast and Mali: test of the luxury axiom by a fuzzy sets theory approach

ABALO, Kodzovi

Graduate School of Statistics and Applied Economics, ENSEA, Cote d'Ivoire

June 2012

Survey of Child Labor in West Africa: Testing The Luxury Axioms in The Agricultural Areas of Cote d'Ivoire, Burkina Faso And Mali
(Working Paper)

Kodzovi ABALO, MEng.

1. INTRODUCTION

Children's involvement in the adults' work is a cultural practice rooted and valued in both rural and urban areas in West Africa (Andvig et al, 2001). This participation often occurs - but not always - in a family setting and is considered to be a fundamental element of their integration in the society. Thus, in a cultural environment somehow favorable to the phenomenon (of child labor), the reaction in face of the international momentum against child labor was still in the late eighties, either indifference or resignation, and even sometimes, denial. However, 1989 was a historical shift with the adoption of a UN convention relative to child rights. Since then, the mobilization of an international political continuous support for banning child labor became clearly and durably stated as an objective (UN, MDGs, 2000). Nevertheless, in the agricultural sector in Cote d'Ivoire, Mali and Burkina Faso, at least 70% of the children still participate in the labor market (ILO[1], 2010). Knowing that the majority (60 to 70%) of population in these 3 countries is mostly active in the agricultural sector, it becomes important to analyze the phenomenon within agricultural households[2] in order to get a comprehensive idea about the intensity, the extent and the determinant of the phenomenon. Besides, it is worth noting that in 2001, the US government has signed with the Cote d'Ivoire's[3] government, the so-called *Harkin and Engel Protocol*[4] in order to fight against child labor in the coca sector, significantly decrease it and totally eliminate its worst forms. Furthermore, Cote d'Ivoire has tight historical links with Burkina Faso and Mali, characterized by the welcoming by Cote d'Ivoire of a huge population of migrant workers from these latter two countries. These migration flows participate to worsen the problem in the 3 countries given that these flows also include child labor traffic. Recognizing this, it seems imperative to draw up a complete inventory of the phenomenon in these three (03) countries while looking at the migration patterns and implications. Specifically, this study addresses, in a comparative perspective, the following questions: how can we explain the persistence of child labor in the agricultural areas in Burkina Faso, Côte d'Ivoire and Mali? Do the migration streams toward the cocoa plantation areas in Cote d'Ivoire contribute to reinforce the phenomenon in the 3 countries? Thus, this paper tests in the three countries, the role of migration as well as the traditionally established albeit controversial links between poverty and child labor. We also test the link between education of parents and child labor. Furthermore, some substitution or complementarity patterns between the main sectors of activity in these agricultural areas will eventually be highlighted, and can be used to better understand the dynamic of the participation and or migration decisions as well as the potential spillovers effects that result. Finally, some key policy recommendations are drawn for the grasping of this comprehensive picture.

The rest of the paper is organized as follows: the second section describes the *theoretical background* of child labor with a focus on unitary vs not household models. The following section establishes the *conceptual framework* within which the study is be conducted. The fourth section describe the *data* of the study. The next sections focus on the *empirical strategy* of the study: an inventory of the phenomenon aiming at capturing the characteristics and potential determinants of child labor on a comparative basis is followed by some econometric estimations aiming at explaining the phenomenon (non-light child labor [5] and worst forms of child labor) and exploring the sectoral decision interrelations. Furthermore, it attempts

---

[1] International Labor Organization (ILO)

[2] Household where one or more members maintain plots of land on behalf of the household.

[3] The first world producer of cocoa

[4] (signed in 2001 between the US, the Ghanaian and the Cote d'Ivoire Governments

[5] The concept of "non-light labor" refers to any work occupying the child for more than 14 hours per week: refers to ILO's Convention 138: this type of work is likely to affect the child's schooling.

to analyze some very important potentially related aspects of the phenomenon such as poverty, education and spatial mobility.

2. THEORETICAL SURVEY

The phenomenon of child labor has ancient origins (Basu, 1999). But the first contemporary theoretical analyzes were first performed under the scope of the *models of household behavior* by Rosenzweig and Evenson (1977). They designed for this purpose a *neoclassical unitary equilibrium model* which explains the links that exist between adult participation in the labor market, schooling and child labor. The aim was to explain the simultaneous family's decisions of consumption and child labor, but also of education and fertility. Since then, an increasing attention has been given to the interrelation of decisions and to the bargaining processes between parents and children on the one hand (intra-household bargaining[6]), and between the parents and employers, on the other (extra household bargaining[7]). These derived models take into consideration the fact that the household is not necessarily managed by a "benevolent dictator". In the intra-household bargaining case, where the parents are altruistic, Basu (1999) show that children's labor supply depends on adult wages and the number of children within the labor market. By cons, in the extra-household bargaining case, if the adult's wage is related to that of children, parents do not care about the welfare of their children (Gupta, 1998). The *existence of multiple equilibria* (when children are potential workers) in the labor market is a possibility underestimated by previous approaches. This limit leads Basu and Van (1998) to propose a model that explicitly incorporates the issue of poverty, through the scope of two hypotheses: the *luxury axiom* and the *substitution axiom*. The first axiom (*luxury axiom*) states that children's participation in the labor market prevails if the household has a standard of living below a critical threshold. Thus, in a poor household, a child is released from working and can then eventually attend school at the only condition that his or her household is able to make a living without his or her contribution. In other words, it appears that the leisure of children, their schooling and more generally their *non-working state* are luxury goods in the consumption basket of the poor household. Child labor status changes according to the change in family income. The second axiom is called *substitution axiom* and indicates equivalence, up to some correction factor, between adults and children workforce, which reinforces the possibility of using child labor. Therefore, the participation of children in the labor market depends on the level of poverty of the household to which they belong. As formalization, Basu and Van specify a curve of decreasing labor supply in the salary of parents that have two possible stable equilibria. A good equilibrium, characterizing a high wage scenario where children do not work; and a bad equilibrium reflecting the opposite situation, with a high prevalence of child labor. In addition, they show that when the bad equilibrium prevails, the prohibition of child labor may lead, ceteris paribus, to the restoration of the good equilibrium. With the idea of multiple equilibria comes also the possibility of taking into account some more subjective factors such as social norms (Hirschman, 1995). In this context, the society end up in a situation where either all parents send their children to work, or none of them do so (Lindbeck, Nyberg and Weibull, 1998).

In this paper, we take into account the existence of multiple equilibria and focus in particular on testing the luxury axiom as well as understanding the social norms vs international standards dynamics in explaining the phenomenon.

---

[6] Bargaining within the family, between the parent and the child
[7] This approach treats the employer and the child's parents as the agents involved in bargaining

3. **CONCEPTUAL FRAMEWORK**

Any study on child labor requires a clear and concise choice of definition of the concept of "child labor".

In the one hand, the need to opting for a clear definition is related to the multiplicity of potential definitions as well as the complexity and variety of national and international standards governing child labor. In this paper, the 138[th][8] and 182[nd][9] ILO's conventions establishing the scopes for acceptable and unacceptable child labor, serve as references. The 138th and 182nd ILO Conventions describe the limits for acceptable and unacceptable type of work. This paper globally complies with the same classification and standards.

(i) The *acceptable work* (in line with ILO standards) is designated "*child work*" by the Unicef. It regroups any work that meets legal limits, which does not hamper the health or the physiological development of the child, and which does not harm his or her education. This type of work can be a positive experience and is authorized from the age of 12 by the Convention 138 of the ILO.

(ii) The *unacceptable work* (non-conform with ILO standards) is designated "*child labor*" by the Unicef. It refers to all children under 12 years old working in any of the branches of the economy. In addition, it includes children aged 12-14 years and working more than 14 hours a week. Finally, it includes any children under the age of 17 engaged in hazardous activities and all children facing the worst forms of labor. The key criteria for hazardous work is related to the minimum age and the arduousness, but more generally, to the security standards as defined by ILO's Convention 190 on dangerous work. In general, the study considers the list of these forms of work as defined by the ILO convention as well as by national legislation of the countries considered. Regarding the "worst forms of child labor", the Convention 182 of the ILO serves as a reference.

On the other hand, there is a challenge regarding the limitation of the standard definition of domestic work which, in the sense of the ILO, does not capture the true extent of the phenomenon especially in the socioeconomic context of the 3 countries covered by our analyses[10]. This definition is quite restrictive in the sense that it ignores the children involved in some chore work within their own households, but at an extent and intensity that can be compared or even worse relative to those involved in a "real" and "paid" domestic job. Therefore, to solve this shortcoming, we propose a holistic approach (complementing the commonly used definition by a new measurement approach) in order to capture as better as possible the reality of the phenomenon. We apply a provision of the Convention 138 of ILO, which sets a weekly quota threshold of 14 hours beyond which the notion of soft or harmless work should no longer prevail. Thus, in the following, any child who fall into the category of "*child work*" but who carries on domestic activities within his or her own household for more than an average of 14 hours a week is be regarded and treated as a part of the "*child labor*" category member. Considering this form of *within-household* labor is reasonable since this type of work can actually potentially undermine the education and or the health conditions of the children (even if it is a domestic work), as well as also being used as a disguised employment (cheap labor substitute), leading to an under-estimation of the true level of the phenomenon of child labor.

---

[8] On minimum age at work (1973)

[9] On the worst forms of child labor: by ratifying this convention signed in 1999, a states agrees to adopt immediate measures to prohibit and eliminate the worst forms of child labor

[10] ILO defines domestic work (for children) as the one carry on by a child for an employer in exchange a "salary". This definition excludes all the children who undertake domestic work at home or within a relative household without necessary getting paid

Ultimately, we consider in this paper as a "child laborer", any child aged 10 to 17 years, working in an economic activity (agricultural or any other economic sector) in both the formal and informal sectors and who had performed for at least one hour (10-12 years old), or for more than 14 hours (12-14 years old) a paid or unpaid work during the past 12 months; also is included any child who had performed a domestic work for more than 14 hours a week during the past 12 months. The choice of the reference period (12 months) is justified by the fact that a child, although not having worked the week before the survey, or even several weeks before, may well have been employed in the past months and only be in a sort of temporary unemployment status, while waiting for an opportunity to "return" to the labor market.

4. DATA

We use data from a series of surveys commissioned by the U.S. Department of Labor, overseen by the Tulane University and supervised by ENSEA[11]. These surveys took place in 2009 and covered the agricultural areas of three (03) Countries: Burkina Faso, Côte d'Ivoire and Mali. The data were collected on the basis of a stratified survey (2 level strata[12]) with the enumeration districts as *primary units*, and the agricultural households as secondary units. The samples comprise 719 (Burkina Faso), 1458 (Ivory Coast) and 741 (Mali) children of 10 to 17 years of age.

5. SOME KEY DESCRIPTIVE FACTS

▪ *Child labor and worst forms of child labor*

The application of Convention 138 related to the acceptable threshold of time, combining with the UNICEF definition of acceptable vs non acceptable child labor leads to the following observations: 56% of children from Burkina Faso are involved in unacceptable activity. We call this category "*non-light child labor*". They are respectively 51% and 44% in Mali and Côte d'Ivoire (Table *1*). Globally, it appears that 98% of these children are engaged in activities that violates the ILO standards in Burkina Faso. They are respectively 95% to 93% in Mali and Cote d'Ivoire. Furthermore, a little more than one child in ten who works above this weekly threshold of time is exposed to the worst forms of child labor in Burkina Faso. In Mali and Ivory Coast, this proportion is somewhat higher (nearly two out of ten children).

Table 1 : Distribution of child workers regarding to the form and compliance (in %)

	Burkina Faso	Côte d'Ivoire	Mali
Active non light workers (%)	56.15	43.96	51.42
ILO non-conform	98.76	93.29	95.01
Worst form	13.18	19.97	18.37
Active non light workers by sector (%)			
Agricultural activities	52.51	36.69	46.83
Economic activities	8.94	13.79	12.28
Domestic activities	41.20	36.15	49.26
Worst forms of child labor	13.36	18.57	21.19

▪ *Participation in the sectors of activity*

The child workers are engaged in three (03) major sectors: agricultural activities, economic activities (other than agricultural) and domestic activities (Graph *1*). In Burkina Faso, 92.49% of the surveyed

---

[11] School of Statistics and Applied Economics of Abidjan
[12] The weighting coefficients is used accordingly and the obtained results are externally valid

children engage in agricultural activities; 41.03% are active in domestic activities and a relatively low 15.99% are engaged in economic activities. In Côte d'Ivoire, 73.73 % of children surveyed are active in the agricultural sector. They are 36.15 % that work in domestic activities and 29.70 % in economic activities. In Mali, 89.88 % of children surveyed are active in agricultural activities, 49.26 % to in domestic activities 19.43 % in economic activities. Therefore, the participation in the 3 sectors are not exclusive. We also observe in the data double or even triple participation and thus, suspect some simultaneity and substitution patterns within the 3 sectors.

Graph 1 : Children participation by sector of activity (in%)

■ Agriculture   **■ Domestic**   **■ Economic**
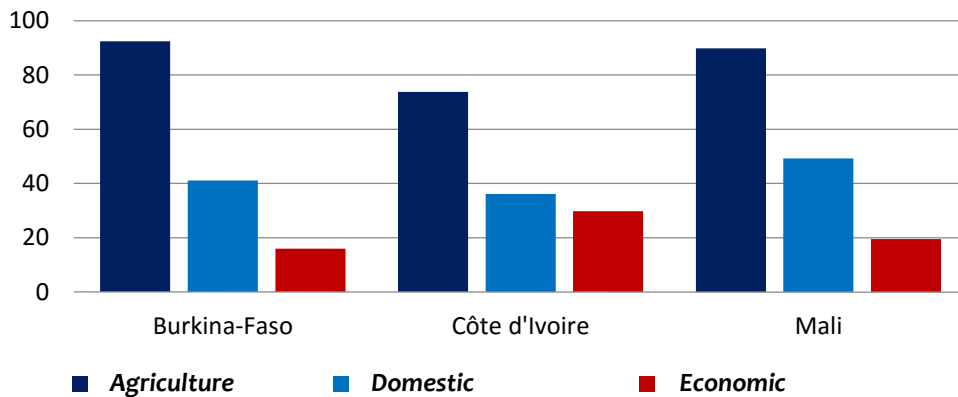
6. **EMPIRICAL STRATEGY**

We develop various explanatory models of labor supply of children, including across the sectors mentioned above (agricultural, economic and domestic). We estimate the substitution or complementarity patterns in order to figure out the interactions between the participation decisions of children to the labor market and the choice of the sector of activity. We also estimate the factors impacting the worst forms of the phenomenon. Throughout all these model, we provide evidences about whether or not the luxury axiom holds in these country.

▪ *Construction of the multidimensional poverty index*

A key variable in our analyses is the poverty level: it is needed in order to test the luxury axiom. Therefore, it need to be constructed. We use a **non-parametric estimation method based on the fuzzy set theory** (Cigno and Rosati, 1990; Zadeh, 1965) to construct a composite index of poverty of the children' respective household. In fact, most methodologies for measuring poverty have a major drawback: they are based on a one-dimension approach, considering the income, and occasionally the expenditures as the only component likely to approximate the level of poverty. However, poverty is a phenomenon with multiple dimensions (Sen, 1982). It would be extremely simplistic to reduce it to its sole monetary component. Moreover, it is very rough to collect reliable data on income of farm households, especially in a context where they have multiple income-generating activities and informal economy dominates. Furthermore, farm households have the particularity to consume a portion of their harvest. Also, the valuation prices of their crops (often for export) fluctuate a lot throughout the year. Given that, we go beyond of a simple accounting of revenue streams and propose a better measurement through the construction of a multivariate index[13], following the deprivation poverty approach[14](Alperin

---

[13] The highest this index is, and more the household is considered to be poor

and Kerm, 2009). We account for five (05) specific dimensions of poverty: the housing, the living standards, the ownership of durable goods or property, the ownership of land assets and the income. Formally, this method requires the definition of two concepts:

(iii) The economic entities or group of all households in the space $E = \{e_1, \dots, e_i, \dots, e_n\}$;

(iv) and a m-dimension vector X representing the socio-economic attributes related to $E : X = \{X_1, \dots, X_j, \dots, X_m\}$.

Consider B (*called fuzzy set*), a subset of E such that every element $e_i \in B$ has a degree of deprivation in at least one of the m attributes included in X. The *membership function* μ_B in the fuzzy set B of the $i - th$ household ($i = \{1, \dots \dots, n\}$) relative to the $j - th$ attribute ($j = \{1, \dots \dots, m\}$) is defined as follows:

$$x_{ij} = \mu_B\left(X_j(a_i)\right)$$

$$with\ 0 \le x_{ij} \le 1$$

(i) with $x_{ij} = 1$ if the $i - th$ household doesn't have the $j - th$ attribute;

(ii) $x_{ij} = 0$ if the $i - th$ household has the $j - th$ attribute;

(iii) and $0 \le x_{ij} \le 1$ if the $i - th$ household has the $j - th$ attribute with an intensity situated between 0 and 1.

The membership function of the $i - th$ household in the set B can be defined as the average weight of x_{ij}.

$$\mu_B(a_i) = \sum_{j=1}^{m} x_{ij}.w_j \left/ \sum_{j=1}^{m} w_j \right.$$

$\mu_B(a_i)$ measures the ratio of poverty of the $i - th$ household, where w_j is the weight attached to the $j - th$ attribute, and where $0 \le \mu_B(a_i) \le 1$. The behavior of the membership function is as follows:

(i) $\mu_B(a_i) = 1$ if a_i is totally devoid of all the m attributes;

(ii) $\mu_B(a_i) = 0$ if a_i has all the m attributes;

(iii) $0 \le \mu_B(a_i) \le 1$ if a_i is totally or partially deprived of some attributes, but not totally stripped of all attributes.

The weight w_j represents the intensity of deprivation linked to the attribute X_j. This is an inverse function of the degree of deprivation in this attribute of the household population. As the number of households deprived of attribute X_j gets small, the weight w_j gets bigger. Cerioli and Zani (1990) defined a weight verifying this property:

$$w_j = log\left\{ \sum_{i=1}^{n} g(a_i) \left/ \sum_{i=1}^{n} x_{ij}.g(a_i) \right. \right\}$$

with $g(a_i)/\sum_{i=1}^{n} g(a_i)$ corresponding to the relative frequency associated with the observation of the sample population a_i. The denominator of the logarithm in the previous equation is always positive. If the value $x_{ij} = 0$, $\forall i$ was part of the group of possibilities, it would mean that there would be no deprivation in X_j. The poverty index of the fuzzy set A is a therefore weighted average of $\mu_B(a_i)$ given by:

---

[14] Measure poverty in several aspects in terms of levels of deprivation.

$$\mu_B = \sum_{i=1}^{n} \mu_B(a_i) . g(a_i) \Big/ \sum_{i=1}^{n} g(a_i)$$

In parallel to the determination of the multidimensional poverty index of the $i - th$ household and that of the overall population, the use of fuzzy set theory also allows the calculation of an index for each j-dimensional attribute considered:

$$\mu_B(X_j) = \sum_{i=1}^{n} x_{ij} . g(a_i) \Big/ \sum_{i=1}^{n} g(a_i)$$

$\mu_B(X_j)$ defines the degree of deprivation of the j-th attribute for the population of n households. The overall fuzzy poverty index can also be defined as a weighted average of one-dimensional for each attribute:

$$\mu_B = \sum_{j=1}^{m} \mu_B(X_j) . w_j \Big/ \sum_{j=1}^{m} w_j$$

- *Estimation of the determinants of child labor: single-sector models*

We estimate the determinants of child labor with a binary choice model, the dependent variable being a dummy expressing whether the child was active or not. The explicative power of the models is prioritized over their unicity across countries[15]. Children's participation in the labor market is a priori assumed to depend on the following groups of exogenous variables: the characteristics of the child, the characteristics of the head of the household, the characteristics of the household and the geographic characteristics[16] (Diallo & Koné, 2001; Dumas, 2005)[17]. The idea is that child labor depends on certain sociological and economic realities. Therefore, we will find the best model possible that explain the phenomenon in each of the countries.

Regarding the formalization of the model, we explain child labor through a discrete choice model where children (or their parents) choose to work (make children work) or not. Considering Y_j the endogenous variable indicating whether the child works or not, the representation for each of the three (03) countries takes the following form:

$$(S_1) \ Y_j = \ 1 \text{ if the child works;}$$
$$0 \text{ otherwise}$$

The purpose is to explain $\mathbb{E}[Y_j]$ by a set of variables or factors related to the child, the family environment to which he or she belongs, the head of household from which he or she relates and finally the geographical localization. To do this, the latent variables approach is used (Long, 1997). The variable of interest Y_j (observable) depends on an unobservable variable (latent variable) Y_j^* which is directly linked a priori to all the above mentioned covariates (vector X_j). The new specification is therefore:

---

[15] We check the adequacy of the respective models through Hosmer & Lemeshow test and the Pregibon's Linktest

[16] We construct a variable that captures the migration patterns. It is derived from the survey strata. These latter strata have been established on the basis of the intensity of the phenomenon of emigration to Ghana and Côte d'Ivoire (case of Burkina Faso and Mali) and the intensity of cocoa production (in Cote d 'Ivory)

[17] With some new variables including the school enrollment status of the child, the perception of the child of the schooling in terms of expected future earnings, the presence status of parents and the mode of decision making on the household finances

$$(S_2) \ Y_j = \ 1 \text{ if } Y_j^* > 0$$
$$0 \text{ otherwise}$$
$$\text{with } Y_j^* = \ \beta'X_j + \in_j$$

(i) β is a vector of unknown parameters to be estimated;

(ii) $\in_j$ is the error term that includes possible measurement, samplings and specification errors (Green, 2002). These errors are assumed to be identically and independently distributed, according to the logistic distribution (in the three countries).

The link existing between Y_j and $\beta'X_j$ is thus given by: $P = \ E(Y_j = 1|X_j) = \ \Phi(\beta'X_j)$, where Φ is the logistic cumulative distribution function. β is estimated following the **Control Function (CF) approach** in order to account for the endogeneity of the poverty index and the income variable[18].

- *Estimation of the decisions of child activities participation: the multi-sectors models*

The children surveyed in this study basically work in the agricultural, economic or domestic sectors. Sometimes, they have been or are still active in two or even the three sectors. Also, it is important to explore not only the supply of labor in each of the specific sector, but also to grasp the interrelations between decisions of participation amongst them. Estimating a separate logistic model for each of the sector doesn't allow to capture these interrelations and can be misleading since their respective error terms could well be correlated because of the potential presence of simultaneity of supply decisions across sectors. To account for this simultaneity which induces endogeneity risks (Wolff, 2004; Wooldridge, 2002), we use the Simulated Maximum Likelihood (SML) procedure.

We opt for a **multivariate probit model with dummy endogenous**. The model solves possible problems related to the endogeneity of choice of participation through **heckman corrections** and the use of **instruments for the income** (weather shocks), and also solves for the violation of the assumption of independence of irrelevant alternatives. It determines the probabilities of undertaking an agricultural activity, an economic activity or a domestic activity while taking into account the interdependence of the participation choices, the simultaneity of working time allocation decisions and the possibilities for double or triple participations. Formally, we consider for each of the three countries, three simultaneous binary probit model, each equation accounting for a specific sector. The decision to allocate time to one or other of these activities depends on several factors such as generally defined in the single-sector model. Let Y_{im} the (observable) binary variable of interest indicating the participation or not of the child i to the activity m. We obtain the following system:

$$(S_3) \ Y_{im} = \ 1 \ if \ the \ child \ works \ in \ the \ activity \ m$$

$$0 \ otherwise \ with \ m = \{1,2,3\}$$

(i) $i = \{1,2,3, \dots, N\}$

(ii) $N = $ number of children

(iii) $m = 1$ for agricultural activities

(iv) $m = 2$ for economic (other than agricultural) activities

(v) $m = 3$ for domestic activities

---

[18] We will get an exogenous variation of the income by instrumenting with the local weather shock (approximated by the variable "amount of rain in the past 12 months")

Each variable of interest Y_{im} depends on an unobservable variable Y_{im}^* (latent variable) directly related to the exogenous variables. The new specification is as follows:

$$(S_4)\ Y_{im} = \ 1\ if\ Y_{im}^* > 0$$

$$0\ otherwise$$

$$\text{with } Y_{im}^* = \ \beta'_m X_{im} + \in_{im,}\ m = 1, \dots, 3.$$

(i)   The $\in_{im}$, $m = 1, \dots, 3$ are the residuals of the equations expressing the participation (or not) to the three activities for individual i. They include possible measurement, samplings and specification errors. These errors are jointly distributed according to a tri-variate normal distribution with parameters zero (mean) and Σ (variance-covariance matrix);

(ii)   Σ is a symmetric $3x3$ matrix with value *1* on its main diagonal, and off the diagonal, the correlation coefficients between the error terms of the different equations estimated. These coefficients are significantly different from zero if decisions between participating to 2 sectors are interdependent and their sign gives us an idea about the substitution patterns;

(iii) X_{im} are the vectors containing the explanatory variables for the participation choice of children in each activity. These variables are not necessarily the same for each sector. Indeed, only the significant variables and or those enhancing the overall significance of the single-sector model as well as those enhancing the consistency of the model are considered. They are generally related to the child, to his or her household and to his or her location.

The resolution of the system S_2 (of three equations) is conducted through the maximization of the likelihood function. This maximization is done through simulations of multivariate normal distributions. This study opts for the Geweke-Hajivassiliou-Keane (GHK) simulator programmed by Cappellari and Jenkins (2003)[19]. The principle of GHK simulator is based on the possibility to express the density function of a multivariate normal distribution as a sequential product of conditional normal univariate probabilities. In our case (three dependent variables), we gets eight (08) joint probabilities (2^3 possibilities) corresponding to the different possible combinations of "success" ($Y_{im} = 1$) and "failure" ($Y_{im} = 0$) for the participation in the three activities whose choice probabilities have to be estimated. Indeed, the combination of three (03) possible working time allocation by children generates seven (07) possible strategies and an additional outside option which is not to engage in any of these three (03) activities ("idle" or "normal" children).

Thus we need to compute eight (08) **predicted (joint) probabilities[20]** which contribute to the likelihood function. We also estimate the **marginal probabilities**[21] of participation as well as the **conditional probabilities**[22]. It is worth noting that the obtained results are somehow sensitive to the number of random samples (random draws) used in the calculation of the simulated likelihood function. This number must at least be equal to the square root of the size of the sample of study (Cappellari & Jenkins, 2003). We then do the simulations with fifty (50) random draws for three (03) countries model.

---

[19] Another advantage is that it also treats the endogeneity of regressors

[20] Joint (single, double or triple participation) probabilities as well as outside option probability

[21] Probabilities of participation in each of the sectors

[22] Conditioned on the sectors

▪ *Variables of influences on the worst forms of child labor*

The purpose of this section is to identify, based on the typology of child labor presented in the conceptual framework, the influential factors of the worst forms of child labor within the group of non-light child laborer. We cannot use a simple sequential logit model due to the endogeneity problems (income variable). We use a **sequential logistic model** following BLP[23] approach for mixed logit models.

7. CONCLUSION

The theoretical framework of this model can be improved with data on the remuneration of children[24] and by also integrating the intensity of work (number of hours) into the models. Therefore, we can construct a structural model of labor supply, and also estimate the welfare function within the household (via the indirect utility function) under the scope of the intra-household bargaining model (Basu, 1998). We can then perform some interesting counterfactuals analyses by looking at the effect of some exogenous shocks such as prices, income, school proximity and weather. This latter exercise will be determinant for identifying the key conjectural and structural factors impacting child labor in these 3 countries. Overall, the study will permit a better understanding of the phenomenon in connection with the migration patterns among the 3 countries and will therefore lead to holistic and targeted policy recommendations.

8. BIBLIOGRAPHY

Baland, J. & Robinson, J. (2000). "Is child labor inefficient?", *Journal of Political Economy*, 108, 663–679.

Bar, T. and Basu, K. (2009). "Children, education, labor, and land: in the long run and short run", *Journal of the European Economic Association*, vol. 7, 487–497.

Basu, K. and Van, H. (1998). "The Economics of child labor", *American Economic Review*, vol. 88, 412-27.

Basu, K. (1999). "Child labor: cause, consequence, and cure, with remarks on international labor standards", *Journal of Economic Literature*, Vol. 37, No 3, pp. 1083 - 1119.

Cappellari, L. & Jenkins, P. (2003). "Multivariate probit regression using simulated maximum likelihood", *The Stata Journal*, Number 3, pp. 278 - 294.

Diallo, Y. and Koné, S. (2001). "Pauvreté des ménages et phénomène du travail des enfants en Côte d'Ivoire", *Working Paper*, Université Montesquieu-Bordeaux IV.

Gourieroux, C. (1989). "Econométrie des variables qualitatives", 2ᵉ édition, Collection: *Economie et statistiques avancées (Economica)*, ENSAE, pp. 56 - 76.

Greene, W. (2002). "Econometric Analysis", 5st ed., *Englewood Cliffs*, N.J.: Prentice Hall.

ILO, (2010). "Intensifier la lutte contre le travail des enfants", Conférence international du travail, *Rapport I(B), Bureau International du Travail*, Genève.

Long, S. (1997). "Regression Models for Categorical and Limited Dependent Variables", *Thousand Oaks*.

Rosenzweig, M. (1980). "Neoclassical theory and optimizing peasant: an econometric analysis of market family labour supply in a developing country", *Quarterly Journal of Economics*, pp. 37 – 55.

---

[23] We are not quite sure whether this fit in this case.

[24] At the cost of excluding the domestic sector (but we can get the data)