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**CHILD LABOR IN AGRICULTURAL HOUSEHOLDS IN BURKINA  
FASO, IVORY COAST AND MALI: TEST OF THE LUXURY AXIOM A  
FUZZY SETS THEORY APPROACH<sup>1</sup>**

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## Abstract

This study highlights the role of poverty factor in the explanation of child labor, by taking the work of Basu & Van (1999) as a theoretical basis. Thus, besides the search for the determinants of child labor by a multivariate approach, it tests the hypothesis of the luxury axiom which link child labor to the household poverty and vulnerability levels.

As main results, it appears that poverty plays a significant role in Ivory Coast, while Burkina Faso and Mali are characterized much more by the impact of the cultural factors. Otherwise, it appears that in Ivory Coast, household poverty is particularly relevant to the agricultural activities. Some elements of recommendations to both the national or international stakeholders, for an effective fight against the child labor under these unacceptable forms have been proposed.

**Keywords:** Harkin & Engel protocol, multivariate probit, logistic model, sequential model, multidimensional poverty index.

## 1. PROBLEM

Sub-Saharan Africa (SSA) where strong population growth is coupled to a low level of income (UNDP, 2009), undergoes a clearly social pressure in favor of the use of child labor. The explanations come from the inefficiencies of the educational policies, and mostly from the persistence of poverty (Lachaud, 2004). In Burkina Faso, Côte d'Ivoire and Mali, there is a large part of the populations in extreme poverty especially in the agricultural community<sup>2</sup>. This situation favors the use of children who contribute to the family income (Kanhur and Grootaert, 1995) by working in the farm, making informal activities or, by stay at home, and then, to permit to the parents to have a much time to spend with their income-generating activities. Thus, with an economic context marked by the disastrous consequences of structural adjustment policies of the 1980s and 1990s, the absence of social protection (ILO, 2003) is more or less offset by the income from child labor which partially reducing the insecurity of farm households. Recognizing this, it seems imperative to study more deeply, and with objective criteria, the influence of poverty on the phenomenon of child labor inside the agricultural households, whatever the sector of activities considered. Furthermore, this study will highlight in these three (03) countries, the links which is more or less traditionally established between poverty and child labor<sup>3</sup>.

## 2. THE THEORETICAL LINK BETWEEN POVERTY AND CHILD LABOUR

Contemporary theoretical analyzes were first performed as part of a model of household behavior. The "bargaining" models, developed with this in mind, take into consideration the fact that the household is not necessarily managed by a "benevolent dictator" and distinguish analysis fields within and outside the household, in terms of negotiations that occur between parents and children on the one hand, and between parents and employers, on the other. In the first case, where parents are altruistic (intra-household bargaining), they show that the supply

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<sup>2</sup> See Human Development Report, UNDP, 2009

<sup>3</sup> Verification of the hypothesis of the axiom of luxury: Basu & Van, 1998)

of child labor depends on adult wages and number of children within the labor market (Basu, 1999). By cons, in the second case (extra-household bargaining), if the adult wage is also related to the children wage (Gupta, 1998), parents do not care about the welfare of their children. The existence of multiple equilibriums (when children are potential workers) on the labor market is a possibility underestimated by previous approaches. This limit leads Basu and Van (1998) to propose a model explicitly incorporating issues of poverty, through two assumptions: the "luxury axiom" and the "substitution axiom". The first axiom states that children's participation in the labor market occurs only if the household standard of living is lower than a critical threshold. Thus, in a poor household, a child may be released from some work to school just if its related household is able to support himself without his contribution. In other words, it appears that the leisure of children, their schooling and, more generally, their "no-work" situation are luxury goods in the consumption basket of poor households: he could not simply avoid consuming such kind of goods. In this analysis, child labor becomes a necessary evil. Children's status changes according to the variation of their family income. They are sometimes on the labor market, and some other times their time is spent for leisure and/or education. On the other hand, the "substitution axiom" indicates relative equivalence, between the adults work and the children one, which increases the possibility of using child labor. Therefore, children's participation in the labor market depends on the poverty level of their household.

### 3. CONCEPT NOTE OF THE RESEARCH

Any study on child labor cannot be done without taking a position on a prior definition of the concept of "child laborer". On the one hand, this need for choice of definition is related to the multiplicity as well as the complexity of national and international standards governing child labor. The 138th<sup>4</sup> and 182nd<sup>5</sup> ILO conventions establishing the limits of acceptable of unacceptable kind will serve as a reference. On the other hand, it is also a concern for the best representations of local realities (holistic approach). In this particular way, this study proposes a new approach regarding in particular the treatment of domestic work. Indeed, it proposes an approach to solve limits of the ILO<sup>6</sup> definition of domestic which does not capture the true extent of the socioeconomic context of the countries covered by the current study. This definition seems quite restrictive because it ignores the children involved in domestic work in their own households in sometimes similar way regarding to those who are involved in a real domestic job. To overcome this, it will be applied any provision of Convention No. 138 which sets a threshold legal weekly working of 14 hours, beyond which the notion of mild work should no longer prevail. Also, any child who carries on domestic activities for his own parents, beyond a threshold of 14 weekly hours shall be regarded as a worker. Consideration of this form of household work is justified by the constraints of this type of work on schooling of children, and also by disguised employment form it can sometimes hides, and which leads to under-estimate the true level of child labor.

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<sup>4</sup> On minimum age at work (1973)

<sup>5</sup> On the worst forms of child Labour: by ratifying this convention signed in 1999, States undertake to adopt immediate measures to prohibit and eliminate the worst forms of child labor.

<sup>6</sup> ILO defines domestic work (for child) as that carry on by a child for an employer

#### 4. RESEARCH METHODOLOGY

The data used for this study come from a series of surveys on agricultural households, commissioned by the

U.S. Department of Labor, overseen by the University of Tulane (Louisiana) and supervised by ENSEA. These surveys took place in 2009 and cover three (03) Countries: Burkina Faso, Côte d'Ivoire and Mali. Data were collected on the basis of a poll in two degrees; the primary unit being the enumeration area (Burkina, Mali) or enumeration district (Cote d'Ivoire) and the secondary unity, the agricultural households<sup>7</sup>. This study focus on a sample of 719 (Burkina Faso), 1458 (Ivory Coast) and 741 (Mali) children aged 10 to 17 years of age.

To achieve the different targets, some methods and analysis tools will be used: descriptive statistics and econometric modeling. Descriptive statistics will allow, by frequency tables, to draw up a typology of child labor, regarding the conceptual framework of this study, before permit a clear distinction between child labor in terms of its acceptable and unacceptable forms. It will be estimated at this level, on the interest variables, with bootstrap methods<sup>8</sup>, the central tendency and dispersion characteristics. These methods will also be used for the independence, linkage and proportion tests<sup>9</sup>. The econometric analysis will develop explanatory models of labor supply of children, highlighting the role of poverty factor. They will also take into account the interactions between the participation decisions to work of the child (Cigno and Rosati, 2005), those which concern the choice of the sector of activity (Dumas, 2006) and those related to economic survival of their household (taking into consideration the poverty factor, Kerm & Alperin, 2009).

- *Construction of the multidimensional index of poverty*

To build the different models mentioned above, and even for the purposes of descriptive analysis, it will be considered a particular variable analysis: a composite index of overall poverty level of households in which children live. A new methodological approach developed by Cigno and Rosati (1990) will be used: the method of calculation of multidimensional privative poverty index based on fuzzy set theory (Zadeh, 1965).

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 pick 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 dimension. Moreover, it is very rough to collect reliable data on income of farm households, especially in a context marked by a multiplicity of income-generating activities and domination of the informal economy. Otherwise, farm households have the particularity to consume a portion of their harvest, and in addition, the valuation prices of their crops (often for export) fluctuate a lot throughout the year. For all these reasons, this study aims, through the construction of a multivariate index, to test the influence of an aggregated and integrated poverty index on children's participation in the workforce, thus going beyond of a simple accounting of revenue streams. This index will be built on the basis of the work of Pi Alperin

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<sup>7</sup> See the study report of Tulane University for details on the methodology (references in annex).

<sup>8</sup> Jack Knife method, for the sake of robustness

<sup>9</sup> The procedure of Marasuilo will be preferred: differences in proportions lead to a dependency relationship

and Van Kerm (2009) who, through an application of fuzzy set theory, measure poverty in several aspects in terms of levels of deprivation<sup>10</sup>, in Luxembourg. These aspects may well result, each one, a specific dimension of poverty. In this study, they are five (05) dimensions: Housing; living standards; ownership of durable property; income and possession of land assets.

Formally, this method requires the definition of two concepts: (i) economic entities or the group of all households in an economic space  $E = \{e_1, \dots, e_i, \dots, e_n\}$ ; and (ii) a  $m$  dimension vector representing the socio-economic attributes related to the level of  $E$  :  $X = \{X_1, \dots, X_j, \dots, X_m\}$ . Considering  $B$ , a subset of  $A$  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 in the fuzzy set  $B$  of the  $i$ -th household ( $i = 1, \dots, n$ ) relative to the  $j$ -th attribute ( $j = 1, \dots, m$ ) is defined as follows:

$$x_{ij} = \mu_B(X_j(a_i)), 0 \leq x_{ij} \leq 1 \quad (1)$$

We have:  $x_{ij} = 1$  if the  $i$ -th household hasn't the  $j$ -th attribute;  $x_{ij} = 0$  if the  $i$ -th household has the  $j$ -th attribute;  $0 \leq x_{ij} \leq 1$  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 fuzzy set  $B$  can be defined as the average weight of  $x_{ij}$ .

$$\mu_B(a_i) = \sum_{j=1}^m x_{ij} \cdot w_j / \sum_{j=1}^m w_j \quad (2)$$

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

$\mu_B(a_i) = 1$  if  $a_i$  is totally devoid of all the  $m$  attributes;  $\mu_B(a_i) = 0$  if  $a_i$  has all the  $m$  attributes;  $0 \leq \mu_B(a_i) \leq 1$  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  $X_j$  is small, and the weight  $w_j$  will be great. Cerioli and Zani (1990) defined a weight verifying this property, namely:

$$w_j = \log\left\{\frac{\sum_{i=1}^n g(a_i)}{\sum_{i=1}^n x_{ij} \cdot g(a_i)}\right\} \quad (3)$$

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 weighted average of  $\mu_B(a_i)$  given by:

$$\mu_B = \sum_{i=1}^n \mu_B(a_i) \cdot g(a_i) / \sum_{i=1}^n g(a_i) \quad (3)$$

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 attributes considered:

$$\mu_B(X_j) = \sum_{i=1}^n x_{ij} \cdot g(a_i) / \sum_{i=1}^n g(a_i) \quad (4)$$

<sup>10</sup> The highest this index is, and more the household will be considered like poor.

$\mu_B(X_j)$  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:

$$\mu_B = \sum_{j=1}^m \mu_B(X_j) \cdot w_j / \sum_{j=1}^m w_j \quad (5)$$

Analysis of the results obtained in (6), for  $j = 1, \dots, m$ , provides an opportunity for decision makers to identify the causes of poverty and respond structurally to reduce it.

- *Determinants of Child Labour : the global models*

Explanatory factors of child labor will be estimated following binary logistic models to be applied to dichotomous variables constructed for this purpose, and indicating for each of the three (03) countries, if the child was active or not during the twelve (12) months preceding the survey. Hausman tests will permit to choose the appropriate form of distribution of the errors, and the sidelining of outliers, influential, atypical or high power will get the most efficient model possible. It will be also conducted tests for heteroscedasticity as well as tests of multi collinearity among the explanatory variables. If necessary, adjustments will be made using appropriate statistical procedures. From a formal point of view, child labor is explained by a discrete choice model where children (or their parents) choose to work (to make them work) or not. Considering endogenous variable indicating whether the child works or not, the representation from each of three (03) countries will have the following form:

$$(S_1) Y_j = 1 \text{ si l'enfant travaille ; } 0 \text{ sinon } (6)$$

The purpose is to explain  $E[Y_j]$  by a set of variables or factors related to the child, family environment to which it belongs, to the household head from which it originates and to the geographical localization. To do this, the approach by the method of latent variables will be privileged (Rakotomalala, 2009). So, each variable of interest (observable) depends on an unobservable variable (latent variable) directly linked a priori to all the above variables. The new obtained specification is:

$$(S_2) Y_j = \begin{cases} 1 \text{ si } Y_j^* > 0 \\ 0 \text{ sinon} \end{cases} \text{ avec } Y_j^* = \beta'X_j + \epsilon_j \quad (7)$$

where  $\beta$  is a vector, whose parameters were unknown, and will be afterward esteemed.  $\epsilon_j$  is the error term that includes possible errors of measure, samplings and specification (Green, 2002). These errors are supposed identically and independently distributed, according to a logistic law (for the three countries)<sup>11</sup>. The  $X_j$  are vectors containing the explanatory variables of the child labor. 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  $\Phi$  is the distribution function of a logistic law. The estimation will be made by the MLE procedure: the maximization of the likelihood function.

- *Estimate of decisions of child activities participation: the specific models*

The estimated participation decisions of child workers in agriculture, other economic and domestic agriculture can be done in two (02) approaches: an integrated approach

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<sup>11</sup> The choice of the shape of distribution adapted to the data available was made by Hausman test at 5%. For Burkina Faso and Mali, the difference between the logit and probit model is not significant. The choice was therefore focused on the logit because of its ease of interpretation. For the case of Côte d'Ivoire, the test reveals a significant difference between the two (02) models. A comparative analysis in terms of information criteria allowed selecting a posteriori the logit model.

(simultaneous estimations) and an independent approach (separate estimations). This latter approach seems unrealistic (Dumas, 2005), because it implies (by assumption) that these decisions are independent (which is somewhat unlikely). The present study will thus opt for a simultaneous equations model. This model will determine the probabilities of making an agricultural activity, an economic or domestic activity, by taking into account the interdependence of the choice of participation, the simultaneity of decisions on allocation of the working time of the children and the possibilities of double or triple participations.

In doing so, the probable correlations between the residuals of the equations, if they had been estimated according to the first approach, will be corrected. The procedure of Cappellari and Jenkins (2003) will be followed to build a multivariate probit model. This procedure will serve as the main estimation tool and some computer programs based on *mdraw* simulations (Cappellari & Jenkins, 2003) will permit to calculate these different probabilities which are not available automatically<sup>12</sup>. The choice of explanatory variables will be based on the main works dealing with this issue and the overall model presented above (global model). This model will solve possible problems related to the endogeneity of choice of participation as well as the violation of the assumption of independence of irrelevant alternatives.

Formally, it will be considered simultaneously, three (03) binary probit for each of the three (03) countries under study. The decision to allocate time to one or other of these activities will depend on several factors such as generally defined in the global model of the determinants of child labor (see previous model). Let  $Y_{im}$  observable variable interest (binary) indicating the participation or not of the child  $i$  to the activity  $m$ . The following system of equations is obtained:

$$(S_1) Y_{im} = 1 \text{ si l'enfant participe à l'activité } m ; 0 \text{ sinon, avec } m = \{1,2,3\} \quad (8)$$

Remark:  $i = \{1,2,3, \dots, N\}$  with  $N =$  number of children,  $m = 1 \rightarrow$  Agricultural activities;  $m = 2 \rightarrow$  Economic activities other than farming;  $m = 3 \rightarrow$  Domestic activities. Each variable of interest  $Y_{im}$  depends on a variable  $Y_{im}^*$  unobservable (latent variable) directly related to the exogenous variables corresponding, a priori, to those of the global model.

The new specification provides as follows:

$$(S_2) Y_{im} = \begin{cases} 1 & \text{si } Y_{im}^* > 0 \\ 0 & \text{sinon} \end{cases} \text{ avec } Y_{im}^* = \beta'_m X_{im} + \epsilon_{im}, \quad m = 1, \dots, 3. \quad (9)$$

The  $\epsilon_{im}, m = 1, \dots, 3$  are the residuals of equations expressing the participation (or not) to the three activities for individual  $i$ . They include possible errors of measure, samplings and specification. These errors are jointly distributed according to a trivariate normal distribution with zero (mean) and variance-covariance matrix  $\Sigma : \epsilon_{im}, m = 1, \dots, 3 \rightarrow \mathcal{N}(0, \Sigma)$ .  $\Sigma$  is a symmetric matrix ( $3 \times 3$ ) with the value 1 on its main diagonal, and elsewhere, the correlation coefficients between error terms of the different equations estimated. In case of independence of these decisions, these coefficients are zero. By cons, they are significantly different from zero if such decisions are interdependent.  $X_{im}$  are the vectors containing the explanatory variables of choice for children's participation in each activity. These variables are not necessarily the same for all three (03) sectors. Indeed, only the significant variables and / or enhance the overall significance of the global model presented in the previous section were considered. The criterion of contribution to the consistency of the model was also selected in

<sup>12</sup> This procedure (on Stata) is recent and still incomplete. It requires some additional programming effort



the choice of these variables. They are generally related to the child, the householder or geographic characteristics.

The simulation method of maximum likelihood (SML) is adopted. This maximization is done by a method of simulating multivariate normal distributions. This study will opt for the Geweke-Hajivassiliou-Keane simulator (GHK), programmed by Cappellari and Jenkins (2003)<sup>13</sup>. Note that the results are dependent on the number of simulations (Random Draws) used for calculating the simulated likelihood function. This number must be at least equal to the square root of the sample size studied (Cappellari & Jenkins, 2003). In this way, a choice of fifty (50) random draws for the three (03) countries covered by this study will provide a reliable estimate of the parameters.

## 5. TYPOLOGY OF THE CHILD WORK

In view of the conceptual framework, a classification of the population of working children based on the criteria of age, arduous and labor intensity, according to ILO standards<sup>14</sup>, can be proposed. Scrupulous compliance with all standards for these criteria allows discovering a well hidden fact: almost all of the three active children in the three countries are active in unacceptable forms of work (worst form included). They work in violation of international standards as defined by the ILO (see Table 1). Indeed, they are only 4.89% and 4.27% to carry out work to these standards, respectively in Côte d'Ivoire and Mali. The proportion is even lower in Burkina Faso where only 1.01% of active children works said in conditions that respect international standards. So, Burkina Faso is the one where the rate of unacceptable work is highest. These three ratios are significantly different from one country to another (p-value zero at the 5%).

*Table 1 : Distribution of children according to active compliance with ILO standards (proportions in %)*

<b>Population concerned: active children</b>						
<b>Country</b>	<b>Burkina</b>		<b>Côte</b>		<b>Mali</b>	
<b>Total children aged 10 to 17</b>	719		1458		741	
<i>Consistent with ILO standards (numbers / frequencies)</i>	7	1,01	60	4,89	30	4,27
<i>Non-conformity with ILO standards (numbers /</i>	689	98,99	1	95,1	67	95,7
<b>Distribution in relation to gender non-conforming</b>						
Boys	57,18		55,57		63,15	
Girls	42,82		44,43		36,85	

Source: TULANE-ENSEA, 2009, *Surveys on living conditions and migration of children*.

Fisher's exact test permit to conclude a link between the country and the rate of compliance with ILO standards. It highlights a difference in situations between these three (03) countries. The results of proportions test following the Marascuilo procedure confirm, moreover, significant differences between proportions of these countries in the working child population according to ILO standards. However, in populations of children working in conditions that violate international standards, there is a equality between the proportions of Burkina Faso and Mali, and the differences in proportions appears particularly between Burkina Faso and

<sup>13</sup> Mvprobit program (See Borsch et al., 1992, Borsch & Hajivassiliou, 1993, Keane, 1994, and Hajivassiliou & Ruud, 1994.

<sup>14</sup> Refer to the definitions of acceptable and unacceptable work in the concept note of the study

Ivory Coast on one hand, and between Mali and Côte d'Ivoire on the other one. In addition, in this population working in breach of standards set by the ILO, the male children are the majority.

### Inter-country sectorial analysis

A sectorial analysis shows, moreover, that all sectors studied are affected with approximately the same extent by the non-compliance (see Table 2), within the three (03) country of study. However, it appears that Mali seems relatively less affected by this non-compliance in the sector of agriculture. Ivorian children (92.84%) and Mali (94.44%) also seem relatively less affected by this non-compliance in the sector of economic activity compared to children from Burkina Faso (98.26%). Finally, the rate of non-compliance of child labor in the domestic activities is relatively low in Ivory Coast (92.41%) than that of Mali (94.79%) and Burkina Faso (98.98%). Independence Tests revealed an influence of country of origin on the rate of participation in child labor in the fields of agricultural and domestic activities. However, they conclude that there is a few impact of the country concerned about the prevalence of child labor in the domestic activities (p-value of Fisher test equal to 0.077 with a Cramer's V of 0.0836).

**Table 2** : Distribution of children by type of activities and compliance of their employment (%)

Country	Burkina Faso	Côte d'Ivoire	Mali
<b>Children engaged in agriculture</b>			
Proportion	92,49	73,73	89,88
Compliance	0,45	0,37	3,15
Non-conformity	99,55	99,63	96,85
<b>Children engaged in the economic sector other than agriculture</b>			
Proportion	15,99	29,70	19,43
Compliance	1,74	7,16	5,56
Non-conformity	98,26	92,84	94,44
<b>Children engaged in domestic activities</b>			
Proportion	41,03	36,15	49,26
Compliance	1,02	7,59	5,21
Non-conformity	98,98	92,41	94,79

Source: TULANE-ENSEA, 2009, *Surveys on living conditions and migration of children*.

### Integrating the time criteria

The application of Convention No. 138 concerning the acceptable threshold of time permits to adjust the previous results. Under consideration of all criteria considered (weekly time threshold, dangerousness, worst forms: Convention No. 138, 182 and 190), it appears that 56% of children from Burkina Faso are involved in unacceptable activity. They are respectively 51% and 44% in Mali and Côte d'Ivoire (see Table 3).

**Table 3** : Distribution of child workers regarding to the form (mild or not) and compliance (in %)

	Burkina Faso	Côte d'Ivoire	Mali
<b>Active non mild workers (%)</b>	56,15	43,96	51,42
ILO non-conforming proportion	98,76	93,29	95,01
Worst form proportion	13,18	19,97	18,37
<b>Active non mild workers by sector (%)</b>			
Agricultural activities	52,51	36,69	46,83

Economic activities	8,94	13,79	12,28
Domestic activities	41,20	36,15	49,26

Source: TULANE-ENSEA, 2009, *Surveys on living conditions and migration of children*.

Globally, it appears that the same proportion of non-compliance is found in children working more than 14 hours per week. Indeed, it is 98% of these children who engage in activity that violates the ILO standards. They are 95% to 93% in Mali and Ivory Coast. Otherwise, a little more than one child in ten workers 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).

## 6. ESTIMATION RESULTS

### ▪ Interpretation of the multidimensional index of privation poverty<sup>15</sup>

In Ivory Coast, the average level of poverty deprivation is 0.3746. It is equal to 0.3080 and 0.2830, respectively in Burkina Faso and Mali. Ivorian farm households are, in average, poorer than Burkinabe and Malian households; Malian households are on average, relatively less poor. This poverty of Ivorian households is explained by a strong presence of immigrants from neighboring countries (Burkina, Mali, Niger), the difficult living conditions and their vulnerability (volatility of their income). From the perspective of the different dimensions, it is the non-possession of land assets that contributes most to poverty of farm households. Owning their own land can be decisive in the economic status of the farm household. Next is the dimension related to the income. That related to durable goods possession is in the 3rd position in the Ivory Coast and Mali, while in Burkina Faso it is the housing aspect that contributes to the third place to the welfare of households. The dimension of housing facilities is one that contributes the least to determine the poverty status of farm households.

- **The determinants of children participation to work (refer annex appendix, global model) (see ANNEXES**
- *Tableau 4: Estimations results table (multidimensional poverty index: by fuzzy set theory)*

Note: IPU: unidimensional Poverty Index	Burkina Faso		Côte d'Ivoire		Mali	
	IPU	Contributio	IPU	Contributio	IPU	Contributio
<b>Dimension 1: Value of dwelling</b>						
Types of accommodation	0,765	3,10	0,310	4,47	0,777	2,76
Ownership status	0,117	3,81	0,151	3,51	0,037	1,74
Amount of rent	0,318	5,53	0,535	4,12	0,462	5,04
Number of bedrooms	0,483	5,53	0,519	4,19	0,499	4,90
<b>Dimension 2: Life amenities</b>						
Source water	0,444	3,52	0,496	3,85	0,677	2,21
Source of energy for cooking	0,010	0,46	0,043	1,50	0,000	0,04
Light source	0,286	3,50	0,375	4,07	0,437	3,03
<b>Dimension 3: Possession of durable goods</b>						
Possession of radio	0,260	5,76	0,269	5,66	0,150	4,57
Possession of a television	0,955	0,72	0,654	4,44	0,874	1,88
Possession of a Phone	0,666	4,45	0,730	3,67	0,657	4,42

<sup>15</sup> This is an index of deprivation. Stronger it is, and the household will be considered poor.

Possession of a refrigerator	0,993	0,11	0,897	1,55	0,994	0,09
Possession of a transportation	0,117	4,13	0,307	5,80	0,140	4,42
<b>Dimension 4: Income</b>						
Annual income	0,508	9,40	0,558	8,33	0,549	9,04
Sales revenues cotton / cocoa	0,383	10,04	0,386	9,41	0,267	9,69
Revenues of economic activities	0,476	9,65	0,575	8,14	0,520	9,34
<b>Dimension 5: Possession of property assets</b>						
Amount of land owned	0,441	15,57	0,493	13,89	0,504	18,76
Area of cultivated land	0,502	14,91	0,531	13,40	0,540	18,07
<b>Total (%)</b>		100		100		100
<b>Dimension 1: Value of dwelling</b>	0,273	17,77	0,304	16,28	0,204	14,44
<b>Dimension 2: Life amenities</b>	0,115	7,49	0,176	9,42	0,074	5,28
<b>Dimension 3: Possession of durable goods</b>	0,233	15,16	0,295	21,12	0,217	15,38
<b>Dimension 4: Income</b>	0,448	29,10	0,484	25,89	0,397	28,06
<b>Dimension 5: Possession of property</b>	0,469	30,48	0,511	27,29	0,521	36,83
<b>Aggregate (average) deprivation</b>		0,3080		0,3746		0,2830

▪ *Tableau 5)*

Within three (03) countries covered by the study, child labor does not depend on the nationality of these, or their place of birth or even the relationship of these with the head household. The lack of significance of the relationship shows that the argument that participation in socio-economic activities of the household is one of the main reasons for children's mobility does not fit in the context of the surveyed households. Indeed, the fact of being a biological child of the household head, or then, to be a child "confided" or related to the household will not affect the propensity of children to participate in the workforce. Furthermore, the perception that children have the usefulness of the school does not seem to affect significantly in their propensity to work or not. This can be explained by the fact that the decision to work and / or going to school is not their job, in general, but belongs to their parents who may have other concerns (such as financial gains in the short term). In addition, competition does not seem to put in the work and schooling decisions since children often associate with little difficulty, these two occupations. Furthermore, household size is not significant (even at 10%) in explaining the phenomenon, contrary to the structure of these that seems more appropriate to understand what can bring a child in a family or household to engage in an activity. This confirms the spillovers ("trickle-down effect") postulated by strategic models, and are thus due to the composition of households. In addition, the method of financial decision in the households surveyed did not play any role in the propensity of children to work. This can be explained by the fact that, even though the person taking these types of decisions may differ from one household to another, the motivation behind it is often the same: to maximize household income. Furthermore, it seems that the sex of the household head as well as its academic level are not decisive in explaining the phenomenon of child labor. Moreover, the strong representation of men in the subpopulation of household heads can understand why the sex of the household head does not play a major role. Within three (03) countries studied, the variables explaining the propensity of children to work are related to the child's age, sex and status of education, structure and level of poverty of the household membership as well as the presence status of his parents, occupation status of household head and its geographical location. In fact, even if these variables explain the general phenomenon of child labor in three (03) countries, it should be noted that the specificities remain a country

to another. In Burkina Faso, the household structure, the presence status of parents, the occupation status of head of household and geographic characteristics influence the probability of child labor. In Mali, the sex of the child would be a factor. In addition, the household structure, the presence status of parents, but also, and unlike in Burkina Faso, the status of schooling are concerned. Regarding the case of Côte d'Ivoire, it's necessary to notice that the influential factors are far more numerous. Indeed, apart from all the above factors for Burkina Faso and Mali, it would add the age factor and the level of poverty. In a more generalized, it should be noted that Burkinabe children are those most likely to work or be active (predicted marginal probability equal to 0.57). They are followed by children in Mali (0.52); the Ivorian children are those who have relatively less chance of working, although with a probability of 0.43.

*The effect of level of household poverty:* the link between poverty and prevalence of child labor seems to be contradicted in the case of Burkina Faso and Mali. In both (02) countries, there is a negative relationship between the level of deprivation and the propensity of children to work. However, the coefficients for this variable are not significant for both countries. On the contrary, the link is significant for the case of Côte d'Ivoire and is in line with the luxury axiom since the probability of child labor increases as the level of deprivation of their household increase. Indeed, the increase in the index of a multidimensional poverty of 1%, resulting in the increased propensity of children to work by 8.1%. This result seems to confirm in Ivory Coast, the traditional assumption that household poverty is a major cause of child labor (Basu & Van, 1998).

- **Estimated of participation of children to the various activities: sectorial determinants**

The estimation results (see Table 4) confirm and justify the use of a multivariate model. Indeed, the likelihood ratio tests (LR tests) indicate that the different correlation coefficients between the error terms of each of the estimated equations are significantly nonzero in the three (03) countries, which shows that decisions to participate in three (03) different activities are dependent on each other. Also, the choice of attending one of three (03) activities depend not only to the specific attributes to this activity, but also to the availability of alternatives (activities)<sup>16</sup>. Clearly, the decisions to participate as soon as the different combinations from these decisions are part of a selective procedure. Moreover, these coefficients are all positive, indicating that the unobserved variables influencing the child's participation in agricultural activities are positively correlated with unobserved characteristics that influence their side, participation in economic activities as well as activities home. Moreover, the positive sign of the correlation coefficients between the residuals of the estimated equations for the three (03) countries indicates that whatever the country considered, the probability for a child to participate in agricultural activities influences positively the probability to participate in the area of economic activities as well as the probability of child participation in domestic activities. With the transitivity principle, it is possible to conclude that there is complementarity between these three (03) types of activity.

*predicted probabilities of participation:* An analysis of predicted probabilities of participation helps to highlight the interrelationships between the different activities performed by children

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<sup>16</sup> So the assumption of independence of irrelevant alternatives (IANP) is lifted

as revealed by likelihood ratio tests. In fact, in terms of interrelationships between the various activities made by children, it turns out, by analyzing the predicted probabilities, that the dependences and interrelations noticed between the decisions of participation by means of the likelihood ratio tests are justified in these three (03) countries, but also, that significant disparities exist between them. Indeed, in Burkina Faso, a child is more likely to work exclusively in agriculture (0.43) and domestic (0.34) sectors. The chances so he participates to both agricultural and domestic activities is 0.30. He has very little chance to participate exclusively in economic activities (0.02) or to curb economic and agricultural activities (0.009). As regards a concomitant participation to three types of activities, the chances are only 0.074. As for Côte d'Ivoire and Mali, it's in the domestic work that the chances of an exclusive participation are greatest (0.26 in Côte d'Ivoire, 0.38 in Mali). Then the agricultural sector and a concomitant participation to the agricultural and domestic works come. As regards a simultaneous participation to three (03) types of activities, it appears that the chances are far greater for children of both countries, compared to the case of Burkinabe children (0.07). They are in fact, 0.11 for both (02) countries (Côte d'Ivoire and Mali). For this last country (Mali), the children have no chance to work exclusively in the agricultural and economic sectors. Finally, the probability that children not participate in any of the three (03) activities is higher in Côte d'Ivoire (0.55). This country is followed by Mali (0.48) and Burkina Faso (0.43). These results are consistent with those expected, the incidence of child labor is higher in Burkina Faso, followed by the Mali and Cote d'Ivoire.

*Marginal probabilities of participation:* Otherwise, the analysis of the marginal probabilities permit to remark that children have about one chance in two to work in agricultural and domestic sectors in Mali, the marginal propensity to work in the economic sector is only 0.12. In Côte d'Ivoire, that's about the same thing that is observed, with however, a lower degree lower concerning agricultural and domestic sectors (nearly 0.36). Thus, an Ivorian child has particularly one in three chance of working in the agricultural and domestic sectors. The situation in Burkina is a bit skewed towards the agricultural sector for which children have more than one in two chance of working. This sector is followed by domestic activities (0.42), non-agricultural economic activities coming in third (0.09)

*Conditional probabilities of participation:* Finally, the conditional probability analysis allows establishing that in Burkina Faso and Côte d'Ivoire, the probability for a child to be active in the domestic activities knowing that he engages in an agricultural or economic (other than agricultural) is 0.73 (Burkina Faso) and 0.78 (Côte d'Ivoire). In Mali, the probability is much higher. Indeed, in the latter country, the chance for a child to be employed in domestic activities while he is already in economic activities is 0.95. Conversely, the propensity for children to be occupied in the group of

economic activities knowing they are already active in domestic activities are much more balanced in three (03) countries. However, the group Burkina Faso - Mali differs somewhat from the Ivory Coast. This conditional probability is, in fact, equal to 0.94 for Mali, 0.92 for Burkina Faso, while Ivorian children whose are in this situation have a relatively lower level (0.86). In general, the conditional distributions highlight conditional propensities rather high, what shows that spillover effects exist well in terms of the participation in the activities inherent to the various sectors. It confirms and strengthens the hypothesis of dependence

between the decisions of participation to each of these activities at the same time as it certifies the link of complementary between these.

*Analysis of variables influencing the sectorial interests (with focus on poverty):* the various significant variables identified in the analysis of the broad determinants (global model) do not influence in the same way the child work, depending on sector and country concerned. Indeed, in terms of determinants of child labor in each sector, the overall model results are generally found. However, there are some significant differences which show some specificity for each country. It appears that age (Cote d'Ivoire, Mali), and gender as soon as geographic location are factors that appear most critical as regarding the participation in the different activities in these three (03) countries. Especially regarding to the poverty factor, the results show that poverty is decisive just in Côte d'Ivoire. Indeed, poverty seems to positively influence the incidence of child labor in the three (03) sectors, but only the agricultural sector seems significantly impacted by this factor. Also, the luxury axiom seems to be significantly verified in the agricultural activities.

## 7. CONCLUSION

This study highlights the role of poverty factor in the explanation of child labor, by taking the work of Basu & Van (1999) as a theoretical basis. Thus, besides the search for the determinants of child labor, it tests the hypothesis of the luxury axiom which link child labor to the household poverty and vulnerability. As main results, it appears that poverty plays a significant role in Ivory Coast, while Burkina Faso and Mali are characterized much more by the importance of the cultural factors. Otherwise, it appears that household poverty is particularly relevant in Ivory Coast, to the agricultural activities.

In term of this study, elements of recommendations (to the national or international agencies) going to the sense of an effective fight against the child labor under these unacceptable forms must be proposed.

First of all, this study allowed noting that the incidence of child labor is significantly important in the agricultural world. It is therefore vital that organizations working against child labor in the three (03) countries are stepping up their efforts in agriculture world by directing firstly their actions on the agricultural and domestic word. Secondary, it should be noted that most of the children who work are also schooled. The schooling is not thus the simple result of arbitration from the work. Building on the only one promotion of schooling, with a view to putting an end to the child labor, is therefore a strategy doomed to failure.

Furthermore, the role of poverty seems quite limited for the cases of Burkina Faso and Mali. Actually, social norms favor the use of child labor in these countries. It's more effective to focus on the future utility of schooling and / or "not work" of the children, concerning the maximizing of the satisfaction of households. Moreover, the geographical location plays a key role especially in Burkina Faso and Cote d'Ivoire. In Cote d'Ivoire, it appears that the incidence of child labor is highest in areas of intensive cultivation of cocoa. In addition, the sequential models showed, through the cross effect of schooling and localization that the worst forms of child labor are more present in these areas. The conclusions that prevailed at the start of the Harkin & Engel protocol are thus confirmed. Priority actions must be

undertaken in these areas. However, the magnitude of child labor is also alarming in other regions. It is therefore necessary to concentrate efforts in both cocoa producing regions than in non-production cocoa areas. Especially in Mali and Burkina Faso, these are the areas of medium and high intensity of emigration which are most affected by the phenomenon. Priority actions must be undertaken by the agencies concerned by the problem of child labor in these regions. Finally, because of differences in explanatory factors across countries regarding children's exposure to the worst forms of labor, the strategies need to be adapted to each country because a standard and unique strategies are a priori doomed to failure. The preferred strategies should also focus on educating parents and the adoption of coercive legal measures to fight for eradication.



## 8. ANNEXES

**Tableau 4: Estimations results table (multidimensional poverty index: by fuzzy set theory)**

Note: IPU: unidimensional Poverty Index	Burkina Faso		Côte d'Ivoire		Mali	
	IPU	Contribution	IPU	Contribution	IPU	Contribution
<b>Dimension 1: Value of dwelling</b>						
Types of accommodation	0,7659	3,10	0,3106	4,47	0,7779	2,76
Ownership status	0,1172	3,81	0,1510	3,51	0,0375	1,74
Amount of rent	0,3188	5,53	0,5353	4,12	0,4628	5,04
Number of bedrooms	0,4839	5,53	0,5191	4,19	0,4993	4,90
<b>Dimension 2: Life amenities</b>						
Source water	0,4446	3,52	0,4960	3,85	0,6779	2,21
Source of energy for cooking	0,0103	0,46	0,0431	1,50	0,0007	0,04
Light source	0,2865	3,50	0,3759	4,07	0,4378	3,03
<b>Dimension 3: Possession of durable goods</b>						
Possession of radio	0,2600	5,76	0,2698	5,66	0,1508	4,57
Possession of a television	0,9551	0,72	0,6540	4,44	0,8741	1,88
Possession of a Phone	0,6661	4,45	0,7309	3,67	0,6574	4,42
Possession of a refrigerator	0,9936	0,11	0,8974	1,55	0,9941	0,09
Possession of a transportation	0,1172	4,13	0,3072	5,80	0,1406	4,42
<b>Dimension 4: Income</b>						
Annual income	0,5087	9,40	0,5586	8,33	0,5499	9,04
Sales revenues cotton / cocoa	0,3836	10,04	0,3869	9,41	0,2670	9,69
Revenues of economic activities	0,4763	9,65	0,5756	8,14	0,5201	9,34
<b>Dimension 5: Possession of property assets</b>						
Amount of land owned	0,4414	15,57	0,4935	13,89	0,5041	18,76
Area of cultivated land	0,5029	14,91	0,5310	13,40	0,5400	18,07
<b>Total (%)</b>		100		100		100
<b>Dimension 1: Value of dwelling</b>	0,2737	17,77	0,3049	16,28	0,2044	14,44
<b>Dimension 2: Life amenities</b>	0,1153	7,49	0,1764	9,42	0,0747	5,28
<b>Dimension 3: Possession of durable goods</b>	0,2335	15,16	0,2956	21,12	0,2176	15,38
<b>Dimension 4: Income</b>	0,4481	29,10	0,4849	25,89	0,3971	28,06
<b>Dimension 5: Possession of property assets</b>	0,4695	30,48	0,5112	27,29	0,5211	36,83
<b>Aggregate (average) deprivation</b>		0,3080		0,3746		0,2830

**Tableau 5 : Estimations results table (global and specifics models)**

ESTIMATED MODELS	Global model : logistic model (marginal effects)			Specific models : multivariate probit (coefficients)									
	VARIABLES				Burkina Faso			Cote d'Ivoire			Mali		
		Burkina	CI	Mali	Agricultural	Economic	Domestic	Agricultural	Economic	Domestic	Agricultural	Economic	Domestic
<b>Child characteristics</b>													
Age group – 10-14 years old	-0,046	-	-0,063				-0,207**	-0,259**	-0,177**		-0,346**	0,066	
Sex – Boy	-0,033	-	-0,195**				-0,382**	-0,745**	-0,312**	-0,538**	-0,880**	-0,194**	-
Recent schooling – of school	-0,030	0,231*	0,076										
		*					0,438**	0,357**	0,365**	0,114	0,136	0,131	
<b>Family environment</b>													
Number of 0 – 5 years old people	-0,005	0,036*	-0,018	0,022	-0,032	0,013	0,069**	0,025	0,055**		-0,070		
Number of 6 – 14 years old people	0,006	-	0,025	-0,025	0,049	0,032	-0,043	-0,071**	-0,038		0,037		
Number of 15 – 17 years old people	-0,098**	0,035*	0,100**	-0,102	0,016	-0,135**	-0,071**	-0,089**	-0,039		-0,024		
Number of 18 – 54 years old people	-0,009	-0,012	-0,004	0,008	-0,021	-0,039	-0,002	-0,026	-0,019		0,127***		
Number of 55 or more people	-0,002	-0,009	-0,061**	-0,011	-0,084	0,017	0,039	0,072	-0,036		0,120		
Only living with his father	-0,062	-0,027	0,218**	-0,027	-0,449	0,120				0,254	0,118	0,444*	
Only living with his mother	-0,019	-0,041	-0,091	0,152	0,102	-0,317**				-0,456*	-0,314	-0,144	
Not living with neither the father nor the mother	-0,143**	-0,021	0,051	-0,327**	-0,031	-0,317**				-0,040	0,058	0,011	
Level of poverty	-0,035	0,081*	-0,071				0,209**	0,088	0,113				
		*											
<b>Head of household characteristics</b>													
Farmer	-0,184**	0,029	-0,247**	-0,081	-0,373	-0,043	0,104	-0,094	-0,077	0,029	0,081	-0,048	
Employee		-	-0,205	0,065	-	0,439	-0,400**	0,279	-	-0,085	-0,225	-0,164	
		0,239*			3,557***				0,546***				

		*										
Liberal work	-0,111**	- 0,075* *	-0,046	0,138	-0,040	-0,190	-0,163*	0,147	-0,092	-0,164	0,219	-0,205
Other jobs	-0,029	0,018	-0,006	0,043	-0,016	-0,195	-0,141	-0,327	-0,317*	0,1933	0,669***	0,265
Unemployed / Inactive	-0,137**	0,007	0,056	0,207	0,012	-0,221	-0,023	-0,145	0,104	0,044	0,117	0,070
<b>Geographical characteristics</b>												
Stratum (1)	0,162**	0,005	0,039	0,366***	-0,131	0,070	0,004	0,108	0,120	0,280**	0,069	0,049
Stratum (2)	0,137**	- 0,183* *	0,106	0,311**	-0,215	0,183	- 0,311***	-0,258**	- 0,300***	0,341**	0,170	0,264*
Constant				0,009	-0,633*	0,364	0,134	-0,307	0,530**	-0,296	- 10,506** *	0,075
<b>Information criterion /Correlations (LR test)</b>	AIC = 935	AIC = 1712	AIC = 940	0,68*** / 0,93*** / 0,58***			0,66*** / 0,90*** / 0,69***			0,73*** / 0,99*** / 0,77***		

Source: TULANE-ENSEA, 2009, *Surveys on living conditions and migration of children, our estimations*

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