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Abstract

The link between poverty and child labor has traditionally been regarded as well established but recent researches have questioned its validity, suggesting that child labor is more important in the richest households (wealth paradox). The present study revisits the link between poverty and farm child labor in Africa and aims at testing the paradoxical wealth effect. Using different modeling techniques, the analysis focuses on family-controlled child labor taking place in the cocoa sector of Côte d'Ivoire.

The results reveal that the effect of different commonly used wealth proxies have opposite effects on child labor participation and are sometimes sensitive to the modeling technique. This mixed result is the root of the apparent wealth paradox found in the literature. However, relevant and robust wealth proxies clearly indicate a positive relationship between poverty and child labor. The study therefore sustains that the apparent wealth paradox found in the literature is the end result of a bad orthodoxy.

Key words : Child labor, Poverty, Cocoa sector, Econometric modeling, Côte d'Ivoire.

JEL: C25; D1; I21; J24; O15

INTRODUCTION

According to the International Labor Organization (ILO/SIMPOC, 2002), sub-Saharan Africa has the highest rate of child labor. Most of these children are involved in agricultural work, predominantly on farms operated by their families, and are not paid for their labor. Addressing this problematic issue of child labor is vital to the development of the youth who are the future of sub-Saharan Africa.

Several studies have examined the determinants of child labor and schooling in rural Africa (Andvig, 2001). In particular, the relationship between the welfare levels of households and participation in child labor market has always been an issue of particular interest. Evidence has traditionally suggested that some parents have children, based on a cost-benefit perspective. This view maintains that children in developing countries tend to be of economic value and, as a result, become a desirable asset for struggling parents (Ilon and Moock 1991).

The link between poverty and child labor has traditionally been regarded as well established but recent research has questioned its validity, claiming that poverty is not a main determinant of child labor (Blunch and Verner 2001). Moreover a recent study in WorldBank Economic Review by Bhalotra and Heady (2003) in Ghana and Pakistan found that the use of child labor emerges mostly from the richest households. Their findings and conclusions are based on the observation that children in land-rich households are more likely to work and less likely to attend school than children in land-poor households, a phenomenon referred to as the *wealth paradox*. The authors use farm size as the main proxy to household welfare, arguing the fact that land is the most important store of wealth in agrarian societies. They later suggest that this apparent paradox can be explained by failures of the markets for principally, labor and land.

The present study revisits the link between poverty and farm child labor in Africa and aims at testing the paradoxical wealth effect. Using different modeling techniques, the analysis focuses on the family-controlled child labor taking place in the cocoa sector of Côte d'ivoire. The sector of particular interest as it accounts for over 40% of global cocoa production. Early empirical work on child labor included as a regressor, a measure of household income, consumption, or farm size as a wealth proxy. In most rural areas, information on income and consumption can be difficult both to obtain and to assess in a reliable way. Moreover, the endogeneity problem associated with the use of such income or consumption has tended to introduce a bias in many studies (Bhalotra and Heady, 2003). Where farm size is used as the main proxy to assess household wealth and the opportunity cost of the non-labor option, it has been suggested by Coulombe (1998) and Cockburn (2000) among others, that the size of the farmland says little about the quality of this land, and thus gives only a partial indication of the marginal return to child labor. In the present study, we introduce, in addition to farm size, information about land quality and productivity to strengthen ability to assess the opportunity costs of non-labor options. The productivity class of the cocoa farm (measured in yield/ha) constitutes a good proxy for land quality, and can, like land size, be perceived as an indicator of the opportunity cost of the non-labor options.

We also believe that the use of farm size as a proxy for wealth is weakened by the fact that non-farm activities and off-farm incomes are very important in many rural areas. The traditional image (farming = rural incomes) is being contradicted by accumulating survey evidence, especially in the 1980s and 1990s (Reardon, 1998). For the Special Chapter of *State of Food and Agriculture 1998* (FAO, 1998), a group of researchers synthesized 100 field studies and found some surprising results in survey samples composed mainly of farm households. The average figures for the share of non-farm income in total household income

are: (1) Africa, 42% (Eastern/Southern, 45%, Western, 36%); (2) Latin America, 40%; (3) Asia, 32% (East/SE, 35%, South, 29%). These figures challenge the orthodox practice of drawing conclusions on the link between poverty, and child labor using farm size as a proxy for wealth. We therefore introduce a more refined variable, based on the quality of the main household building, as a proxy for the household's living standard and compare the effect of the use of different proxies for wealth.

The next section of this paper describes the survey and data source. Section 3 presents the econometric models used in this paper. Section 4 presents the empirical model specification, while section 5 discusses results. The paper ends in section 6 with conclusions and some policy implications.

2. SURVEY AND DATA

The Ivorian cocoa production is overwhelmingly in the hands of small family farmers who mainly employ family labor (Nkamleu and Ndoye, 2003). Ninety-eight percent of the farms have less than 12 ha of productive cocoa farmland, with an average farm size of around 4 ha. This is in contrast to many other African agricultural export crops, such as tea, tobacco, and fruit, that tend to be produced on larger commercial plantations with higher numbers of employed tenants, sharecroppers, and other hired hands. The labor intensity of the cocoa farm and, subsequently, the labor input, fluctuate over the year with the main peak season in September and October during harvest time.

To obtain information on the state of child labor utilization in the cocoa sector in Côte d'ivoire, an extensive national survey was conducted in 2002. A national census of cocoa producers was conducted in 1998. The database of this census was used to randomly select households of cocoa producers to be surveyed. A total of 1501 households and over 250

villages, hamlets and cocoa "camps" across the cocoa belt in Côte d'ivoire were visited. All villages and clusters of households were selected using a stratified random sampling procedure, and randomly selected household heads were interviewed using structured questionnaires[2]. This was complemented by a qualitative survey with informal interviews conducted at the community level. Detailed information was collected on work conditions and other socioeconomic characteristics of households and their members. All household heads surveyed were cocoa producers operating their own cocoa farms. Among them, fewer than 2% were female household heads. Cocoa is essentially a man's crop. So this was not surprising. The 1501 households surveyed consisted of 11,669 people, of which 1490 (12.8%) were household heads, 1910 (16.4%) were spouses, and the rest (8289 - 70.8%) were other family members[3]. Among the ''other family members'' 5263 (45.1%) were biological children of the household heads, 2622 (22.5%) were extended family members, and 384 (3.3%) were members having no family ties to the household heads (Table 1). We should also note that children (0-17 years), represent 46.3% of household individuals.

Although the 1989 UN Convention on the Rights of the Child defines children as all individuals under the age of 18, the child labor literature tends to concentrate on the age group 6-14 years. This is justified by the fact that the 1973 ILO Convention 138 (the Minimum Age Convention) establishes that *"…the age of admission to employment shall not be less than the age of completion of compulsory schooling and, in any case, shall not be less than 15 years"*. Children under-6 have generally been considered too young to participate substantially in the labor force. Joint decision on child labor and schooling shows it would also make little sense to include those 15-17-year-old who are beyond the compulsory school

[2] The survey is described in detail in the IITA report (2002).
[3] This is the category which is analyzed in this paper.

age and are rarely in school in the areas studied. Therefore, in the analyses that follow, we have used the 6-14 age groups in the econometric models.

3. CONCEPTUAL MODEL

Cocoa farmers in Côte d'Ivoire must decide whether to send a child to school or to work on cocoa farms. There are several ways to econometrically model child labor and schooling. Contemporary labor economics employs theories of choice to analyze and predict the behavior of labor market participants (McConnell et al., 1989).

Economists investigating choice decisions have accumulated considerable evidence showing that the observed choice decision on a technology or a behavior is the end result of a complex set of inter-technological preference comparisons. Despite all the development in decision theories by anthropologists, sociologists, and philosophers, farmers today still largely rely on perception and intuition for their decision-making. Variables that affect the farmers' access to information and, hence, their perception (e.g., extension, education, media exposure, individual characteristics) are typically used in economic models of the determinants of adoption (Kebede et al., 1990; Polson and Spencer, 1991; Nkamleu and Adesina, 2000). Several empirical studies have tried to identify the influence of socioeconomic variables on child labor and schooling (Andvig, 2001; Andvig et al., 2001). Recently, the literature has moved into analyzing the school-or-work decision as a joint decision, by applying either (1) a bivariate probit, thus simultaneously estimating a probit for the schooling decision and one for the work decision (Canarajan and Coulombe, 1998; Coulombe, 1998) or (2) a multinomial logit model for the four possible outcomes (school only; school and work; work only; no work and no school) (Grootaert, 1998; Nkamleu and Kielland, 2006). In this analysis, both bivariate probit and multinomial logit will be estimated to test the consistency

of our results and verify whether the wealth effect is sensitive to the choice of the model. In both models, farmers are assumed to make decisions based upon an objective of utility maximization.

The Bivariate probit model

Suppose that work is represented by ''w'', where w is 1 if the child works on the cocoa farm and 0 otherwise. Similarly, school is represented by ''s'', where s is 1 under school enrollment, and 0, otherwise. The underlying utility function, which ranks the preference of the i^{th} child, is assumed to be a function of child-specific attributes -"X"- (e.g., age, sex, household characteristics) and a disturbance term having a zero mean:

$\mathbf{U_{i1}(X) = \beta_1 X_i + \varepsilon_{i1}}$ for work/school and $\mathbf{U_{i0}(X) = \beta_0 X_i + \varepsilon_{i0}}$ for non work/school.

As the utilities are random, the i^{th} child will fall in work or school alternative if and only if $\mathbf{U_{i1} > U_{i0}}$ Thus, for the child 'i', the probability of work (or school) is given by:

$$\begin{aligned}
&\wp(1) = \wp(U_{i1} > U_{i0}) \\
&= \wp(\beta_1 X_i + \varepsilon_{i1} > \beta_0 X_i + \varepsilon_{i0}) \\
&= \wp(\varepsilon_{i0} - \varepsilon_{i1} < \beta_1 X_i - \beta_0 X_i) \\
&= \wp(\varepsilon_i < \beta X_i) \\
&= \Phi(\beta X_i)
\end{aligned}$$

Where Φ is the cumulative distribution function for ε. The functional form for Φ will depend on the assumptions made about ε. A probit model arises from assuming the normal distribution for ε. Thus for a child "i", the probability of being a child worker and being enrolled in school is given by:

$$\Phi_w(\beta_w X_{iw}) = \int_{-\infty}^{\beta_w X_{iw}} \frac{1}{\sqrt{2\Pi}} \exp\left(\frac{-t^2}{2}\right) dt \qquad \textit{for work}$$

$$\Phi_s(\beta_s X_{is}) = \int_{-\infty}^{\beta_s X_{is}} \frac{1}{\sqrt{2\Pi}} \exp\left(\frac{-t^2}{2}\right) dt \qquad \textit{for school}$$

The two equations can be estimated consistently by individual single equation probit methods. However, this is inefficient in that it ignores the correlation between the disturbances ε_w and ε_s of the underlying stochastic utilities function associated with work and with school (Greene, 1993, p.465). It is well known that various decisions within the household interact and often are taken simultaneously. This is particularly obvious in the child labor/school decision. The bivariate probit model circumvents inadequacies of the single probit or logit model and is based on the joint distribution of two normally distributed variables. It is specified (Greene, 1993; Brorsen et al., 1996; Nkamleu and Adesina, 2000) as:

$$\phi(w,s) = \frac{1}{2\pi\sigma_w\sigma_s\sqrt{1-\rho^2}} e^{-(\varepsilon_w^2+\varepsilon_s^2-2\rho\varepsilon_w\varepsilon_s)/(2(1-\rho^2))}$$

$$\varepsilon_w = \frac{f-\mu_w}{\sigma w} \qquad \varepsilon_s = \frac{p-\mu_s}{\sigma_s}$$

ρ *is the correlation between w and s. The* cov *ariance is* $\sigma_{sw} = \rho\sigma_w\sigma_s$

μ_w , μ_s , σ_w , and σ_s are the means and standard deviations of the marginal distributions of ''w'' and ''s''. The distributions ''w'' and ''s'' are independent if and only if $\rho = 0$. The most suitable technique of estimation when using the bivariate probit model is the full information maximum likelihood. The technique requires the use of an iterative algorithm. We have used the Davidon/Fletcher/Powell (DFP) algorithm.

The Multinomial logit model

Instead of having two dichotomous alternatives (0, 1) as in the bivariate probit, the Multinomial Logit has S possible states or categories s = 1, 2,3...,S. that are exclusive and exhaustive (Nkamleu and Coulibaly, 2000). In this analysis, the four categories considered are given below: 1 – Not working on a cocoa farm and not going to school (None). 2 – Going

to school and not working on a cocoa farm (School only). 3 – Working on a cocoa farm and not going to school (Work only). 4 - Working on a cocoa farm and going to school (School and Work).

If there is a random sample of farmers, i=1,2,3...,N, given four choice categories, s = 1,2,3,4, the Multinomial Logit model assigns probabilities P_{is} to events characterized as 'i^{th} child in s^{th} category'. The vector of the characteristics of the child is denoted by 'z'. To estimate this model there is a need to normalize on one category, which is referred to as the reference state. In this analysis, the first category (1=None) is the reference state. Our Multinomial Logit model for choice across *S* states (s =1,2,3,4) can then be specified as:

$$P(Y = s) = \frac{e^{\beta_i Z}}{1 + \sum_{j=2}^{S} e^{\beta_j Z}} \qquad \text{for s not equal to 1}$$

$$P(Y = 1) = \frac{1}{1 + \sum_{j=2}^{S} e^{\beta_j Z}} \qquad \text{for s equal to 1}$$

The parameters β_i are estimated using LIMDEP© (Greene, 1993).

4. EMPIRICAL MODEL

The core variable measuring household wealth is based on the quality of the main household building (HQUALITY). Based on our observations in rural Africa, where information on income and consumption can be difficult to obtain and to assess in a reliable way, house quality is quite a good proxy for welfare. Houses with fragile walls and thatched roofs are thus in this context given the lowest wealth score (=0). Houses with either solid walls or solid roofs are given a medium score (=1), while houses built with blocks and with iron sheets or other forms of solid roofs are given the highest wealth score (=2). The wealth paradox

assumes that rural child labor will increase with the marginal return to child labor proxied by the size of available farmland. However, as pointed out in the introduction, farm size alone says nothing about soil quality and is thus a noisy measurement of the marginal return to child labor. Being particularly concerned with opportunity cost issues, we therefore, as explained, introduce a second child labor return proxy, namely that of cocoa productivity class (YIELDCLS), measured in cocoa yield per acre. Farmers are divided into three equal cocoa productivity classes (terciles) coded 1=Low; 2=Average; 3=High. In cocoa production systems, there is a high correlation between productivity and the use of chemical inputs. Farmers having a high level of productivity are those using labor-demanding chemical inputs, particularly fungicides and fertilizers. On the other hand, farmers having a level of high productivity are more likely to be able to afford school fees for their children. It is therefore hypothesized that COCOA PRODUCTIVITY is positively related to both WORK and SCHOOL.

Previous studies in sub-Saharan Africa suggest that labor participation is influenced by the different characteristics of the child, the parents, and the household. Consequently, we have also included the most common of these characteristics as independent variables in the regression together with our core variables. The discussion and justification of the other independent variables included in the model are provided below.

Child characteristics

MALE_CHILD indexes the gender of the child (0=female, 1=male). Some authors have emphasized that boys are more likely to be involved in the labor market while girls are more likely to do more housekeeping work (Psacharopoulos and Arriagada, 1989; Patrinos and Psacharopoulos, 1994). A recent study by Canagarajah and Coulombe (1998) in Ghana came

out with gender discrimination, with boys being more likely to go to school than girls. We expected MALE_CHILD to be positively related to both WORK and SCHOOL.

AGE_CHILD is a variable that measures the child's age in years. Most activities on cocoa farms are heavy tasks that are not appropriate for children with inadequately developed muscles. It is therefore more likely that older children will be more involved in work on cocoa farms. Also, due to delay in enrolling children in school, it is more likely that older children will be enrolled in school. We hypothesized AGE_CHILD to be positively related to WORK and also positively related to SCHOOL. The model includes a quadratic in child age to determine any non-linearity in the relationship.

BIOLOGICAL_CHILD is a dummy variable equal to 1, if the child is a biological child of the household head, and to zero otherwise. In the sample used for econometric estimation (6-14 years), 74% were biological children, 24% were other kin, and only 2% were non-kin children. Kinship fostering or guardianship of orphans and other children is a common practice in Africa (Case et al., 2002). However, inheritance laws favor biological sons/daughters over foster-children. Work experience is especially valuable for the children (especially the male children) of landowners, who can expect to inherit the farm. We expect biological children to be more likely to work on cocoa farms in preparation for inheritance. A phenomenon discussed in the child labor literature is the impact of family ties on school enrolment (Case et al., 2002). Children who are cared for by adults other than their biological parents have been found to be disadvantaged. We therefore hypothesized a positive relationship between BIOLOGICAL_CHILD and both WORK and SCHOOL.

Parent characteristics

COCOA EXPERIENCE measures the household head's number of years of cocoa farming experience. With experience, it is expected that farmers will be able to better assess the hidden wealth of cocoa farming. Grootaert and Kanbur (1995) argued that child labor is perceived as a process of socialization in many African countries. We have observed that experienced farmers tend to believe that working, as well as attending formal education, enables a child to get acquainted with the skills necessary for a better future. We hypothesized that the greater the experience, the more likely it is that the child will combine WORK and SCHOOL.

PRODUCER _AGE measures the age of the household head. In an analysis of child labor incidence and determinants in Côte d'ivoire, Grootaert (1998) found, both for urban and rural areas, that the older the head of the household, the more likely it is that a child will be attending school and not working. Based on that finding, we hypothesized that PRODUCER _AGE is negatively related to WORK and positively related to SCHOOL.

PRODUCER_EDUCATION measures the level of education of the household head (1= no formal education. 2=primary school, 3=secondary 1; 4=secondary 2; 5=post-secondary). This variable included those who had at least started the indicated level (whether they had completed it or not). The effect of education on child labor has been intensely debated. Empirical studies have shown that the level of education negatively affects the likelihood of child labor (Canagarah and Coulombe, 1997; Coulombe, 1998). It is hypothesized that PRODUCER_EDUCATION is negatively related to WORK and positively related to SCHOOL.

MIGRANT, IMMIGRANT are two binary variables which index whether the farmer is a national (in-country) migrant (MIGRANT) or international migrant (IMMIGRANT). MIGRANT takes the value 1 for a migrant and 0 otherwise. IMMIGRANT takes the value 1

for an immigrant and 0 otherwise. Migrants (as well as immigrants) are less likely to have access to much land. They may also be restricted in the use of land for perennial crops. This is because they generally acquire land either through begging or renting (Stier, 1982; Russell et al., 1990). Therefore, migrants will need more inputs to maintain an acceptable level of production. This pressure on child labor in cocoa farms might also restrict children from going to school. We therefore expect more children living in migrant (as well as immigrant) households to have a lower probability of school enrollment. It is hypothesized that MIGRANT and IMMIGRANT variables are positively related to WORK and negatively related to SCHOOL.

Household characteristics

HOUSEHOLD SIZE is the household family size. Generally, large households have more problems to resolve (sickness, etc.), that leave them with insufficient capital to send all the children to school. Also, a large family may have more labor availability and hence, other members are able to take care of the cocoa farm, preventing children from having to work. It is hypothesized that HOUSEHOLD SIZE is negatively related to WORK and to SCHOOL. The square of ‘‘family size’’ is included to determine any non-linearity in the relationship.

DEPENDENCY RATIO represents the share of household members < 6 and > 55 years. Caring for young siblings and serving the elderly increase the demand for housework, substantially, reducing work in cocoa farms and school enrollment. In Ghana, Bhalotra and Heady (2003) found that the number of children under-6 in the household strongly increases child labor in housework. We expected a negative relationship between DEPENDENCY RATIO and both WORK and SCHOOL. Other authors have been concerned with the two-way relationship between fertility choices and schooling/child labor (Coulombe, 1998). In

the case of our data, we found that running our models with and without HOUSEHOLD SIZE and DEPENDENCY RATIO did not affect other estimates.

COCOA FARM AREA is the measure of cocoa land size in ha. As the farm size increases, farmers need more labor inputs (Kebede et al., 1990). An increase in cocoa farm size is likely to increase the use of child labor and decrease schooling. We hypothesized that COCOA FARM AREA is positively related to WORK and negatively related to SCHOOL.

FOOD CROP FARM AREA and OTHER CASH CROP AREA refer to the sizes of the food crop farm and the farm for other perennial crops. Since the survey did not collect data on child labor in non-cocoa farming, these two variables are introduced to proxy the demand for child labor in non-cocoa farm activities. Farmers with large non-cocoa land resources, other things being constant, will need more labor to take care of these lands and, therefore, a lower participation on cocoa farms and enrollment in school can be hypothesized. We expected FOOD CROP FARM AREA and OTHER CASH CROP AREA to be negatively related to both WORK and SCHOOL.

NUMBER OF SHARECROPPERS is the number of sharecroppers working with the household head. One advantage of sharecropping to the landlord is that it improves the landlord's access to labor by making the labor of the tenant's family available, in addition to the labor of the tenant (Basu, 1997). Hence, school-aged children are able to attend school and not to work. It is hypothesized that NUMBER OF SHARECROPPERS is negatively related to WORK and positively related to SCHOOL.

Community characteristics

Cocoa production typically takes place in areas where child labor is common, and where children and adults, to some extent, may replace one another in different types of labor. Child

labor participation in cocoa farming should be, therefore, partly decided by the external labor demand for both adults and children in other labor sectors. The present survey focused only on child labor in the cocoa sector and did not collect information on whether or not the child was working outside the household sphere. To circumvent this limitation, we therefore introduce proxies for the demand from the most likely places of work that would "compete" for the labor available. We assume that increased labor demand in workplaces that typically demand adult labor will increase child labor participation on the cocoa farm, as family children will replace adult workers. Increased demand in typical child labor tasks will, on the other hand, pull children away from cocoa farming.

COCOA FARMLAND IN THE CLUSTER and NON-COCOA FARMLAND IN THE CLUSTER are the average size of cocoa farms in the sample cluster (the s*ous-prefecture* or commune) and the average size of other perennial crop (non-cocoa) farms in the region. It is expected that the larger the size of farmlands in the area, the higher the demand for community adult farm labor will be, and the greater will be the demand for child labor on household cocoa farms. Inversely, we expect COCOA PRODUCTIVITY IN THE CLUSTER (average productivity class of cocoa in the cluster) to be negatively related to child work and schooling due to high marginal return for child labor in external farms.

HOUSE QUALITY IN THE CLUSTER represents the average household quality in the cluster (*sous-prefecture* or *commune*). This is a good proxy for community wealth. Wealthier communities are better-off in terms of apprenticeship opportunities as well as salaried domestic service that can pull children away from farming activities.

WEST, EAST and CENTER-WEST are dummy variables taking the value of 1 for farmers in the corresponding area and 0 otherwise. Regions are not homogeneous in terms of agricultural opportunities, potential for employment in farming and non-farming activities, or quantity,

quality, and distribution of school infrastructure. The regional factor will normally have an impact on the pattern and intensity of child labor and school attendance.

Past studies acknowledge the particular risk of endogeneity related to certain core independent variables when examining issues such as child labor. Most prominently, household income assessment is maybe endogenous, as children often contribute to the household income level through their labor. In this analysis, the potential endogeneity problem of household wealth is reduced by the fact that we examine only child labor delivered to *one* of the potential labor markets available to the household members. We, moreover, assume that the *house quality* wealth proxy is less potentially risky than the direct assessment of income or consumption. With regard to productive land size, cocoa farming is less flexible than most other types of farming, in the sense that it takes approximately 7 years to obtain productive cocoa trees. Cocoa farming is, therefore, not very suitable for a flexible adjustment based on what labor might be available at any given time.

Cocoa productivity is a variable of a much more central concern as it could potentially bear a high risk of being endogenously related to the child labor input in cocoa farming. This problem was tackled using the instrumental variable procedure developed by Rivers and Vuong in 1988 (Wooldridge, 2002). In a first step, we ran an OLS regression (prediction equation) of the productivity variable on a series of exogenous variables. Secondly, we used the estimated residuals from the first step and the predicted COCOA PRODUCTIVITY from the first regression as regressors in our Multinomial Logit and bivariate probit regression. The significance level of the coefficients on the residual variable forms the basis of the exogeneity test[4].

[4] This procedure known as Hausman-Wu test requires that the auxiliary regression (OLS regression) includes at least one variable that does not directly determine the outcome, i.e., is excluded from the regression outcome (multinomial regression) or is an instrument. In our estimation, 'member of farmer organization' and

Table 1: Descriptive Statistics for the variables used in the econometric models.

Variable	Description	Mean	Std.Dev	Minimun	Maximun	Number of Cases
Dependent variables						
Labor	Dummy for the work status of the child. 1=work in cocoa farm	0.49	0.50	0	1	2872
School	Dummy for school enrollment status of the child. 1=In school	0.62	0.48	0	1	2910
Child characteristics						
Child is a boy	Gender dummy of the child. 1=male	0.55	0.50	0	1	2917
Child's age	Age of the child.	9.58	2.54	6	14	2920
Age squared	Square of age of the child.	98.12	50.03	36	196	2920
Biologic child of hhh	Dummy for child being the biological child of household head. 1=yes	0.74	0.44	0	1	2920
Parent's characteristics						
Cocoa experience	Producer's cocoa farming experience in years.	20.31	10.77	1	69	2875
Producer's age	Age of the producer.	52.57	13.71	20	110	2893
Producer's education	Producer's educational attainment 1 = no formal education. 2=primary school, 3= secondary1 ; 4= secondary2 ; 5=post secondary.	1.56	0.77	1	5	2905
Producer is a migrant	Dummy for whether the producer is a migrant from another region of the country (national migrants). 1=yes	0.25	0.43	0	1	2920
Producer is an immigrant	Dummy for whether the producer is an immigrant from another countr (international migrants). 1=yes	0.21	0.41	0	1	2920
Household characteristics						
House quality	Index composed by standard quality of wall and roof material.	1.00	0.77	0	2	2920
Household size	Number of household members.	10.43	4.60	2	36	2604
Household size squared	Square of household size	129.94	127.47	4	1296	2604
Dependency ratio	Share of household members <6 and >55.	0.21	0.14	0	0.75	2660
Farm characteristics						
Productive cocoa land	Productive cocoa farm size (ha).	3.98	3.88	0	45	2891
Food crop land	Food crop farm size (ha).	3.64	9.84	0	150	2522
Other cash crop land	Other cash crop farm size (ha).	2.74	5.86	0	75	2503
Cocoa productivity class	Yield per hectare. 1=Low; 2=Medium; 3=High	2.01	0.80	1	3	2697
Number of sharecroppers	Number of sharecropper working with household head.	0.55	0.96	0	6	2920
Community characteristics						
Area cocoa farm size	Average size of cocoa farms within region (ha).	3.62	1.17	2	9	2920
Average productivity class	Average productivity class of cocoa in the region.	1.82	0.33	1	2.8	2920
Area non-cocoa farm size	Average size of non-cocoa farms within region (ha).	4.95	3.03	1	17.5	2920
Average wealth	Average housing standard in region.	0.95	0.31	0	1.6	2920
Western region	Dummy variable for western region. 1=west	0.09	0.29	0	1	2920
Eastern region	Dummy variable for eastern region. 1=east	0.21	0.41	0	1	2920
Central Western region	Dummy variable for center-west region. 1=center-west	0.41	0.49	0	1	2920

'last year cocoa price' were used as instruments in the prediction equation and there were both statistically significant.

5. RESULTS

Empirically analyzing the determinants for child labor participation in cocoa farming and school enrollment, we test our hypotheses using alternative modeling forms for children 6-14 years. Estimates of the Multinomial model for work/school participation are shown in Table 2, while bivariate probit model results are presented in Table 3. Several interesting results appear in the tables. Almost all of them, however, corroborate our *a priori* hypothesis.

Turning to the central issues of this paper, at a first glance, we see that our new opportunity cost measurement of *productivity class* turns out to increase child labor delivered to the cocoa farm, although insignificant in the Multinomial Logit model. We should thus assume that productivity class remains a good indicator of the marginal return to child labor on the farm, and therefore increases the opportunity cost to non-cocoa farm work options. *Cocoa farmland size*, the previously suggested measurement of opportunity cost, also has a mixed outcome. Significant in the bivariate probit model, this variable seems insignificant as a determinant of child labor participation on the cocoa farm in the Multinomial Logit model. In fact, when removing the productivity class variable from the multinomial regression, the farm size coefficient becomes significant. This tends to suggest that children of land-rich households are more likely to be in work than the children of land-poor households.

Also as predicted, the *house quality* wealth proxy reduces child labor. The coefficient of house quality is negative and significant. It is a very robust result since it is found to be statistically significant for the model variants. This suggests that compared to the other wealth indicators, house quality is a more powerful wealth proxy, and gives evidence of a positive link between poverty and child labor usage.

The fact that wealth proxied by house quality reduces child labor without increasing school participation indicates that wealth beyond all reduces the group of children who combine

work on the cocoa farm with schooling, increasing the number of children who *only* go to school. While wealth thus may improve the school achievement of those in school, wealth does not seem to increase school participation rates overall. Similarly, *cocoa productivity class* and *cocoa farmland size* increase child labor without reducing school participation. This implies that the group of children who combine work and schooling increases (with the likelihood of deteriorating school performance – Heady, 2003), while the overall school participation rates remain constant.

We find that the effect of different wealth proxies have opposite effects on child labor participation: *Cocoa farmland* has a positive impact on child labor while *house quality* has a negative influence. This mixed result is the root of the apparent wealth paradox found in the literature. What sometimes appear to be paradoxical patterns are only the result of the orthodoxy followed.

It is our view that due to the traditional image which ignores or downplays the importance of the *Rural Non-farm Employment* and *Income*, the farm sector has been considered to be the principal sector for the creation of rural employment opportunities. Thus, policymakers have tended to equate 'rural' with 'farm sector' and "rural income" with "farm" incomes. But, as noted by Thomas Reardon (1998), we are now realizing that the farm sector is a limited source of rural employment growth in the future. This is not only because of land constraints, but also from the nature of intensification in terms of its changing capital-labor requirements. Even from a historical point of view, in Green Revolution areas, labor demand first increased and then declined.

The positive and significant effect of *cocoa productivity class* and *cocoa farmland size* corroborate our *a priori* hypothesis that the marginal return to child labor is an important stimulus to child utilization. But contrary to what has been suggested in previous studies, this

does not challenge the commonly held presumption that child labor emerges from the poorest households. This presumption is even reinstated and strengthened. Invariably, it is established that poor households are more likely to use child labor than non-poor households.

Table 2. Multinomial Logit model of work/school choice in the cocoa sector of Côte d'Ivoire.

VARIABLES	**CHILD STATUS**					
	Work only		***School only***		***Work and School***	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
CONSTANT	-7.426	-3.397 ***	-5.521	-2.874 ***	-14.067	-6.714 ***
Child characteristics						
Child is a boy	-0.064	-0.370	0.450	2.928 ***	0.652	3.972 ***
Child's age	1.492	4.839 ***	1.308	4.801 ***	2.592	8.618 ***
Age squared	-0.054	-3.427 ***	-0.061	-4.299 ***	-0.112	-7.283 ***
Biologic child of hhh	0.220	0.869	0.485	2.149 **	0.480	1.996 **
Parent's characteristics						
Cocoa experience	0.010	0.640	0.001	0.109	0.008	0.545
Producer's age	0.014	0.961	0.008	0.589	0.018	1.288
Producer's education	-0.132	-0.858	0.340	2.609 ***	0.257	1.871 *
Producer is a migrant	0.481	2.075 **	-1.159	-5.669 ***	-1.107	-5.069 ***
Producer is an immigran	0.044	0.182	-1.617	-7.446 ***	-1.861	-7.722 ***
Household characteristics						
House quality	-0.223	-1.674 *	0.101	0.856	-0.134	-1.067
Household size	-0.182	-2.015 **	0.051	0.530	-0.189	-2.224 **
Household size squared	0.006	1.886 *	-0.003	-0.805	0.007	2.336 **
Dependency ratio	-0.938	-1.378	-0.853	-1.419	-2.174	-3.367 ***
Farm characteristics						
Productive cocoa land	0.068	1.520	-0.016	-0.392	0.039	0.904
Food crop land	-0.011	-0.999	-0.003	-0.333	-0.014	-1.513
Other cash crop land	-0.023	-1.206	0.004	0.259	-0.050	-2.485 ***
Cocoa productivity class (Prediction)	0.829	0.770	-0.636	-0.660	1.124	1.091
Residual	0.240	2.108 **	0.152	1.507	0.339	3.123 ***
Number of sharecropper	-0.208	-1.349	0.015	0.108	-0.333	-2.224 **
Community characteristics						
Average cocoa farm size	0.136	1.141	0.166	1.584	0.228	2.038 **
Average productivity class	-1.593	-2.071 **	-0.027	-0.039	-0.844	-1.157
Average non-cocoa farm size	0.149	3.506 ***	0.064	1.645 *	0.177	4.441 ***
Average household quality	-1.003	-2.629 ***	-0.952	-2.821 ***	-1.497	-4.146 ***
Western region	-0.321	-0.666	-0.721	-1.624 *	-0.732	-1.562
Eastern region	-0.408	-0.890	0.179	0.458	0.299	0.721
Central Western region	0.383	1.287	0.802	3.043 ***	0.712	2.536 ***

$X^2(54)$ = -962 ***

Percentage of correct predictions of child utilization categories = 51.03 %

log-Likelihood function = -220752 ; Sample = 1993

*** =Significant at 0.01; **=significant at 0.05; *= significant at 0.10.

Table 3: Bivariate probit regression on the labor and school choice of children aged 6-14.

VARIABLES	WORK		SCHOOL	
	Coefficients	t-values	Coefficients	t-values
CONSTANT	-4.652	-5.760 ***	-3.658	-4.417 ***
Child characteristics				
Child is a boy	0.028	0.429	0.338	5.128 ***
Child's age	0.743	6.302 ***	0.769	6.763 ***
Age squared	-0.027	-4.521 ***	-0.039	-6.735 ***
Biologic child of hhh	0.036	0.389	0.203	2.115 **
Parent's characteristics				
Cocoa experience	0.006	0.996	0.000	-0.012
Producer's age	0.006	1.053	0.003	0.446
Producer's education	-0.064	-1.250	0.206	3.931 ***
Producer is a migrant	0.196	2.328 **	-0.825	-9.748 ***
Producer is an immigrant	0.001	0.008	-1.052	-11.385 ***
Household characteristics				
House quality	-0.140	-2.909 ***	0.069	1.346
Household size	-0.111	-2.449 ***	-0.004	-0.126
Household size squared	0.004	2.304 **	0.000	0.273
Dependency ratio	-0.615	-2.445 ***	-0.601	-2.288 **
Farm characteristics				
Productive cocoa land	0.036	2.139 **	-0.018	-1.095
Food crop land	-0.007	-2.495 ***	0.000	-0.002
Other cash crop land	-0.023	-2.592 ***	-0.005	-0.557
Cocoa productivity class (Prediction)	0.788	1.964 **	-0.152	-0.361
Residual	0.117	2.731 ***	0.051	1.193
Number of sharecroppers	-0.166	-2.846 ***	-0.014	-0.220
Community characteristics				
Area cocoa farm size	0.037	0.864	0.067	1.451
Average productivity class	-0.570	-1.995 **	0.269	0.897
Average non-cocoa farm size	0.073	5.052 ***	0.015	1.018
Area wealth	-0.360	-2.625 ***	-0.372	-2.522 ***
Western region	-0.041	-0.230	-0.298	-1.611 *
Eastern region	-0.038	-0.241	0.305	1.795 *
Central Western region	0.041	0.377	0.322	2.924 ***
Rho = -0.14 (t= -3.328 ***) Sample size = 1993 Log-likelihood = -2231.38				

*** = Significant at 1%; ** = Significant at 5%; * = Significant at 10%.

6. CONCLUSIONS

Based on a survey carried out in 2002 over a sample of more than 1500 cocoa farmers, and using alternative econometric models, this paper revisits the relationship between child labor and poverty in African agriculture. The relationship between wealth and participation in child labor may seem obvious, but has nevertheless been proven much more complex issue in poor rural communities. In this type of environment, it can be difficult to get reliable estimates on household income and expenditures, and proxies such as house quality and ownerships are, therefore, often applied.

We find that different commonly used wealth proxies have opposite effects on child labor participation: (1) P*roductivity class* and *Farmland size* increase child labor, probably because of a higher marginal return to child labor. (2) The better the quality of the house of the farmer, the less likely is farm child labor to be observed. The study demonstrates that house quality is a much more relevant and robust wealth proxy, and reinstates the positive relationship between poverty and child labor.

These findings have important ramifications for the current efforts to reduce the participation of child labor in farming systems. The poorer the household, the more likely it is that child labor will occur. This confirms the frequently held notion that child labor is mainly explained by poverty. Many past studies on child labor and/or on other subjects use land size as a proxy for household wealth. This practice downplays the role of rural non-farm activities and might bias the conclusions drawn from the analysis. In this study, we have made the point that using land as proxy for wealth in child labor study will generally lead to a wealth paradox conclusion.

As the welfare of the farmer and his family improve, children will be withdrawn from farm work. However, it is important to keep in mind that wealth improvements that are channeled through improvement in agricultural productivity and that improvement in land ownership will inevitably increase the return to each unit of children's labor provided to the farm. Thus it will increase the propensity to use child labor, that is: if not parallel interventions aiming to prevent such side effects are not simultaneously implemented. These could include sensitization work and increased opportunity costs of alternatives such as school attendance. This will imply for example, lowering schooling costs proportionally, or introducing labor-saving technologies.

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