Assefa Admassie

Allocation of Children's Time Endowment between Schooling and Work in Rural Ethiopia

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The author:
Assefa Admassie, Center for Development Research, Bonn, Germany.
(contact: a.admassie@uni-bonn.de or Economic.dept@telecom.net.et)

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Abstract

Children have always been part of the economic life of societies. Historical evidence indicates that the contribution of children to family income in cash or in kind has been consistently significant. Currently, the issue of child labor has become an important global development issue in academic research. Empirical evidence indicates that child laborers are found mostly in developing countries and are employed mainly in agriculture and related activities. The aim of this study was to examine the decision-making behavior of subsistence rural households with respect to allocating their children's unit-time endowment among competing activities, including work and school attendance. A multinomial logit model has been used to identify the social, economic and cultural factors influencing household's decision about the allocation of children's time using data from a survey of rural households in Ethiopia. The results show that there are a number of child- and household-specific attributes, culture- and location-specific factors as well as economic factors related to household wealth and technological development that affect the decision-making process. Improving the educational infrastructure, encouraging technological adoption and creating a more stable economic base for rural households could significantly contribute towards reducing the problem of child labor.

Kurzfassung

Kinder waren schon immer Teil des wirtschaftlichen Lebens von Gesellschaften. Historische Belege weisen darauf hin, dass Kinder zu allen Zeiten einen wesentlichen Beitrag zum Familieneinkommen, sei es in Bargeld oder in Naturalien, geleistet haben. In jüngster Zeit ist das Thema Kinderarbeit zu einem wichtigen Thema in der Entwicklungsforschung geworden. Empirische Untersuchungen belegen, dass Kinderarbeiter hauptsächlich in Entwicklungsländern anzutreffen sind und vor allem in der Landwirtschaft und verwandten Bereichen beschäftigt sind. Das Ziel dieser Studie war es, zu untersuchen, wie sich subsistente ländliche Haushalte bei der Entscheidungsfindung in Bezug auf die Zeiteinteilung für ihre Kinder verhalten. Dabei konkurrieren die verschiedenen Aktivitäten der Kinder wie Arbeit und Schulbesuch miteinander. Ein multinomiales Logit-Modell wurde angewandt, um die sozialen, wirtschaftlichen und kulturellen Faktoren zu bestimmen, welche die Haushaltsentscheidung über die Zeiteinteilung der Kinder beeinflussen. Die Datengrundlage bildete eine Studie ländlicher Haushalte in Äthiopien. Die Ergebnisse zeigen, dass es eine Reihe von kinder- und haushaltsspezifischen Merkmalen, kultur- und standortspezifischen Faktoren sowie wirtschaftlichen Faktoren bezüglich des Haushaltsvermögens und der technologischen Entwicklung gibt, die den Prozess der Entscheidungsfindung beeinflussen. Eine Verbesserung der Bildungs-Infrastruktur, die Förderung der Einführung technischer Neuerungen sowie die Schaffung einer stabileren wirtschaftlichen Basis für ländliche Haushalte könnten wesentlich dazu beitragen, das Problem der Kinderarbeit zu verringern.

1   Introduction

Children have always been part of the economic life of societies. Even in what are now the developed countries, the proportion of children in the work force during the industrial revolution was significant. In fact, historical evidence documents that some of the worst forms of child labor once occurred in these industrialized countries. Even at the beginning of the new millennium, the incidence of child labor continues to be a cause for concern. However, today the problem is largely a phenomenon of the developing countries. In these countries, millions of under-aged children are forced to undertake work activities, willingly or unwillingly, under exploitative and hazardous conditions. The International Labor Organization (ILO) estimates that worldwide up to 250 million children under the age of 15 are forced to work (ILO, 1996a). More than 95 percent of these children are found in the developing countries of Africa, Asia and Latin America; the vast majority of whom do not have access to primary education. Nevertheless, no one actually knows how many children are working today, primarily because many of them are employed in the invisible, informal sectors, and also because the estimates on child labor vary depending on how the term is defined. Although estimates show that there is a declining trend in participation rates, the number of child workers still continues to rise in absolute terms.

Concern about child labor is based largely on three broad perspectives: the humanitarian concern, the developmental concern and the economic concern (Anker, 2000). The humanitarian concern emphasizes the need to protect children from the worst forms of child labor,[1] since working children are vulnerable to abuse and exploitation. Children are often forced to do work that is beyond their physical capabilities. Childhood is a critical stage of life that must be respected and honored. It is a period of learning, recreation and physical, mental and social development, thus forming the basis for the transition to a productive and capable adulthood. Children have the right to a nurturing and stimulating environment that fosters growth and development in all areas of their lives. The participation of children in work activities can deprive them of their childhood by denying them the opportunity for meaningful relationships with their families and peers as well as the time for play, recreation and rest. In this respect, child labor can be considered a violation of their human rights.

The second concern about child labor relates to its interference with children's abilities to attend and do well in schools. Empirical evidence shows that child labor directly competes with school attendance. If children are unable to attend schools and to have sufficient time for play and recreation, their mental development can be seriously impaired. Thus, early participation in

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[1] According to the ILO Convention No. 182, the worst forms of child labor are comprised of all forms of slavery or similar practices, including the sale, trafficking, bondage and serfdom of children and their forced or compulsory recruitment, the use of children in the sex industry, in drug trafficking, as well as all forms of work that are likely to harm the health, safety or morale of children (ILO, 1999).

the labor force may be a dis-investment in the formation of human capital, having detrimental effects on the subsequent private and social returns. However, some argue that the activities of children that do not constrain human capital development should not necessarily be considered as detrimental and could even be stimulating. According to this view, while excessive and long hours of full-time work may conflict with school attendance and performance, a few hours of work during holidays and after school may not. Light work could be important for children, since it teaches them valuable skills and knowledge. Children could be pushed out of schools not only because of work commitments but also because of the poor quality of the education provided. Therefore, the provision of good quality education is essential and is the best means to discourage and justify the elimination of child labor. If school quality is poor, costs are prohibitive or school is not available, light and non-hazardous work might even be in the best interest of the child than school attendance or idleness. Hence, child work should be perceived as harmful only if it is exploitative or is in conflict with young children's intellectual and physical development.

The final aspect of child labor relates to its anticipated micro- and macroeconomic impacts and its intricate linkage to poverty. Poverty is often considered to be one of the main determinants of child labor. Empirical studies show that the survival of poor families partly depends on the cash or the in-kind contribution of their children. Hence, many argue that child labor programs should consider the income needs of poor families, which can be addressed, for example, through targeted income transfers or subsidies to poor families and the provision of income-generating opportunities for adult members of the family. Within the framework of its labor market effect, child labor is thought to displace the work of unskilled and less-educated adults, thereby reducing wage rates and increasing adult unemployment. The debate and struggle for the establishment of universal labor standards is partly a response to this concern. However, participation of children in unpaid family work or housework may not necessarily have a negative effect on the labor market.

Currently, the issue of child labor is receiving increasing attention from the academic professionals, media and international organizations.[2] The most common reactions to this social problem have been legislation banning child labor and trade sanctions. However, many argue that trade sanctions are disguised protectionist devices. Similarly, legislation, even if it can be enforced, may not be the only or necessarily the best way to combat child labor.[3] Moreover, it is not yet clear whether such policy interventions really can be effective in reducing the incidence of child labor, particularly within the context of subsistence rural economies in Africa. The few empirical works on child labor have focused disproportionately on the visible forms observed mostly in the labor-intensive manufacturing sector in South Asia and Latin America. The results

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[2] For instance, international organizations such as the ILO and UNICEF repeatedly have taken up the issue in various public forums, which contributed to sensitizing the general public. Increasing interest in the status of child work in developing countries and its implications for children's human capital development is also being observed.

[3] Child labor legislation needs to be accompanied by a range of targeted interventions depending upon the institutional arrangement, types of child labor prevalent and the capacity of the individual country.

of these studies are very diverse.[4] Empirical results vary and are ambiguous for different regions, time periods, age groups, model specifications and, above all, interpretations of the term child labor (Basu, 1999). Also, many studies do not consider domestic work as child labor, and they distinguish between market and non-market work, although all of these can become socially exploitative.[5] Differentiating between market and non-market work may mean ignoring much of its effect on African children, particularly girls, who are occupied mostly within the household.

Although the lack of systematic data has undermined the amount of research done on the topic in Africa, the literature shows that Africa has the highest rate of child labor force participation rate in the world. Eastern Africa has the highest incidence of child labor within the African continent. Child labor in sub-Saharan Africa is mostly a rural phenomenon and is undertaken either in the home or on the farm. Often, housework has not been considered as a potential impediment to schooling (Levison and Moe, 1998). Work in rural areas could accentuate poverty if it conflicts with school attendance. If children are required to work for too many hours, both domestic and farm work can be as detrimental to them as participating in the labor market. It is also important to determine whether child work is a choice or is rather a function of household poverty or poor access to schools. A holistic approach is needed, which considers schooling in conjunction with labor force participation, farm work, domestic work and household responsibilities, in order to formulate policies that will encourage greater attainment of education. Policy interventions require careful analysis of the supply-and-demand factors involved in the practice of child labor.

One of the controversial problems in the child labor debate is the lack of a uniform definition for the term; no universally applicable definition exists. There are important disagreements and controversies on what constitutes child labor. Generally, the definition ranges from one extreme position, which considers all non-educational, non-leisure time activities of the child, including light work after or before school or during school holidays, as child labor, to the other extreme position, which considers only full-time employment in economic activity as child labor. The latter position excludes housework and light work that might endanger the physical, psychological, mental and social development of the child.[6] The term child labor may encompass very heterogeneous activities, ranging from wage employment, trading and heavy physical work to housework (household chores) or home-based domestic work, which could be equally detrimental to the health, education and normal development of children (BMZ, 1997). Some work activities are acceptable and constructive, making children less marginalized, while others can be very exploitative and harmful, thereby hindering their mental and physical development.

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[4] Some of the recent works in this area include Canagarajah and Coulombe (1998), Grootaert and Patrinos (1998), Patrinos and Psacharopolous (1997), Jensen and Nielsen (1997), Bhalotra and Heady (2000), Cockburn (2000), Ray (2000), and Blunch and Verner (2000).

[5] The ILO does not consider cooking, cleaning, child care and other domestic duties as child labor (Ray, 2000). As a result the ILO estimates bias downward the estimates of female child laborers, since boys tend to be less involved than girls in domestic work.

[6] For an extensive review of the different definitions of child labor in the different literature, see Assefa (2000).

International organizations also differ in their interpretations of who is considered a child. For instance, the ILO's Convention 138 states that the minimum age for employment should not be less than the age of compulsory education and, in any case, should not be less than 15 years (ILO, 1973).[7] On the other hand, UNICEF defines a child as any person who is under the age of 18 years, and the organization argues that unless the work endangers children's physical, cognitive, social and psychological development, it may not necessarily be considered harmful. The African Charter on the Rights and Welfare of the Child also defines a child as every human being below the age of 18 years, who should be protected from all forms of exploitation.[8] The lack of a uniform definition for the term has led to different estimates of the number of working children.[9] Therefore, whether all kinds of work activities, including unpaid work on family farms, household enterprises and domestic work, should be considered as child labor or whether it should be viewed only as wage employment, are still controversial issues.

In the context of this study, the term child labor is used to describe all activities that are understood to be harmful to children with negative implications on their normal physical, mental, psychological and social development. It consists of any activity that the child undertakes to help the family in its subsistence efforts, whether paid or unpaid and legal or illegal. Any form of child work that limits their capabilities to lead a worthwhile life as children, or as adults in the future, should be seen as intolerable (Sen, 1981). The traditional approach of distinguishing between economic (i.e., labor force) and non-economic (i.e., non-labor force) activities is illogical and impractical for most children in Africa and rural Ethiopia.

The major goal of this paper is to examine and discuss the impact of household assets and modern agricultural practices on work and school attendance in rural Ethiopia. The social and economic determinants of school attendance, working and combining work with school attendance are jointly estimated. Ethiopia was chosen for this study, because it is characterized by a high incidence of poverty, low school enrollment rates, recurrent drought and the consequent famines and because of the significance of agriculture in the rural economy, all of which accentuate the incidence of child labor (Basu, 1999; ILO, 1995; ILO, 1996b; Assefa, 2000). Ethiopia also has one of the highest rates of participation of children in the labor force in the world (ILO, 1996c). Understanding the pattern of the use of children's time in the context of a rural subsistence economy is important, not only because young children are made to undertake work obligations that may be beyond their physical capability, but also because of its long-term effect on human capital formation.

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[7] Convention 138 allows countries whose economy and educational facilities are insufficiently developed to initially specify the minimum age of 14 and to reduce from 13 years to 12 years the minimum age for light work.

[8] Article 15 of the Charter states that every child shall be protected from all forms of economic exploitation and from performing any work that is likely to be hazardous or to interfere with the child's physical, mental, spiritual, moral or social development (OAU, 1990).

[9] For instance, a study in an Indian district showed that if the ILO definition is used, 13 percent of the children aged 5–14 years were laborers, while a more liberal definition increased the rate to 33 percent (Jayaraj and Subramanian, 1997). Anker (2000) also argues that several estimates of child labor are needed because of the complexities and the prevalence of different forms of child labor.

The paper is organized into five sections. Section 2 discusses the theoretical framework used for analyzing the decisions about the use of children's time and the empirical econometric model adopted. Section 3 reports the data used and some descriptive statistics on the incidence of child labor. Section 4 presents the results of the econometric analysis, and section 5 draws the main conclusions and tentative policy implications derived from the study.

In many developing countries small and medium enterprises (SME) account for a significant share of production and employment and are therefore directly connected to poverty alleviation. Especially in developing countries SMEs are challenged by the globalisation of production and the shift in the importance of the various determinants of competitiveness. Through the rapid spread of information and communication technologies (ICT) and ever decreasing prices for communication, markets in different parts of the world become more integrated. Therefore, one basic question is whether the use of ICT (as production technology, as information processing technology or as information communication technology) can help them to cope with these new challenges. The spread of ICT has led several commentators to argue that these technologies are creating a new economy – an information economy – in which information is the critical resource and basis for competition. It is argued that in remote regions, the disadvantages that arise with isolation can be significantly lessened through access to rapid and inexpensive communication (Torero 2000). However, there are also more pessimistic views that assume that the digital divide will increase and therefore producers in developing countries and especially in rural areas will face even grater disadvantages relative to their competitors in developed countries (Bedi 1999).

2 The theoretical framework and empirical model used

2.1 The theoretical framework

The theoretical framework for analyzing households' decisions about the allocation of children's time is best captured by the household production function approach formulated by Becker (1965).[10] The household economic theory of labor deployment states that intra-household decisions regarding task allocation are made on the basis of utility maximization. This framework has been widely used in empirical works to study the joint allocation of time of household members. The model assumes that the household makes joint decisions on how many children to have and how to allocate the time of household members to market and household work and to schooling (Rosenzweig and Evenson, 1977; Chernikovsky, 1985). Household members are allocated those tasks that will bring the greatest returns to the household. For instance, Becker (1981) argues that the sexual division of labor is a logical response to women's reproductive role. As women bear children, they are most suited to their care and are consequently tied to tasks within the home. Men are not as well deployed for childcare and are therefore best deployed generating an income for the family.

Similarly, a child's non-leisure time can be spent on schooling, on home-based production, on economic activity in the market or on a combination of these. Thus, the three rival claims on the non-leisure time of the child will be school attendance, work and the combination of school attendance with work. A household allocates the time of children between these competing activities, taking into account the private returns to each activity, and the household allocates the time of its children to wherever the perceived private return is highest until the marginal return is equalized across all of the child's time.[11] Thus, child labor becomes a consequence of a rational family strategy if the marginal benefits of child labor (i.e., earnings and saved costs of schooling) are higher than the marginal cost of child labor in terms of the forgone return to human capital investment.

According to Singh et al. (1986), the basic household model specifies that the household maximizes a utility function at any given production cycle:

$$u = u(X_a, X_m, X_l) \tag{1}$$

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[10] Becker's model is often criticized because of its neglect of intra-household bargaining and power relations. But it is not realistic to assume that a child will have outside bargaining options.

[11] Often the household's utility function is dominated by the head of the household, and the welfare of the child may carry little weight in the decision-making process (Grootaert and Kanbur, 1995).

where the commodities are home-produced (X_a), purchased from the market (X_m) and leisure (X_l). The above utility function is well behaved: quasi-concave with positive partial derivatives. The commodity vector (X) can be a vector of commodity consumption for different members of the household. The household maximizes its utility subject to three constraints, namely a production constraint, a time constraint and a budget constraint. In the first place, the household faces a production constraint, or production technology that depicts the relation between input and output that is given as:

$$Q = q(K, L) \tag{2}$$

where K is the household fixed asset, such as land, and L is the total labor input, including family labor, child labor and hired labor.

Similarly the household also faces a time constraint, since it cannot allocate more time to leisure, home production or on employment in the labor market than the total time it has available. This is specified as:

$$T = X_l + F \tag{3}$$

where T is the total stock of household time, X_l is the leisure time and F is the total family labor input in the production of X, including child labor.

Finally, there is the household's cash income constraint, which is specified as:

$$P_m X_m = P_a(Q - X_a) - w(L - F) \tag{4}$$

where P_m and P_a are the prices of market-purchased commodities and the household's own produced commodities, respectively. Q is the household's own production, so that ($Q-X_a$) is the marketed surplus; w is the market wage rate, and (L-F) is the hired labor input. The production constraint, the cash income constraint and the time constraint can be combined to get the full income constraint. Substituting the production constraint into the cash income constraint for Q and substituting the time constraint into the cash income constraint for F yields the following single full income constraint:

$$P_m X_m + P_a X_a + w X_l = P_a q(K, L) - wL + wT \tag{5}$$

The left hand side shows the total household expenditure on three items: the market purchased commodities, the household's own production and its purchase of own time in the form of leisure. The right hand- side captures the full income of the household. Hence, the household maximizes (1) subject to (5).

The above standard constrained maximization household model, which explicitly takes into account the contribution of children and regards households as multi-personal economic units, i.e., both as producing and consuming units, has been adopted as the theoretical framework in this study. It is assumed that a household's utility depends on the level of consumption of purchased and own-produced goods (Q), representing the standard of living of the household, the child's school time (S), and the child's leisure time (H). The vector (Z) represents the observable child, household, and environmental attributes, which are exogenous, and (e) the stochastic element that captures the unobservables.

$$u = u(Q, S, H; Z, e) \tag{6}$$

The composite commodities are produced on the basis of the available concave production functions for the household, using household assets and the time of the household members as inputs. The household's income is expended on consumption and on schooling.

The scope of action is restricted by two constraints - the income constraint, which states that the household's expenditures must be equal to the household's money income in each period, and the time constraint, which states that the total time devoted to several activities must be equal to the entire time available for each individual. As pointed out earlier, parents determine in which manner the total time endowment of a child may be allocated among school attendance, leisure, work at home or on the farm and even work in the labor market for wages. In the case of a subsistence rural economy where a labor market is nonexistent, the total child time available (T_c) can be devoted to schooling (T_s), leisure (T_l), work (T_w) or a combination of these and produce the time constraint given as:

$$T_c = T_w + T_s + T_l \tag{7}$$

Households then maximize household utility subject to the combined time and income constraints with respect to the composite commodities.[12]

2.2   The empirical model used

The study has adopted a general utility-maximizing framework to model the choices regarding child-time-allocation activities as a function of child-specific, parental, household, environmental, technological and cultural characteristics. It is assumed that the time allocation decisions for the children are made either through a complete agreement among family members regarding the choices or by an altruistic adult, who often is considered to be the household head.

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[12] Maximization of the utility function subject to the household income or expenditure constraint and the time constraints of each individual yield the shadow price of each commodity and the familiar first order conditions for profit maximization.

Households' decisions about allocating their children's unit-time endowment can be econometrically modeled in different ways depending on the number of options and on the view one holds about the decision-making process. The decision can be modeled on the basis of simultaneous consideration of all the options or on the basis of an ordered decision. If the decision can be modeled in terms of a dichotomous choice model and the decision to work and to go to school are assumed to be independent, then a univariate probit model can be used. But if the two decisions are assumed to be made jointly, a bivariate probit model will be the appropriate approach. Under circumstances with more than two possible states in which a child could be at any one time, the bivariate or univariate probit approach will not be suitable. Hence, when a simultaneous decision-making process is assumed for three or more alternative choices, a multinomial choice model is appropriate.[13]

Although, there may be several activities that children may undertake simultaneously, the study assumes that a child's unit-time endowment can be used for four mutually exclusive activities. At a particular time, a child could be only attending school, only working, attending school and working at the same time or being idle, i.e., neither working nor attending school (leisure). This gives rise to the polychotomous choice framework.[14] Hence, the probability of a child having activity j (j =0 inactive; j = 1 school only; j= 2 work only; and j= 3 school and work) is given by the following multinomial logit model.

$$prob(Y_i = j) = \frac{e^{a_j + b_j X_j}}{\sum_k e^{a_k + b_k X_k}}; ..j,k....0,1,2,3 \tag{8}$$

The multinomial probability model assumes that the possible disjunct states are exhaustive in that they cover all possibilities. The probability of each outcome is a function of the same set of explanatory variables Xs. In this study four possible decision outcomes have been considered: school attendance only (A), work only (B), combining school attendance and work (C) and being inactive (D). Assuming that the inactive group is chosen as the standard or base alternative and considering the fact that the sum of the probabilities of the four alternatives must be unity, it can be shown that:

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[13] Grootaert (1998) argues that households make sequential decisions in allocating the time of their children between school and work rather than a simultaneous decision. But there is no concert theoretical support suggesting that households make sequential decisions.

[14] The neither category includes all those children for whom the main activity was neither school attendance nor work participation.

$$prob\,(school\,) = \frac{e^{x\beta_A}}{1 + e^{x\beta_A} + e^{x\beta_B} + e^{x\beta_C}}$$

$$prob\,(work\,) = \frac{e^{x\beta_B}}{1 + e^{x\beta_A} + e^{x\beta_B} + e^{x\beta_C}}$$

$$prob\,(school\,+work\,) = \frac{e^{x\beta_C}}{1 + e^{x\beta_A} + e^{x\beta_B} + e^{x\beta_C}}$$

$$prob\,(inactive\,) = \frac{1}{1 + e^{x\beta_A} + e^{x\beta_B} + e^{x\beta_C}} \dots\dots\dots \dots\dots\dots \dots\dots\dots \dots\dots(9)$$

Given the above specification, the likelihood function becomes:

$$L = \prod_{s} \frac{e^{x_s\beta_A}}{1 + e^{x_s\beta_A} + e^{x_s\beta_B} + e^{x_s\beta_C}} \prod_{h} \frac{e^{x_h\beta_B}}{1 + e^{x_h\beta_A} + e^{x_h\beta_B} + e^{x_h\beta_C}} \cdots \prod_{m} \frac{1}{1 + e^{x_m\beta_A} + e^{x_m\beta_B} + e^{x_m\beta_C}}$$

(10)

where the subscripts s, *h, k* and *m* refer to those children attending school only, working only, combining work and school attendance and being inactive, respectively. Given *n* children, each of which will fall into one of the *j* categories with probabilities given by (9), the likelihood function for the multinomial logit model given by (10) can be summarized by defining a set of dummy variables:

$$y_{ij} = \begin{cases} 1..if..the..i^{th}..child..falls..in.the..j^{th}..category \\ 0...otherwise \end{cases}$$

(11)

Given the respective probabilities and the specification in (11), the likelihood function, which is a generalization for the binomial logit model, the equation can now be written as:

$$L = \prod_{i=1}^{n} p_{i0}{}^{y_{i0}} p_{i1}{}^{y_{i1}} p_{i2}{}^{y_{i2}} p_{i3}{}^{y_{i3}}$$

(12)

where the P_is are the respective probabilities of a child being in the inactive group, school attending group, working group or school-work group. Finally, following the usual procedure, the log likelihood function can be derived from (12)

$$\log..L = \sum_{i=1}^{n} \sum_{j=0}^{3} y_{ij} \log..p_{ij} \tag{13}$$

By differentiating the log likelihood function given in (13) with respect to the parameters (β_i), the maximum likelihood estimators can be generated through an appropriate mathematical iterative procedure.

Unlike the standard regression analysis, the parameter value (β) is not directly interpretable as the effect of a change in the explanatory variable on the mean or expected value of the dependent variable.[15] The coefficients need to be adjusted to be marginal effects in the case of the logit model. In other words, the marginal effect, which gives the partial derivatives indicating the change in the probability of the dependent variable relative to a unit change in one of the independent variables, needs to be computed. As the relationship between the regressors and the absolute probabilities is nonlinear, marginal effects vary according to the choice of vector X and, consequently, they will vary among individuals according to the point of evaluation. By differentiating the multinomial logit model, we find the marginal effects of the explanatory variables on the probabilities as:

$$\boldsymbol{d}_j = \frac{\partial P_j}{\partial X_i} = P_j \left[\beta_j - \sum_{k=0}^{J} P_k \beta_k \right] = P_j \left[\beta_j - \overline{\beta} \right] \tag{14}$$

For continuous variables the marginal effect is the probability change in response to an increase in the value of the independent variable by one evaluated at the mean value. For dummy variables the marginal effect is computed as the difference in probabilities of the dependent variable between the group with designated value 1 and the reference group. The probabilities are constrained to sum to zero for each variable across the choices in the multinomial logit model. It should also be noted that the signs of the β coefficients are not necessarily equal to those of the marginal effects.

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[15] The parameter (β) simply gives the change in the log of the odds ratio ($P_i /(1-P_i)$) per unit change in the explanatory variable and not the change in the probability itself.

3   The data and some descriptive statistics

3.1. The data

The data used for this study came primarily from an LSMS-type survey on rural households in Ethiopia. The Department of Economics at the Addis Ababa University undertook five rounds of rural household surveys in collaboration with different organizations, such as the Center for the Study of African Economies (CSAE - Oxford University), IFPRI and USAID. ZEF also participated in the fifth round of the rural survey, which was undertaken during the 1999/2000 crop season in 18 sites. The main source of data for this study was the fifth round of the survey. Additional information from previous rounds of surveys also was used to complement the present data set. The fifth round survey involved 1,681 households with an average household size of 5.88 members, giving a total of 9,884 individuals. Of these individuals, about 49.6 percent were males, and 50.4 percent were females. Also, some 47.6 percent of these individuals were below the age of 15 years. The data included information on the primary and secondary occupations of every member of the household, including children above the age of 4 years. It is not uncommon to find children participating in more than one form of activity in rural Ethiopia. For instance, it was observed that children combined school attendance with work. Children also may participate in different types of work activities. For the purpose of this study a child has been assumed to be in one of four different states: attending school, working, combining school attendance with work or doing none of these activities at any particular time.

Farm and household are the main types of work activities in rural Ethiopia, since wage employment opportunities outside the household are nonexistent. Herding livestock, fetching firewood and water, taking care of younger siblings and the elderly as well as domestic activities such as cooking and cleaning are the main types of work for children in Ethiopia. Children start participating in these work activities very early, even before reaching the age of four years (see Table 1). Similarly, some children also start going to school at an earlier age than usual.[16] Therefore, children between the ages of 4 and 14 years have been the main focus of this study. The upper age limit was chosen because it defines the age at which some pupils begin their secondary education and because that is the minimum age for employment according to the Ethiopian Labor Law (TGE, 1993). Moreover, because of lack of secondary schools or limited number of places in schools, it is expected that after this age schooling might even be less of a

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[16] The school starting age in Ethiopia is set officially at seven years. But since there is no compulsory education system in the country many children do not start school attendance at the age of seven. Some children may start going to school at younger ages particularly in urban centers while late school enrolment is very common in rural areas.

choice. There were a total of 3,611 children between the ages of 4 and 14 years, who were either in school and not participating in other activities, specializing in work, combining school attendance with work or were neither in school nor in the labor force. But individuals with missing values have been excluded from the final analysis, and the pooled sample consists of only 3,003 children. In addition to the pooled sample analysis, gender-disaggregated models also were specified and analyzed. The results of this analysis are discussed in section 4. The next section presents some descriptive statistics on the prevalence and nature of child labor in rural Ethiopia.

3.2   Some descriptive statistics

3.2.1 *Distribution of children's main activities by age*

The early participation of children in work is a cause for concern and is not uncommon in developing countries such as Ethiopia. The employment of very young children emerges as an alarming problem in the child labor literature. The younger the child is, the more vulnerable he or she is to physical, chemical and other kinds of hazards at the workplace and to the economic exploitation of his or her labor. Previous empirical evidence shows that children begin participating in work activities at ages as young as four or five years (Canagarajah and Coulombe, 1997; Assefa, 2000). Our data also show that some 12 percent of the children have started participating in work activities by the age of 4 years (see Table 1). In order to take stock of the main types of activities performed by children, respondents were requested to identify the primary and secondary occupation of every member of the household, including children. The data presented in Table 2 clearly show that children participate in a multitude of work activities, such as farm work, domestic work, herding, child care as well as other informal activities. The empirical evidence presented in the table shows that there could be a substantial amount of harmful child labor - harmful in the sense that it may directly conflict with children's education. Work participation by children is significant not only below the minimum working age, but also among those children who are supposed to be in school. The table shows that working is the primary responsibility for more than 37 percent of all children below the age of 15 years, while only 14 percent of the children reported that their main activity is school attendance.

Although the large majority of economically active children belong to the above-8-years age category, the proportion of child workers under the age of 8 is far from being negligible. Nearly one-third of the children less than 7 years old have indicated that their main occupation is work, whereas only 1 out of 20 child between the ages of 4 and 7 years has stated that his or her main obligation is to attend school. In general, work participation of children increases with age and reaches its peak at around 11 years, after which it starts to decline. Over 45 percent of the surveyed children between the ages of 8 and 11 years and over 35 percent of those in the next

higher age category reported that work is their primary responsibility. School attendance also seems to increase with rising age. Thus, with rising age the activity tends to shift dramatically from the inactive state to either the schooling or work state or both, as expected. In general, the results imply that there could be a high trade-off between child work and education. Child work could be a major determinant of educational attainment in the sense that every hour allocated to work reduces the time available for schooling. A full-time working child, be it in the house, on the farm or in the labor market, is unlikely to be enrolled in school.

3.2.2 *Combining school attendance with work*

Although one could argue that whatever promotes school attendance is likely to impede child labor, working and schooling may not necessarily be mutually exclusive. Putting it differently, school attendance may not necessarily be the exact inverse of child labor, as simplistic hypotheses assert. If children are engaged in work, this may not necessarily mean that they do not have access to formal schooling. And the mere fact of being in schools may not protect children per se from the exploitation of work. Non-harmful child work is often part of life in many developing countries and may even be necessary for family survival. Work may be preferred above school attendance and may be seen as a more effective strategy to prepare for adult life, or it may be imposed by economic conditions that the available school does not address. Unlike wage employment, which often absorbs the child's entire time endowment, domestic and farm work may be integrated with schooling. Moreover, some work activities could be more compatible with school attendance than others (Assefa, 2000). Yet excessive and long hours of work could definitely be incompatible with school attendance and affect the learning ability of the child. Combining work with school attendance also might be expected if the school system operates in shifts, and children spend relatively little time in schools. Empirical studies from other countries also indicate that many children combine school attendance with work (Rodgers and Standing, 1981; Patrinos and Psacharopolous, 1997; Grootaert, 1998; Bhalotra and Heady, 2000).

The proportion of children who are combining school attendance with work activities is presented in Table 2. More than one-fourth of the surveyed children below the age of 15 years reported that they combine school attendance with work activities. About one-third of all the children between the ages of 8 and 11 years and more than two-fifths of the children between the ages of 12 and 15 years are combining work with school attendance. While the proportion of children specializing only in work activities shows a declining trend, the proportion combining work with school attendance shows an increasing trend for all children and age categories. In other words, the likelihood of combining work with school attendance increases with age, reaching nearly 45 percent by the age of 15 years. Therefore, it would appear that combining farm work and/or domestic work and school attendance occurs frequently in rural Ethiopia. This has important policy implications, particularly for educators. Moreover, the question may not

necessarily be whether children should participate in work activities or not but rather for how long.

3.2.3 *Gender differences*

The participation rates in work activities and in school attendance usually are different for boys and girls. Empirical studies from other developing countries have found that girls have relatively higher participation rates in domestic activities than boys. The main reason for this is that traditions usually force parents to prepare their female children to become good wives in the future, thereby imposing a greater work burden on girls. The present data also show that the incidence of child labor and school attendance differs according to gender (see Table 3). Although school attendance generally increases with age for boys and girls, the school participation rate is relatively higher for boys than for girls. More specifically, the increase in school attendance from ages 12 to 15 is much greater for boys than for girls. Among the 8- to 11-year-old boys, about 17 percent were in school during the time of the survey. The school participation rate for the 12 to 15 year old boys and girls increased to nearly 21 and 17 percent, respectively. On the other hand, participation in work is generally higher among female children, although there is a general decline in the work participation rate for both boys and girls after the 11th year. The decline in the work participation rate after age 11 was much higher for male children than for female children. Table 3 also shows that about one-third of the boys and more than 30 percent of the girls in the 8- to 11-years-old category combine work with school attendance.

The gender difference in school attendance and work participation rates may be explained primarily by cultural factors. The practice of early marriage for girls, which is very common in rural Ethiopia, is one such example. Early marriage and fear of abduction are the most important reasons for the low school enrollment and high school drop-out rates for girls in rural Ethiopia. Similarly, religion also plays a crucial role in making decisions about children's time use. Gender differences may influence decisions about children's allocation of time because of parental preferences. If stressed economically, parents might sacrifice the education of girls rather than that of boys, thereby discriminating against the girls.

3.2.4 *Types of work activities performed by children*

Child labor is often interpreted on the basis of the internationally accepted definition of labor force participation in economic activities. If the production of economic goods and services includes the production and processing of primary products, whether for the market, for barter or for their own consumption, then child work in subsistence agriculture, subsistence animal care, home improvement and the processing of food for family or their own consumption can be considered as child labor activities. As pointed out elsewhere, the contribution of children to the

rural economy in Ethiopia is mainly in the form of farm and domestic work, since wage employment opportunities outside the household are nonexistent. Domestic work includes fetching firewood or water, cooking, cleaning, laundry, shopping, child care and similar activities. Herding livestock is one of the most important activities of children in rural Ethiopia, absorbing significant portions of the children's time and energy. Some children also participate in work in the informal sector, including trading, manual work and other income-generating activities.

Children's labor contribution to farming and to output processing and marketing is probably substantial. In this study it has been observed that children's contributions to the total agricultural labor input could be as high as 95 percent. On the average, children were found to contribute about 5 percent of the total agricultural labor force. Other studies in Africa also have documented children's immense contribution to the farm labor force to agricultural production (Reynolds 1991 cited in Andvig 1997). Their contribution may vary according to different types of activities, since work participation generally differs on the basis of gender.

As stated earlier, some work activities may be more compatible with school attendance than others, at least for those children who combine schooling with work. For instance, fetching of firewood and water may be relatively more compatible with school attendance than child care (Assefa, 2000). Thus, looking only at the main activities in an aggregated way as presented in Tables 2 and 3 may obscure the harmful effects of different types of work activities on children's scholastic development. It is therefore necessary to disentangle the work activities into their specific components and on the basis of gender in order to isolate their differential impacts and to see if some activities could be more gender biased than others. Table 4 presents the proportion of rural children performing different types of work activities by age and sex. As pointed out earlier, farm and domestic work are the main types of work activities for rural children in Ethiopia. However, the table shows that male and female children generally specialize in different types of work activities. While more than 47 percent of the boys between the ages of 12 and 15 years were engaged in farm work, only 3 percent of the girls in the same age category participated in farm work. On the other hand, about 13 percent of the male children between the ages of 12 and 15 years and more than 82 percent of the female children in the same age group participated in domestic work. So it seems that there is a clear work specialization in which boys have a greater participation rate in farm work, while girls are primarily engaged in domestic activities. Both farm and domestic work increase with age for male and female children, respectively. Herding is an important activity for both boys and girls, although their participation in herding activities continuously declines as they get older.

3.2.5 Hours of child work

Participation of children in work for too many hours or work beyond their physical strength could have serious implications for children's physical and mental development. Work participation at early ages also may have several harmful effects, including possible damage to their health and psychological development and, most importantly, their educational development. Development in human capital is considered to be the most important avenue to economic and social development and to reducing poverty in the long run. Therefore, the main question with respect to child labor may not be why children work, but how much time they spend on work each day. As pointed out earlier, the participation of children in work activities may not be harmful unless it affects the learning capability and the health of the child. The duration of the work activity is an important indicator of whether work will be harmful or not. Beyond a certain threshold, which could vary according to the age of the child and type of work, participation in work may have serious detrimental effects on children's ability to learn.[17] It may be difficult to reconcile long hours of work each day with study. In addition, fatigue caused by excessive hours of work can cause accidents. Therefore, one also should examine the implications of work in terms of the number of hours worked per week.

Moreover, our previous analysis has shown that many children actually combine work with school attendance. Hence, the use of only school attendance as a measure of scholastic achievements may obscure the harm to children's learning abilities caused by work. Children who work excessively long hours will be unable to learn properly because of exhaustion and insufficient time to attend school and study. From a policy perspective, participation of a child in work activities for a few hours is different from participation of a child for long hours. Empirical evidence shows that many children work long hours every day of the week. Some studies show that more than half of working children are toiling for 9 or more hours every day.[18] Many more work 7 days a week, including public holidays. ILO estimates show that some children might be working more than 56 hours per week, particularly in rural communities (Kebebew Ashagrie, 1998). In addition, many children work during the evenings or nights as well. According to the empirical evidence, in general female children work more hours than male children.

Table 5 reports the duration of different types of work activities performed by children in rural Ethiopia in terms of the number of hours worked per week. The table clearly shows that rural children could be subjected to excessively long hours of work. It indicates that some children are forced to work up to 80 hours per week, which implies that they may have to work for more than 12 hours every day. Moreover, there are also wide variations in the mean hours of work. On the average, boys spend more time in livestock herding and farm work, while girls

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[17] The ILO Minimum Age Convention (No. 60, 1937) states that no child under 14 years of age shall be employed on light work for more than 2 hours per day, whether that day be school day or holiday, nor spend at school and on light work a total number of chours exceeding 7 hours.

[18] According to research in the United States, school performance of young persons aged 12 to 17 years can be negatively affected after more that 15 or 20 hours of work per week. But this threshold is often substantially exceeded in developing countries, including Ethiopia, even among the children under 12.

spend more time on herding and child-care activities. One of the most important activities carried out by children that is incompatible with school attendance is child care. When young children are forced to take care of even younger siblings, they lose educational opportunities at school. The table does not include the hours spent on work over the weekends and on holidays. If the work done over weekends and on holidays is included, the average hours of work could even be much higher. Such excessive work hours definitely would affect children's physical development and reduce their learning abilities, even if they are able to attend school. Therefore, it should be considered harmful.

4 Impact of economic and social factors on the allocation of children's time endowment

Evidence in the previous sections has demonstrated that children undertake a variety of work-related activities, which may have serious implications for their educational development. The question that arises now would be "what determines the likelihood of children's school attendance and work-related activities". More specifically, an examination of the impact of the social, economic and cultural factors identified earlier on decisions about the allocation of children's time endowment in rural households would be interesting. On the basis of the theoretical and empirical model developed earlier, a multinomial logit model was used to address this issue.[19] The allocation of children's time endowment was hypothesized to depend upon child-specific and household attributes, school-related factors, cultural and regional factors, household physical and financial assets and improved agricultural practices (see Table 6). This section reports the results of the econometric analysis on the determinants of the allocation of children's time endowments among the four child activities. Three multinomial logit results are reported, one corresponding to the combined (pooled) sample of boys and girls, then separate models for male children only and for female children only. The marginal effects are reported in Tables 7 through 12, along with their respective significance levels.

4.1 Attributes of children and time-use decisions

The literature indicates that child-specific characteristics could have important implications for the allocation of children's unit-time endowment between labor activities and education. Characteristics such as the age and gender of the child and the biological relationship with the head of the household (son or daughter versus other relatives) could be important determinants of the likelihood of school attendance and work. The positive or negative influences of the effects of these variables usually are determined by socio-cultural factors. Gender considerations are important, because if poverty forces parents to choose which children should attend school, girls are usually less likely to be chosen. The allocation of a child's time endowment between schooling and work also will be determined by the child's age, with older children spending less time in schools and more time in work, particularly in wage employment. Greater age is often associated with more responsibilities, experience and human capital. Similarly, children of the household head may have a different time allocation curve relative to the non-biological children, such as nieces, nephews, grandchildren or other siblings living in the household. Having a non-biological relationship to the head of the household may decrease a

child's probability of attending school and increase his or her likelihood of working. Households often give their own children higher priority when they have to decide who should attend school and who should perform home duties. Foster children are very common in social environments characterized by an extended family system.

The main results of the child-specific attributes that were hypothesized to affect children's probability of school attendance, work participation, combining school and work or being inactive are similar to those reported in other studies. There is a clear and significant gender difference between male and female children in school attendance, work participation or in the combination of school attendance and work. Male children are more likely to specialize in school attendance or in combining work with school attendance but less likely to specialize in work activities than female children. The male dummy had the strongest effect on the work equation. The results show that boys are 3.6 percent more likely to attend school. They are also 5.2 percent more likely to combine work with school attendance, but are 6.6 percent less likely to specialize in work activities. Other studies have documented similar results. For instance, the study by Levison et al. (2000) showed that girls in urban Mexico are less likely to specialize in school than boys if a broader definition of work that includes housework is adopted. Studies from other African countries have reached similar conclusions. For instance, Jensen and Nielsen (1997) found that being a female child has a negative effect on school attendance in Zambia. Grootaert (1998) showed that girls in rural Cote d'Ivoire were 15 percent less likely to be in school than boys. The study by Canagarajah and Coulombe (1998) in Ghana also arrived at similar conclusions. A recent study by Blunch and Verner (2000) confirmed that girls are more likely to work than boys. All of these studies underscore the fact that girls generally have a lower probability of attending school than boys. Empirical evidence also shows that girls drop out of school earlier than boys, primarily because girls are either more overburdened with housework than boys or because of early marriage practices and early pregnancy (Jensen and Nielsen, 1997).

Having a biological relationship with the head of the household (being the son or daughter) significantly increases the likelihood of school attendance and the probability of combining work with school attendance. In other words, a child of the head of the household will be less likely to be engaged in activities harmful to children than other relatives. Non-biologically related children living in a household often substitute the labor of the household's own children. Our results show that the direct offspring of the head of the household are 8 percent more likely to attend school than distant relatives living in the household. Compared to other relatives, they are also 4 percent more likely to combine work with school attendance. On the other hand, sons or daughters of the head of the household are 11 percent less likely to specialize in work activities than other relatives. A household head tends to give his or her own children priority when deciding who should attend school and who should perform home and/or farm duties. These results have been supported by other empirical studies (see, for instance,

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[19] The analysis was done using an updated version of the *Limdep* software version 7.0 written by W. Greene.

Jensen and Nielsen, 1997; Canagarajah and Coulombe, 1998; Cockburn, 2000; Levison et al, 2000; Blunch and Verner, 2000).

The gender-disaggregated analysis shows that not being biologically related to the head of the household reduces the probability of attending school and increases the probability of work for both boys and girls. Daughters of the household head are nearly 14 percent more likely to attend school than other female relatives living in the household. On the other hand, female children of the head of the household are 13 percent less likely to specialize in work alone. Similarly, sons of the head of the household are 9 percent less likely to specialize in work. Both sons and daughters of the head are more likely to combine work with schooling than other members. Boys are nearly 5 percent more likely to combine work with schooling than other male relatives living in the household.

Age is another child attribute that is expected to have important implications for work and school attendance. Being older is usually associated with more experience and greater human capital, which influence the potential for wage employment and thereby induce children to leave school early. But in situations where wage employment opportunities in the labor market are limited and where work is broadly defined to include farm, domestic or other household activities, such as fetching firewood and water, child care, herding, etc., a positive association with school attendance could be expected. The probability of going to school or combining work with school attendance increases with age and decreases with its square, suggesting an inverted-U shaped relationship. Age has the strongest effect on the combined work and school participation equation. As the age of a child increases by one year, the likelihood of combining work with school attendance increases by 21 percent, while the likelihood of specializing in schooling increases by only 6 percent.[20] On the other hand, the likelihood of specializing in work activities declines by about 13 percent with a one-year increase in the child's age.

These results may seem incompatible with the results of other studies, which found a negative relationship between a child's age and school attendance (for instance, Jensen and Nielsen, 1997; Levison et al, 2000). It is often argued that older children leave school because of their desire to contribute towards the family income by working in the labor market. However, the studies which reported a negative association between the age of a child and work participation actually have considered only wage employment in which the characteristics are different from domestic and farm work. Greater age, which is associated with more experience and greater human capital influences potential wage employment and thereby induces children to leave school early. However, in an environment in which wage employment opportunities in the labor market are limited and work is broadly defined to include farm, domestic or other similar

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[20] In contrast to our results, Cockburn (2000) found a positive association between age of the child and work participation in Ethiopia. But his results are based on the assumption that schooling and work are mutually exclusive activities. Since rural children in Ethiopia undertake a multiple of activities simultaneously, such an assumption may be questionable.

household activities such as fetching firewood and water, child care, herding etc., a positive association with school attendance could be expected.

Age has a similar effect on male and female children's likelihood of school attendance and work participation. Female children's likelihood of specializing in school increases by about 8.5 percent as they get older, but at a decreasing rate.[21] On the other hand, female children's likelihood of specializing in work declines by almost the same amount as their age increases. In the case of boys, age also has an extremely negative effect on the likelihood of specializing in work. Boys' likelihood of specializing in work declines by about 16 percent with each year older they get. For both boys and girls, the likelihood of combining work with schooling increases significantly with each year of age. Boys are almost 25 percent more likely to combine work and school attendance, whereas girls are 16 percent more likely to combine the two activities with each year their age increases. The likelihood of staying idle declines significantly for boys and girls as they get older.

4.2   Household attributes and decisions about the use of children's time

Demographic and socio-economic characteristics of the household also affect decisions about the allocation of children's time and hence need to be controlled. Parental education, household size and composition as well as the gender and age of the head of the household have important implications for decisions about the allocation of children's time. Parental education generally reflects the earnings potential and the social respect of the head of the household. The positive effect of parental education on children's schooling can be interpreted as an income effect, as more highly educated heads of households have better potential incomes than those who are less educated. In addition, parental education is a measure of the value or importance that households attach to the education of their children. Education of the head of the household is also an indicator of the vulnerability of the households and the differences in attitudes among households on the return to schooling. In general, a higher level of education of the head of the household is expected to promote school attendance. For instance, we expect that children of more educated parents will spend more time in school and less time in work than children of illiterate parents. However, the counter argument points to the possibility that educated parents, particularly mothers, could be more likely to take jobs outside the home, thereby forcing children to contribute more to household production. But in a subsistence rural economy where employment in the labor market is limited, even for adults, this argument may not be realistic.

Two indicators of the human capital level of the head of the household have been used in this study: the literacy level of, and the highest grade attained in formal education by the household head. The results generally support the hypothesis that parental education increases

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[21] Contrary to our finding, a significant and negative effect of age on school attendance was observed in Pakistan by Bhalotra and Heady (2000). The authors argue that older children leave school because they complete their studies or fail to continue and because of higher potential wages associated with greater age and more experience.

the likelihood of school attendance and reduces the propensity to specialize in work activities. Each additional year of formal education of the household head reduces children's likelihood of specializing in work activities by more than 1.6 percent and raises the likelihood of school attendance by more than one percent. Similarly, literate household heads are 7.3 percent less likely to deploy their children in work activities only. Both literate household heads and those with formal education encourage the combination of work and school attendance. Compared to an illiterate household head, a literate household head is 4.2 percent more likely to encourage the combination of work and school attendance. These results are consistent with those reported by other empirical studies (Jensen and Nielsen, 1997; Cockburn, 2000; Levison et al, 2000). Grootaert (1998) found that the more educated the parents, the more likely a child is to combine education with work. Canagarajah and Coulombe (1998) also found that parental education has a stronger positive effect on school participation than on working.

A close observation of the gender-specific results reveal that both education variables were significant in some of the equations for boys and girls, but more so for girls. The literacy level of the head of the household negatively affects the likelihood of boys' and girls' specialization in work activities. Boys' likelihood of specializing in work activities declines by more than 6 percent if the head of the household is literate, while female children's probability of specializing in work declines by 9 percent. If the household head is literate, an increase in the level of education leads to an increase in girls' probability of school attendance by about 1.4 percent and reduces their likelihood of specializing in work activities by 2.4 percent. Education seems to encourage the combination of work and school attendance for both boys and girls. Boys whose household heads are literate are 5 percent more likely to combine work with school attendance, while girls are only 4 percent more likely to do so. Household heads with formal education are more likely to encourage girls' to combine work with schooling. Each additional year of formal education for the head of the household increases girls' likelihood of combining work with school attendance by about 1.4 percent, while boys' likelihood of doing so increases only by one percent. Hence, education of the household head is an important determinant of female children's school attendance.

Another household characteristic that has been considered in the child labor literature is the household size. Considerations of household size are important, because households often grow large by adding on children, which increases the dependency ratio and hence the likelihood that children will participate in work activities. Therefore, some studies have argued that the correlation between household size and child work may even encourage higher fertility rates (Rosenzweig and Evenson, 1977; Cain, 1977; Singh and Schuh, 1986; Eswaran, 1996; Bardhan and Udry, 1999). Some people suggest that children from larger households are more likely to work as a consequence of having fewer resources per person (Patrinos and Psacharopolous, 1997). But in cases where child work is exclusively on household farms and/or in domestic activities and in cases where farm sizes are relatively small, an inverse relationship between household size and child work might be expected. In other words, an inverse relationship

between family size and child wellbeing could be expected, because the resources per person would become smaller as family size increases (Bhalotra and Heady, 2000).

The household size and its composition may also have an important impact on the time-allocation decisions for children, since the presence of other individuals in the household may either provide substitutes for children or may create more work for them. Both the age and the presence of other siblings or older family members in the household may affect the schooling and work patterns. If other members of the household can take care of household chores, then school-aged children can be liberated from this housework, which is likely to prevent them from attending schools. The literature indicates that female labor is either a close substitute or complement to child labor. For instance, if there are many women in the household (mother, aunt, grandmother, etc.), we might expect that young children, particularly girls, might be released from household tasks to attend school. Canagarajah and Coulombe's (1998) study shows that the presence of female siblings in the household had a positive marginal effect on school participation in Ghana. Bhalotra and Heady (2000) also found that the proportion of females in the household has a negative effect on child work. However, Cockburn (2000) observed that the number of males and females did not have a significant effect on decisions about the use of children's time, thereby rejecting the substitution and complementarity theorem. On the other hand, the presence of younger siblings and/or older people in the household also might lead to a higher probability of domestic work for the children. Minding small infants is an important child activity that hinders school participation significantly in rural communities. Some studies have shown that larger dependency ratios increase the likelihood of child work and reduce the probability of school attendance.[22]

The household size, the number of females in the household, the number of infants (less than 4 years of age) and the dependency ratio (the ratio of dependents to the economically active population) were included in this study to demonstrate the effect of household size and composition on the time-allocation decision. The results indicate that each time the household size increases by one more member, the probability of combining work with school attendance decreases by one percent. On the other hand, a higher dependency ratio negatively affects school attendance, thereby raising the likelihood of child work. An increase in the dependency ratio reduces the probability of school attendance by about 2.3 percent. Most of the child activities considered here such as child care, fetching water and wood or other domestic work such as cooking and cleaning, are primarily women's activities in rural Ethiopia. While the presence of more females in the household means increased substitution of child work by female labor and less work burden for children, a higher dependency ratio means more work for them.

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[22] Some might argue that including household composition into the specification might introduce an endogeneity problem. But this argument is not convincing, since the time allocation of children is a short-term decision, while the household composition decision is a long-term decision, which is fixed in the short run or in the current time period.

For both boys and girls, larger household size discourages the probability of combining work with schooling. As household size increases, the probability of combining work with school attendance declines by about one percent. This result suggests that as household size increases, children are likely to specialize in either of the two activities or maximize their leisure time. The results also show that a higher dependency ratio leads to a decline in girl's schooling, thereby increasing their likelihood of specializing in work. A rise in the dependency ratio would decrease girls' likelihood of school attendance by more than 2 percent. The result suggests that when the dependency ratio increases, girls start assuming more responsibility for caring for the old and sick, even at the expense of their education. Age of the household head does not seem to affect the likelihood of school attendance and work participation significantly. However, older household heads seem to encourage combining school attendance with work, at least for female children. Contrary to our expectations, the number of younger siblings seems to have a positive impact on boys' school attendance.

The number of females in the household has a positive impact on the school participation and the joint work and school attendance equations, with a slightly stronger effect on the schooling equation. The result also shows that the number of females in the household increases the likelihood of school attendance for boys by about 2 percent, but the effect of the number of females in the household has not been significant for the female children's work in the schooling equation. The result shows that an increase in the number of females in the household elevates girls' likelihood of combining work and school attendance by more than one percent. Having more female members in the household will reduce the burden of domestic and farm work for boys and girls and enable them to attend school. It also implies that boys may have a comparative advantage over girls when the number of females in the household increases.

Other household characteristics that are important in the child time-allocation decision include the gender and age of the head of the household. The gender of the head is particularly important in Ethiopia, since highland farming is historically a male-dominated activity, at least in those areas where ox-plow culture is practiced. It is often claimed that households headed by females have lower access to productive resources and social services, which affects their productive ability and the intra-household allocation of resources, including education. Female-headed households are also more insecure than male-headed households. Hence, a negative association between schooling and female heads of families might be expected.[23] Differences between boys' and girls' school participation may also reflect attitudinal differences between male- and female-headed households towards education. Some studies have found that women have a stronger gender bias in favor of boys than men, implying that boys are more likely to attend school and less likely to work, whereas girls are more likely to be engaged in work activities in female-headed households. Boys may attend school more in such households, primarily because of a lack of other income-earning opportunities in the house or in the area.

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[23] Haddad et al. (1996) argue that female-headed households have more rationale in intra-household resource allocation patterns and invest on essential items.

The results presented in this study, though not statistically significant, suggest that having a female head of the household increases the probability of school attendance and the likelihood of combining work with school attendance, though the increase is small. Children from female-headed households are also less likely to specialize in work. Similar results were reported in other empirical studies (see, for instance, Canagarajah and Coulombe, 1998; Cockburn, 2000). On the other hand, Bhalotra and Heady (2000) found that having a female head of the household has a positive impact on farm work in Pakistan. Female heads did not show any significant impact on boy's time-allocation decisions but encouraged female children's school attendance in our study. However, girls from female-headed households are nearly 6 percent more likely to attend school than girls from male-headed households.

The likelihood of attending school or being engaged in work also is influenced by the age of the household head. It is hypothesized that the likelihood of a child attending school decreases with an increase in the head's age, while the likelihood of working increases. This indicates that young adults (or parents) are able to protect their children better from work than older adults. The result of this study indicates that the age of the head of the household has a significant effect only on the probability of the joint school-work decision. Older household heads are more likely to allocate the time of their children to the joint work and school outcome than younger parents. The likelihood of engaging children in both school and work activities increases by about one-tenth of a percent with each additional year of age of the household head. Similar conclusions were drawn by the Grootaert's (1998) study.

4.3   Impact of ethnicity and religious factors on time-allocation decisions

Religion and ethnic group were included in the study to examine the effect of cultural factors on children's time-use decisions. Ethnic dummies did not matter in the case of the work participation equation and in the case of combining work with school attendance. However, it was a significant factor in the schooling equation. Children from the Oromo ethnic group were 11 percent less likely to attend school than children from other ethnic groups. This negative association between ethnicity and school attendance may be due to cultural factors unique to the ethnic group or to supply-side problems. Resource endowment also may play a role. Families whose productive assets are limited or who live in areas where there is little economic dynamism can provide fewer work opportunities for their household members. For instance, having more land and cattle may encourage children's work participation more than school attendance. Being from either the Tigrawi or the Amhara ethnic group does not seem to have any significant influence on the allocation of children's unit-time endowment.

Cultural factors also may have different effects on decisions about male and female children's time allocation. Girls are often engaged mainly in domestic work because of specific cultural and social factors. The practice of early marriage for girls is a cultural practice that affects their school attendance significantly. Specialization in wage employment, farm work,

schooling and domestic work is often a function of gender. All the dummies for ethnicity except for the Oromo ethnic group are insignificant for both boys and girls.[24]. Boys and girls from the Oromo ethnic group are 10 and 14 percent less likely to specialize in school attendance than children from other ethnic groups, respectively. Although not statistically significant, the results show that boys and girls from the Amhara ethnic group are also less likely to specialize in schooling than the other groups.

The effect of religion has been significantly different the reference group on both the work participation equation and the combined school attendance and work equation. In relation to other religious groups, Orthodox Christian and Moslem households encourage work participation for their children but discourage joint school-work participation. A child from an Orthodox Christian family was 16 percent more likely to specialize in work and 14 percent less likely to combine school attendance with work than other religious groups (Catholics, Protestants, atheists, etc.). Similarly, Moslem children were 16 percent more likely to take work as a priority occupation and 17 percent less likely to combine work with school attendance. On the basis of these results, one might argue that the value of education is seriously undermined by both religions, which may be important deterrents to school attendance in rural Ethiopia.

Our results show that the religion dummies are significant for male and female children in both the work and the combined schooling and work equations. Both religion dummies encourage specialization in work and discourage school attendance as well as combining work with school attendance. Boys from Orthodox Christian families are 16 percent more likely to specialize in work activities than boys from other religions, but they are less likely to combine work and school attendance by nearly 19 percent. Moslem boys were also nearly 11 percent more likely to specialize in work and nearly 21 percent less likely to combine work and school attendance. Similarly, Moslem and Orthodox Christian girls were 18 and 15 percent more likely to specialize in domestic work, respectively, compared to girls from other religions. Moslem and Orthodox Christian girls are also 14 and 10 percent less likely to combine work with school attendance, respectively, compared to girls from other religions. Thus, religion does not have a differentiated impact on male and female children's school attendance and work.

4. 4 Supply-side school related variables

Access to primary education is the undisputed universal right of every child, and thus, school attendance is considered to be the main competing alternative to child work. With increasing globalization and technological changes, basic education is becoming more important than ever. A negative relation is assumed between school attendance and working, since the factors that increase the probability of attending school usually decrease the probability of working. A child who is in school is less likely to be in the labor market and vice versa. It is

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[24] The statistically insignificant results of ethnicity may be due to the correlation of this variable with the religion of

becoming increasingly evident that child work may not be entirely the result of economic need. Children may also be deployed to work activities because of school-related reasons, such as lack of schools, or because of the relative return to supply-side factors or the high cost of schooling.[25]. The failure of an educational system to offer adequate, stimulating and affordable schooling encourages children to drop out of schools in favor of work that appears to offer advantages more relevant to their everyday life. Parents also may undervalue the role and purpose of schooling and see work as a more valuable and certainly a more positive alternative if school is unattractive. Improvement in coverage, quality and affordability could lead to greater acceptance of schooling as the best alternative to child work and provide greater incentive for parents and children alike to participate more fully in schooling.

Families cannot afford to send their children to school if the price of schooling is too high or if the household income is too low (Bonnet, 1993). Increased household wealth levels will encourage investment in schooling only if the expected net returns from schooling are greater than those from child labor activities. For instance, if there is high unemployment of educated youth in the economy, parents will be discouraged from investing in their children's education. The important variables that have been included in this analysis to reproduce the effects of school-related factors have been the household expenditure on schooling, an indicator variable for the quality of schooling and the distance to the nearest school measured in terms of the travel time. Household school expenditure per enrolled child consisting of the direct costs of the school uniform, school registration fee, books and supplies, transportation, contributions, etc., has been included in our specification to indicate the budget constraints faced by the household.[26]. Distance to the nearest school was included in the model, since it is one of the important direct costs that affect the probability of working and the probability of school attendance. Children's school attendance also may be severely constrained due to the poor quality of education provided. The quality of schooling as measured by the degree of satisfaction of the household determines whether or not the time spent in school transmits into higher earnings.[27]. Poor families may find schooling to be a less attractive alternative if the private returns from education are not sufficiently high. High youth unemployment may influence households' perceptions of the benefits of education. Consequently, it is necessary to consider some of the school-related factors that may affect school attendance when examining decisions about children's use of time. Three school-related variables were included in this study.

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the household.

[25] The price of schooling is too high if either the direct or the indirect costs are too high. The direct costs of schooling include school fees, books, uniforms and the distance to school. The indirect costs include forgone income of the child while going to school. It is difficult to come up with a measure of the indirect cost of schooling if child work is mostly in the form of unpaid farm and household work.

[26] Household expenditure for education cannot be directly entered into the model, because it is endogenous to the child-labor decision, since these expenses for education are incurred only for children for whom the decision was made to enroll them in school.

[27] Poorly educated or poorly motivated teachers may cause low quality of schooling. Alternatively, inadequate materials, buildings or equipment may cause it. As a result, the return to schooling could be very close to zero, as confirmed by Jensen and Westergard-Nielsen's (1996) study on the return to primary education on the Zambian labor market.

The variable "quality of education" attempts to reflect the expected return from education as perceived by the household. Dissatisfaction with the education provided either because it is too academic or because education does not improve the propensity to be employed could discourage children's school attendance. Hence, satisfaction of the household with the quality of education provided was interpreted as a positive perception about the benefits of schooling. Poor quality of education may be a disincentive for parents to send their children to school, because it reflects the low expected return from school attendance. This variable has been the single most important supply-side factor significantly affecting all of the options, the strongest effect being on the combined school-work equation. A household that is satisfied with the quality of the education provided is 3 percent more likely to send its children to school and 8 percent less likely to engage them in work activities than other households. Households that are satisfied with the quality of education are also 8 percent more likely to induce their children to combine work with school attendance. The results suggest that households that are satisfied with the quality of education seem to be more inclined to prefer combining school attendance with work activities.

The analysis of the gender-disaggregated data shows that satisfaction with the quality of education is the most important factor that is likely to raise the probability of school attendance for boys and reduce the likelihood of working. It also lowers the likelihood of combining work and school attendance for both male and female children. Improvement in the quality of education tends to increase the probability of boys' school attendance by more than 6 percent and to reduce their likelihood of specializing in work by nearly 14 percent. Improved school quality also raises boys' likelihood of combining school attendance with work by 11.5 percent. In the case of girls, the provision of good quality education was likely to raise the probability of combining school attendance with work by about 6 percent.

Distance is another factor that can hinder school attendance and encourage children's work participation. A testable hypothesis is that the distance to the nearest school is negatively related to the probability of going to school and positively related to the probability of specializing in work. Though not conclusive, the result suggests that as the distance to the nearest school increases, the likelihood of school attendance declines, thereby raising the probability of work participation. Other studies also have reported similar results. For instance, Jensen and Nielsen (1997) found that increased distance has a significant negative effect on school attendance. Blunch and Verner (2000) reported a positive relation between the distance to school and the likelihood of engaging in child labor activities in Ghana. As distance to the nearest school increases, there seems to be a similar negative effect on school attendance for both boys and girls.

If direct and indirect costs of schooling are exorbitant and unaffordable for poor households, they create a disincentive for them to send their children to school and may force children to seek employment in the formal and informal labor market. Thus, a negative association between a household's school expenditure and school attendance or a positive relationship with work participation is expected. Although in rural Ethiopia there are only public

schools, which normally do not charge tuition, there are often expenses on registration fees, uniforms, supplies, books, etc. The results show a positive association between school expenditure and school attendance, though this is not statistically significant in all the three equations.[28]. Hence, direct school costs do not necessarily marginalize poor children in rural Ethiopia. Not attending school must result from factors other than school costs for these children. Similar results also were reported in other studies (Jensen and Nielsen, 1997; Canagarajah and Coulombe, 1998). The per capita school expenditure has broadly similar effects on male and female children.

4. 5 Household assets and decisions about the use of children's time

The link between household income and decisions about the allocation of children's time is one of the most important aspects of child labor, and it has received much attention in the related literature (see, for instance, Psacharopolous 1997; Patrinos and Psacharopolous, 1997; Kassouf 1998; Canagarajah and Coulombe, 1998; Grootaert, 1998; Blunch and Verner, 2000; Ray, 2000). According to the insufficient income hypothesis, households are compelled to put their children in the labor market, because their income is low. Several empirical studies also have discovered that the contributions of children to family income in developing countries can be substantial, ranging between 10 and 40 percent of the household income (see, for instance, Sharma and Mittar, 1990; Swaminathan, 1998; Cain, 1977; Patrinos and Psacharopolous, 1997; Myers, 1989; Kassouf, 1998). Hence, household poverty, which is manifested in terms of low or declining income, has often been singled out as the most important reason that under-aged children are pushed into the labor market.

Nonetheless, the relationship between household income and decisions about the allocation of children's time still remains controversial and inconclusive. [29]. Historical evidence does not provide adequate explanations for whether the rise in household incomes has been the instrumental factor in eliminating child labor from the present-day industrialized countries or

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[28] An important estimation problem that arose during the course of this work was the observation of positive school expenditure only for those families whose children were in school. Considering school expenditure per capita without correcting for the zero school expenditures might introduce a bias. Therefore, school expenditures were imputed for those households reporting zero actual school expenditures by regressing the non-zero per capita school expenditures on a number of variables and estimating the following equation:

$$E_i = \beta_0 + \beta_1 X_i + e_i$$

where E_i is the school expenditure per enrolled child; X is the vector of variables thought to affect school expenditure, including household size, number of children below 15 years, age of household head, education level of head, quality of education, distance to school, land size; β_is are the parameters, and ε_i is the random error term. This equation was estimated using the sub-sample of households reporting positive school expenditure.

[29] For instance, some econometric studies have concluded that the participation of children in work activities is not correlated to household income (Jensen, 1999; Canagarajah and Coulombe, 1998; Grootaert, 1998; Patrinos and Psacharopolous, 1997; Psacharopolous, 1997; Ravallion and Wood, 1999). Some argue that children might also work to gain economic independence from their parents or to acquire training and skill.

whether the introduction of relevant legislation was the driving force.[30]. Nevertheless, there is now a general consensus that the poorer their households, the more likely children are to work. According to Basu and Van's (1998) luxury hypothesis, a family only sends its children to the labor market if their income from non-child labor sources drops very low. When household wealth rises, children will be progressively withdrawn from labor activities in favor of alternative activities, such as schooling (Grootaert and Kanbur, 1995; World Bank, 1998). A casual observation of the geographic distribution of child labor today also suggests a negative association between child labor and aggregate income (Basu, 1999).

Empirical evidence about the link between family income and child work within the context of rural subsistence and non-monetized economies is hard to find, primarily because of a lack of an appropriate and direct measure of household income. This problem is especially difficult when analyzing rural economies, where households do not rely heavily on the market for consumption and production decisions[31]. Thus, it is better to use proxy measures to examine the effect of household income on decisions about the allocation of children's time. An appropriate proxy for rural household income or wealth is to use the physical and financial assets of household. Assets empower the poor by increasing their incomes, serve as reserves against shocks and provide choices to escape from harsh or exploitative conditions. Some studies on poverty argue that its main cause in developing countries is the lack of access to productive assets. Thus, increased access to productive assets by poor households is the best means of reducing poverty.[32] For these households, the amount of land that they own is too small to ensure the nutritional well-being of the family and is also of poor quality. Lack of draft power and fragmented plots of land are additional factors characterizing poor households. In addition, access to credit can be an important factor, since imperfect capital market arrangements or credit constraints often are considered to be one of the serious obstacles to agricultural productivity on the one hand and to children's school attendance on the other. Some empirical studies have argued that child labor can be observed, despite parental altruism, because there are no markets for loans against the future earnings of children.[33] The availability of credit would encourage parents to incur the direct costs of schooling.

Theoretically, ownership of productive assets should decrease children's probability of working and increase the probability of school attendance. However, some have called for a careful approach to asset-based poverty measures, since asset accumulation may actually lead to an increased incidence of child labor, thereby creating a conflict between asset ownership and

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[30] According to Fyfe (1989), child labor was reduced and virtually eliminated from these countries through a combination of economic changes, which decreased the demand for child labor, and the introduction of universal schooling, which absorbed the supply of children.

[31] Income among rural communities is also unstable, so that the income at the time of the survey may not necessarily be the current annual income. Moreover, markets in rural areas do not indicate the sum of economic transactions and often ignore payments in kind or home-grown consumption.

[32] For instance, Dercon and Krishnan (1998) argue that the most effective measure to combat poverty is to increase the access of the poor to productive assets.

[33] Lahiri and Jaffrey (1999), Ranjan (1999), Grote et al (1999) and Ranjan (2001) have all presented theoretical models in which child labor arises as a result of imperfect credit markets.

human capital formation.[34] Nevertheless, it can be argued that if households lack productive assets, they would survive a sudden drop in income by borrowing on the human capital market, meaning sending children to work instead of school.

With the objective of highlighting the relationship between the allocation of the child-time endowment and household asset ownership, several household productive assets were considered in this study. The most important asset variables included in the model were the size of the land owned together with its fertility and steepness indices, the mode of operation (sharecropping), the number of plots cultivated, the number of large and small livestock owned, the construction material used for walls and roofs and the total expenditure on farm assets, such as hoes, plows and sickles. All of these are important measures of wealth in rural Ethiopia. Land and livestock are the two most important productive resources rural households own. In a non-monetized rural economy, the construction material used for dwellings is an important indicator of wealth. While poor households use mostly grass and wood for roof construction, wealthier households often use galvanized iron. Similarly, wealthy households use concrete material or brick for wall construction, while poor households usually use mud or wood. In addition, participation of household members in non-farm[35] and income-generating activities,[36] acquisition of remittances, participation in reciprocal labor-sharing arrangements to ease any labor shortages and households' access to credit also have been included. The results show that households' asset ownership does have important implications on the allocation of children's unit-time endowment. An attempt is made here to examine the impact of each variable on child work and school attendance.

One of the most important productive assets owned by rural households is livestock. The rural poor depend heavily on income from livestock production. Livestock ownership also reduces risk. For instance, small ruminants require less cash and capital to buy and maintain relative to labor. Livestock also provides draught power and manure for crop production. Livestock embody savings, serving as a store of wealth to which rural households could turn to, in times of crisis and in times of cash needs. In addition, livestock provides an alternative food source for the family. Ownership of large and small livestock is expected to reduce income volatility, thereby inducing households to invest more in human capital accumulation. On the one hand, it generally can be assumed that livestock ownership and child labor may be inversely

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[34] Studies reporting increased child labor participation as a result of greater access to assets include that of Canagarajah and Columbe (1997), Levison and Moe (1998) and Rosenzweig and Evenson (1977). Cockburn (2000) also has argued that since the types of activities performed by children are different from those performed by adults, the effect on child labor will vary considerably depending on the types of physical assets targeted in poverty-alleviation policies. In rural Ethiopia, the principal activities of children are fetching water and/or wood, herding, etc., while adult males are primarily involved in farming and adult females in domestic work. Therefore, targeting assets used in activities commonly performed only by adults may make it possible to avoid increased child labor and reduced schooling. Labor-saving assets, such as a nearby well or a wheelbarrow, can be expected to directly reduce child labor and poverty.

[35] Off-farm employment includes engagement in wage employment and food-for-work programs, working as a daily laborer and some professional activities, except traditional labor sharing.

[36] Income-generating activities include traditional crafting, collecting and selling firewood, trades in different types of food crops and livestock, food and drink preparation and sale, etc.

related, since children in wealthier households will work less and go to school more. However, livestock production may also require more labor, particularly that of children, since herding is one of the main activities of children in rural Ethiopia. Herding animals is probably one of the main reasons for the prevalence of child bondage in the country.[37] In order to examine the effect of livestock ownership on child work and school attendance, three types of livestock were included in the analysis.[38]

The results of the analysis show that ownership of cattle (large livestock) has a negative association with school attendance and a positive association with the likelihood of combining work with schooling. As the number of large livestock increases by one livestock unit children's likelihood of school attendance declines by nearly one percent and their likelihood of combining work with schooling increases by more than a full percentage point. Oxen is an important production unit particularly in the highlands suggesting that more labor is required to complement the number of oxen available. Combining herding and school attendance might be possible if school going children also participate in herding activities after and before school and on school holidays. Increasing the number of pack animals also raises the likelihood of school attendance by nearly 2 percent. The effect of owning small ruminants (sheep and goat) was not statistically significant in all the equations. This variable was positive in the school equation indicating that households have more small ruminants may be more likely to encourage school attendance.

Generally, the effect of livestock ownership on decisions about the allocation of male and female children's time has been mixed. Ownership of large livestock significantly reduces boys' likelihood of specializing in schooling, while ownership of pack animals promotes both female and male children's school attendance. It also reduces the likelihood of specializing in work at least for girls. Thus, an increase in the number of large livestock reduces boys' probability of school attendance by nearly 2 percent. An increase in the number of pack animals raises female and male children's probability of school attendance by 4 and 2 percent, respectively. An increase in the number of pack animals also reduces girls' likelihood of specializing in work by more than 4 percent. On the other hand, increasing the number of large livestock owned is likely to raise both male and female children's probability of combining work with school attendance. The likelihood of combining work with school attendance increases by more than one percent for male children and by nearly one percent as the number of cattle increases by each livestock unit. Since small ruminants mostly are used to meet the immediate cash needs of the family, ownership of sheep and goats does not usually constrain school attendance. Pack animals are used primarily for transportation purposes, which is an important activity in rural areas.

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[37] Cockburn (2000) has argued that the effect of livestock ownership on child schooling may be positive or negative, depending on the type of livestock. But this argument is somewhat unrealistic and unfounded, since children often herd both large and small livestock together.

[38] Different livestock types were converted into standard livestock units using standard conversion units. Hence, the following livestock units have been used. calf =0.25, heifer/bull = 0.75; cows and oxen = 1.00; horse =1.10; donkey/mule =0.70; camel =1.25; sheep/goat = 0.13 and chicken =0.013 (Storck, et al, 1991)

Land is the other most important physical resource for rural households in Ethiopia. The amount of land owned reflects the permanent income potential of households and can be used as collateral, thereby indicating the borrowing ability of the household. Since children working on the family farm are not paid an explicit wage, their marginal product is demonstrated by the size of the land operated. The size of the land owned may increase the likelihood of a child working if land-intensive farming activities are undertaken, which require more labor, including child labor. Thus, land size may have a negative effect on school attendance. The effect of land size was significant on both the schooling and work participation equations, with the strongest effect on the school attendance equation. In general, land size has a negative effect on school attendance and a positive impact on work participation. The result shows that increased farm size reduces children's school attendance likelihood by nearly 4 percent and increases their likelihood of work attendance by about 2 percent. Land size does not contribute greatly to explaining the decision to combine work with school attendance. The negative and strong effect of land size on school attendance suggests that as land size increases, households need more labor, including child labor, to transform it into a productive resource. On the other hand, since poor households own less of this productive resource, the available work opportunities for household members are limited. A negative effect of land ownership on school attendance was also reported in other empirical studies (Jensen and Nielsen, 1997; Cockburn, 2000; Bhalotra and Heady, 2000).

Land size is an important household asset, significantly affecting male and female children's school attendance and work participation. An increase in land size seems to decrease boys' likelihood of school attendance by 5 percent and increase their likelihood of specializing in work by more than 4 percent. In the case of female children, an increase in land size also hinders school attendance by 2.5 percent. The result implies that increased land size might lead to more work, since it requires more labor, including child labor, thereby reducing children's likelihood of attending schools. As stated elsewhere, land is an important indicator of wealth in rural Ethiopia. It is also one of the most important productive resources that can be transferred from parents to children as an inheritance. Therefore, larger farm size might lower the need for an alternative source of income and livelihood through investment in education for the children. Consequently, parents may not see the value of education and invest less in it if they have sufficient productive resources that they can pass on to their children. Having more land could mean that children have secure sources of future income.

Investment in children's education also might be seriously affected by the productivity of the available resources. Land and livestock could be more or less productive, depending on the environmental circumstances prevailing in the system. One household's land may be more productive and fertile, while another household may have more livestock units to resort to during times of crisis. The productivity of the land owned by a household is reflected in, among other things, the fertility status of the farm plots and the degree of steepness (slope). Good land quality could reduce child labor, since a fertile and flat plot is conducive to farming and requires less labor but generates higher income. In other words, relatively more fertile and flat land will require less labor, including child labor, thereby releasing children from work and creating better

opportunities for school attendance. But, on the other hand, less fertile land could reduce household income and increase the risk of income fluctuations, thus demanding intensive agricultural practices and more labor input. Therefore, land size alone may not be an adequate indicator of wealth, unless there are means to transform it into a productive asset.

Two indices were included in the model to account for differences in land quality-fertility and steepness indices. The land-fertility index and the land-steepness index had significant effects only on the work and combined school-work equations. As the land-fertility index declines by one unit, specialization in work activities increases significantly. More specifically, the likelihood of specializing in work activities increases by nearly 4 percent when land fertility declines by one unit, and the likelihood of combining school and work is reduced by about 2 percent. Cockburn (2000) also reported that land quality reduces child labor. The steepness of the land does not seem to have any significant effect on decisions about the use of children's time. The effect of land quality is more pronounced on female children's time allocation. Soil fertility status has a strong impact on decisions about girls' school attendance and work participation. Declining soil fertility raises the likelihood of work for female children by more than 7 percent.

Apart from land size and its quality, the mode of agricultural operation and the number of farm plots could have important implications for decisions about the use of children's time. If households shared in more land, then the demand for child labor could increase, thereby hindering school attendance. Farm households usually have several plots of land at different locations for compensating land fertility and for reducing risk. Hence, one may expect a positive relationship between the number of plots and school attendance. Our empirical results show that sharecropping is an important and significant factor in decisions about the allocation of children's time. A household practicing sharecropping is 5 percent less likely to send its children to school and about 4 percent more likely to encourage them to combine school attendance with work. The effect of the number of plots cultivated on the probability of school attendance was positive and significant, but it was negative in the work equation. The positive effect on school attendance might be explained by the varying fertility levels of different farm plots. Bhalotra and Heady (2000) have found a positive relation between the number of farms operated and the hours worked in Ghana. Since agricultural production is faced with a number of environmental and climatic risks, having more plots of land is often seen as a mechanism for reducing these risks.

The results show that practicing sharecropping has similar implications for male and female children's school attendance. Practicing sharecropping generally reduces the likelihood of school attendance and increases work participation rates for both boys and girls. A household practicing sharecropping is 8 percent less likely to send male children to school. Sharecropping also encourages the combination of work with school attendance for both boys and girls. Boys and girls from households practicing sharecropping are 4 and 3 percent more likely to combine work with school attendance, respectively. This variable was significant only on the girl's school

equation. As the number of farm plots increases by one unit, girls' likelihood of registering in schools increases by a full percent.

The rural non-farm sector is an important source of income and employment for the poor. Traditional crafts and services usually engage a large proportion of the rural poor in developing countries. Consequently, the expansion and promotion of income-generating activities through non-farm work often is considered to be one of the important approaches to reducing the incidence of poverty. Participation of households in non-farm and income-generating activities may have mixed implications for child work and school attendance. While the participation of household heads in off-farm employment opportunities may lower the probability of child work, participation in income-generating activities may actually increase the incidence of work, at least for female children. Hence, households' participation in income-generating activities and off-farm employment have been included in the analysis. The results show that participation in income-generating activities generally increases children's likelihood of school attendance (significant only at 13 percent), but reduces their probability of specializing in work activities and of combining schooling with work. Household participation in non-farm employment also seems to encourage the probability of school attendance and of combining work with schooling, but reduces the probability of specializing in work.

The results of the gender-disaggregated analysis show that participation of households in off-farm employment activities generally increases girls' school attendance and reduces work participation. It was observed that girls from households participating in off-farm employment activities were 5 percent more likely to attend school and 7 percent less likely to specialize in work activities. Households taking part in off-farm activities also encouraged their female children to combine work with school attendance, as shown by the positive and significant marginal effect (4 percent). But participation in non-farm activities did not have any significant impact on male children's likelihood to work or to attend school. On the other hand, household's participation in income-generating activities seems to promote boys' school attendance but, though not significantly, to discourage girls' school attendance. This may present a realistic picture, since income-generating activities are mostly female-dominated activities. Therefore, the negative association between participation in income-generating activities and girls' school attendance was not unexpected.

The link between poverty and child work can be analyzed by examining the impact of other wealth indicators, such as the construction material used for walls and roofs and the value of farm equipment owned, in addition to the land and livestock resources. These indicators also could represent the relative wealth position of rural households. Wealthy households generally use cement, bricks or stone for wall construction and galvanized iron for roof construction, while the poor ones use mostly grass or other non-durable materials. The productivity of the land owned by a household also depends on the availability of farm equipment. The results of the analysis show that households using galvanized iron for roof construction are 4 percent more likely to send their children to school than households using other construction materials.

Similarly, households using brick, stone or cement for wall construction are nearly 5 percent more likely to encourage the combination of work with school attendance. Families owning more farm equipment are more likely to encourage the combination of work with school attendance. All these results imply that wealthier households encourage at least combining work with schooling, if not schooling alone, suggesting a strong link between poverty and child labor.

The value of farm assets and the type of construction material used for wall and roof construction may have different or similar implications for making decisions about male and female children's school attendance and work participation. Being from a household that uses galvanized iron for roof construction increases male children's likelihood of school attendance by about 5 percent and reduces their likelihood of specializing in work. On the other hand, owning more farm equipment seems to encourage specialization in work for female children. Ownership of more farm equipment also promotes the likelihood of combining work and school attendance for boys. Contrary to our expectations, households using durable materials for wall construction seem to encourage specialization in work activities.

The effects of remittances and participation in traditional labor-sharing arrangements on decisions about the allocation of children's time also were examined. External support in the form of remittances and gifts is an important source of income for many migration-income-dependant poor families. It is hypothesized that households receiving remittances are less likely to deploy their children in work. External support also improves households' liquidity positions and encourages human capital formation. Acquiring remittances has significant impact on all the options, with the strongest effect being on the work specialization equation. Acquiring gifts or other support from outside increases the likelihood of children's school attendance by about 4 percent and reduces the likelihood of children's work specialization by about 10 percent. Children from households receiving outside help in the form of remittances are also 6 percent more likely to combine work and school attendance than those children whose parents did not receive any remittances.

Acquisition of remittances generally has a similar impact on decisions about the time allocations of male and female children. A household receiving remittances was 5 and 4 percent more likely to send its boys and girls to school, respectively. Boys from households receiving remittances were 10 percent less likely to specialize in work activities, whereas girls from the same households were 12 percent less likely to specialize in work. Acquisition of external assistance also encourages the likelihood of combining school attendance with work for boys and girls by about 7 and 6 percent, respectively. These results seem to suggest that remittances improve households' risk management capacity, so that the propensity to invest in the future of their children is improved.

Pooling together the available labor resources for specific activities is also a common practice in rural areas of Ethiopia in order to ease the problem of labor shortages, particularly during peak seasons. A traditional labor-sharing arrangement is a labor-exchange practice, where

households decide to share the available household labor for farm work in a rotating manner. Local practices such as "debo" or "wonfel" are concrete examples of a labor-sharing arrangements in Ethiopia. The results show that participation in traditional labor-sharing arrangements reduces children's likelihood of attending school by more than 3.5 percent and raises the likelihood of work specialization by more than 5 percent. A household entering a rotational labor-sharing obligation may be forced to use the labor of its children to fulfill this, even at the expense of their education, particularly for activities where adult and child labor are close substitutes.

Participation in mutual aid work programs seems to have broadly similar implications on boys and girls' school attendance and work participation. Participation in labor sharing arrangements is less likely to encourage female children's school attendance and more likely to encourage work specialization for boys. Households participating in traditional labor-sharing arrangements were 5 percent less likely to send their female children to school. These households were also 6 percent more likely to induce their male children to specialize in work. Therefore, traditional labor-sharing arrangements seem to conflict significantly with girls' school attendance.

Finally, the special constraints faced by the poorest segments of the households were represented by the inclusion of households' access to credit. A negative relation between child labor and credit availability and, correspondingly, a positive relation between school attendance and credit availability was expected, since child labor may be interpreted as borrowing across generations. The result of the study shows that access to credit seems to enhance school attendance and reduce the likelihood of specializing in work activities in general. The gender-disaggregated analysis also shows that access to productive credit seems to encourage joint school-work participation, particularly for boys. Boys from households that had obtained credit were 3 percent more likely to combine work with school attendance.

4. 6   Improved agricultural practices[39]

The values of land and other productive assets depend on the technologies that, together with (adult and child) labor, turn those assets into incomes. Poor economies often are characterized by the low penetration rate of modern technologies, the result of which is a high incidence of poverty. Hence, poverty is often associated with not adopting modern agricultural practices. An agricultural technology may have a neutral effect if the innovation reduces all costs by the same proportion or may have a biased effect if the new method saves some costs more than others. Evidence shows that many of the technological changes in the agricultural sector are biased, saving either labor or land. Since child labor in Ethiopia is predominantly a rural

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[39] Improved agricultural practices include all farming practices whose application create disequilibria in the traditional subsistence farming system and help to raise agricultural productivity and production.

phenomenon, technological advancement will have important implications on rural poverty and child labor.

Children are preferred for activities that are labor intensive, operate with rudimentary technology and require laborious and repetitive work for long hours. The adoption of new and improved agricultural practices definitely would save millions of rural children from the burden of excessive work. Technological development could reduce child labor in at least two ways: (1) it replaces children doing routine, repetitive work with machines or other technologies that perform the same work more efficiently; (2) it increases the relative demand for more highly-skilled adults over the less-skilled children. The long-term effect of technological progress is the reduction of the demand for the employment of children and the increased incentive for them to stay in schools to develop their skills. Efforts to modernize production systems will, therefore, affect labor relations and lead to the adoption of technologies and work rules that discourage the employment of children.

Although the long-term implications of technological improvement in reducing the demand for child labor are obvious, the short-term implications of such changes are not. Technological changes may have unexpected short-term effects. For instance, a rise in labor productivity resulting from technological innovations may increase the opportunity cost of leisure and encourage its substitution by increased work. As the marginal cost of production falls, the producer might wish to increase output in order to maximize profits and so employ more of all factors of production, including children. Thus, there might be a trade-off between the displacement of labor resulting from technological change and increased employment of labor because of an increase in production. Thus, if child and adult labor are substitutes, there might be an increased likelihood that a given technological change may lead to an increased incidence of work among children. On the other hand, since technological progress raises household incomes, it may lead to an increase in non-work activities for children, including schooling and leisure.

The impact of a given technological change on labor is expressed mainly in terms of its labor-saving potential. However, it is not obvious whether all types of technological progress will save labor, including child labor. While the effect of mechanical technology on child labor is quite obvious, in the sense that it displaces labor, not much is known about the impact of biotechnological innovations. However, the effect of mechanization on the prevalence of child labor could work in either direction, depending upon whether child work is a substitute for or a complement to the new machines. The introduction of animal draft power and tractors may reduce or eliminate the work peak for cultivation and planting. Similarly, it can be expected that technological innovations such as herbicides may have a labor-displacing effect. The use of herbicides reduces labor needs for weeding, which is an important activity for women and children in rural Ethiopia. On the other hand, the impact of other land saving innovations, such as the application of fertilizer or the use of improved seeds, on the use of child labor is not clear. While an increased application of fertilizer and improved seeds may increase the productivity of

land, it also may lead to an increased demand for harvest labor, including child labor at least in the short run. The implications for children's school attendance of undertaking soil-conservation measures and irrigation practices, for which the return may not be immediate, also are not obvious. Thus, the introduction of improved agricultural practices might have ambivalent effects on the demand for child labor and therefore require empirical analysis. Examining the effect of modern agricultural practices on children's school attendance and work participation could have important policy implications. For instance, programs to promote the adoption of modern technology may deserve a place on the list of policy instruments to reduce child labor if farmers can be induced to adopt new technologies that improve their productivity and thereby reduce child labor.

Few empirical studies have been done on the impact of technological change on the allocation of children's time. Even the few existing studies focus mainly on the manufacturing sector and on mechanical power. For instance, Galbi (1997) reported that one of the most powerful reasons for the decline in the incidence of child labor in industrialized countries has been the gradual sophistication of technology. Similarly, a study in Colombia indicated that the introduction of wheelbarrows displaced children who previously had carried rocks piece by piece (Salazar, 1988). The study by DeGraff and Bilsborrow (1993) documented that the introduction of electricity in the homes significantly reduced the amount of home production by children in the Philippines. Studies related to the agricultural sector underlined the importance of technological innovations in reducing child labor. According to Rosenzweig (1981), the green revolution in India has made significant contributions to reducing child labor and promoting increased school attendance. Similarly, the mechanization of Egyptian agriculture (the use of tractors and irrigation pumps) reduced the demand for child labor in tasks such as driving animals to power water wells, picking cotton and hauling freight on donkeys (Levy, 1985). Apart from these few examples, it is hard to find empirical studies examining the link between technological change and child labor, particularly in Africa. The available evidence is far from conclusive, underscoring the need for a close examination of the link between improved agricultural practices and the allocation of children's time endowments.

The development of the agricultural sector is strategic in any effort to reduce rural poverty in Ethiopia, because the majority of the rural poor depend on agricultural activity. In general, the agricultural sector plays a pivotal role in all efforts to improve nutrition by increasing the quantity, quality and variety of food supplies and by creating employment and income earning opportunities for the poor. Empirical evidence indicates that the advent of new technology in the form of improved cultural practices or in the form of biochemical innovations is associated with reductions in rural poverty. Increased agricultural development requires an intensive and aggressive diffusion of new and improved technologies and practices to enhance land and labor productivity. As stated earlier, estimates of child labor show that more than 70 percent of the child laborers are in the agricultural sector. In this connection, the question that needs to be raised is whether the introduction of improved agricultural practices has any appreciable impact on child labor. This section attempts to provide information about the

potential impact of improved agricultural practices on decisions about the allocation of children's time.

Information about the potential link between the adoption of improved agricultural practices and child work is particularly relevant and timely, because Ethiopia currently is engaged in an intensive and aggressive extension program aimed at introducing farmers to new and modern methods of agricultural production, such as inorganic fertilizers, high-yielding seed varieties, agricultural chemicals and new cultural practices (see Appendix Table A1). Several indicators of improved agricultural practices have been considered, the most important of these being the adoption and application of land-saving (fertilizer and improved seeds) and labor-saving (agricultural chemicals, tractors and harvesters, draught power) technologies. Undertaking soil conservation measures to reduce soil erosion and nutrient losses, practicing irrigation and participation in extension programs[40] also were considered to be new approaches to raising agricultural productivity.

Ethiopian agriculture is predominantly rain fed. Therefore, a dummy variable for irrigation was included, since irrigation practice is considered to be an improved method of harnessing water that is better for agricultural production and for increasing productivity than rain-fed agriculture. Participation in extension programs also was included as a component of improved agricultural practice, since this intervention is aimed at improving farmers' know-how about new methods of farming and land- and crop-management techniques. Undertaking land management measures could improve soil fertility and increase crop production. However, this may, require more labor, including child labor, thereby restricting children's chances to attend school. Therefore, a dummy variable indicating whether the household has undertaken any soil conservation measures during the year was included in the model. In addition, two land- and labor-saving technologies were included to capture the effect of the fertilizer-seed and the herbicide-machine technologies on decisions about the allocation of children's time, respectively.

Most of the technological variables were not statistically significant, except that of herbicide-machine technology, which was highly significant both in the school and work equations. The practice of irrigation was only significant at 13 and 17 percent in the school and work equations, respectively. As expected, the use of herbicides and machine power, such as tractors and combine harvesters, had significant impact on decisions about the allocation of children's time. Households that had applied herbicides and/or used machine power for agricultural production were 10 percent more likely to send their children to school than those that did not. Children from households adopting these technologies were also 9 percent less likely to specialize in work activities. On the other hand, the adoption of the fertilizer-seed technology seems to constrain school attendance, though the results were not statistically

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[40] A new extension program called the Participatory Demonstration and Training Extension System (PADETES) was introduced in Ethiopia in 1994/95. The program merged the extension management principles of the T&V system with the technology diffusion experiences of the SG2000 program and emphasized the provision of fertilizers, improved seeds, pesticides, herbicides and better cultural practices.

significant and hence may not be conclusive. Fertilizer and improved seeds do not necessarily have a clear and direct impact on school attendance, but they can have an indirect one by raising the demand for harvest labor. Practicing irrigation, participating in new extension programs and undertaking soil conservation measures are likely to reduce school participation and enhance work specialization.

As expected, the use of herbicides and mechanical power strongly affects decisions about the allocation of both male and female children's time. The use of herbicides and machine power significantly promotes school attendance for both girls and boys and discourages children's specialization in work activities. Boys' likelihood of attending school increases by more than 8 percent if the household adopts these labor-saving technologies. But male children's likelihood of specializing in work declines by more than 6 percent. Similarly, adoption of this technology promotes girls' school attendance by nearly 12 percent and reduces their likelihood of specializing in work activities by 11 percent compared to girls from other households. Thus, the implication is that adopting labor-saving technologies has a strong effect on decisions about the allocation of both male and female children's time. The use of fertilizer and improved seeds did not have any meaningful effect on most of the gender-segregated equations. However, this factor was significant in the school equation for female children. Girls from households who have used this technology were nearly 6 percent less likely to attend school. This implies that the increased land productivity has led to an increased demand for labor, particularly female labor.

The variables included in the analysis to indicate the effect of modern land practices on decisions about the use of male and female children's time have generally contrasting implications. On the whole, adopting improved land management practices or soil conservation measures has a negative impact on male children's likelihood of school attendance. Undertaking land improvement measures reduces boys' likelihood of school attendance by about 6 percent. However, the same practice reduces female children's likelihood of work specialization (significant at 12 percent). This result was expected, since undertaking soil conservation measures, such as the construction of soil and stone bunds, is a laborious activity demanding a large amount of human labor, particularly male labor. The effect of soil conservation measures on the likelihood of combining work with school attendance has not been strong.

The results also suggest that participation in extension programs generally encourages children's work specialization. Male children from households that participated in the new extension program were more than 7 percent more likely to specialize in work than their counterparts from non-participating households. The same trend can be observed for female children, although the relationship was not statistically significant. Undertaking irrigation activities also increases girl's likelihood of specializing in work. Girls from households that undertook irrigation practices during the year have been 8 percent more likely to specialize in work than girls from other households.

4. 7 Location-specific effects

Regional- and local-specific economic and social conditions could also bear important implications for decisions about the allocation of children's time. Infrastructural and technological development, availability and adequacy of school facilities, attitude of people about child labor, production technologies used and practiced, region's vulnerability to famine, topography and agro-climatic factors may affect a child's choice between working and school attendance. Traditions and norms could dictate the school and work participation decisions. In order to reflect the effects of some of these factors, the 18 survey sites were grouped into five clusters of regions on the basis of their vulnerability to famine, topography and predominant agricultural technology used in the area (see Appendix Table A2). Location 1 includes all those survey sites that are relatively vulnerable to famine, have hilly and mountainous terrain and in which predominantly ox-plow technology is used. Those regions that are relatively vulnerable to famine but have relatively flat terrain and use the ox-plow culture were grouped in location 2. Sites that are relatively rich, have flat terrain and use the ox plow technology were grouped in location 3. Those survey sites that are relatively rich and flat but use predominantly the hoe technology were grouped in location 4. Finally, those sites that are either migration-income dependent or just self-supporting were grouped in location 5, which was used as the base group.

Since vulnerability to famine increases the risk of income fluctuation, it discourages investment in education and increases the probability of the joint work-school option. The results of our analysis show that children living in regions vulnerable to famine are less likely to specialize in school attendance but are more likely to combine school attendance with work. More specifically, children living in famine vulnerable areas are 7.5 percent less likely to have school attendance as their only activity and are 5 percent more likely to combine school attendance with work. On the other hand, children living in areas that are relatively rich and produce surpluses are 9 percent more likely to specialize in school attendance and 24 percent less likely to specialize in work activities. They are also 9 percent more likely to combine work with school attendance. Therefore, living in a relatively rich and fertile or surplus-producing region encourages investment in education. Thus, local economic conditions seem to have a strong impact on child labor.

Site-specific factors also may have differential impacts on decisions about the allocation of boys and girls' time. Some of the location dummies are statistically significant and have stronger effects on the equation for boys than for girls, while others have a greater effect on girls. Living in a poor and famine-prone region generally reduces the possibility of school attendance both for boys and girls, while children from relatively rich regions are more likely to specialize in school attendance and less likely to work. Boys' and girls' likelihood of school attendance in famine prone areas where the terrain is relatively flat declines by 7 percent more than for children from other sites. On the other hand, girls in relatively rich and fertile regions are 13 percent more likely to attend school. Girls residing in famine-vulnerable regions are also 5

percent more likely to combine work with school attendance than female children from other sites.

Living in fertile and surplus-producing regions strongly reduces the likelihood of specializing in work for both boys and girls. Male children living in these sites are more than 25 percent less likely to specialize in work than boys from other regions, while female children from the same region were 29 percent less likely to take up work as a priority occupation. For both male and female children, households living in these regions also encourage the combination of work with school attendance. However, boys in these regions are more than two times more likely to combine work with school attendance than girls. More specifically, boys are about 13 percent more likely to combine work with school attendance, while girls living in the same region were only 6 percent more likely to combine work with school attendance.

5   Conclusions and policy implications

Child labor has become a very sensitive and controversial issue in the development economics literature. Debates continue about what constitutes child labor and what is the best way to address it. Empirical work on the subject is limited, and even the few empirical studies have focused mainly on the visible forms of child labor, ignoring the more invisible forms. Work on the farm and in the house also can be harmful for children if such activities preclude them from attending schools. The fact that a child is working means that his or her educational achievements could be impaired relative to a control group of non-working children. More importantly, although the highest incidence of child labor is found in sub-Saharan Africa, studies on child labor in the continent are limited and sketchy. Ethiopia is one of those countries in sub-Saharan Africa where the problem of child work is rampant. The child labor force participation rate in Ethiopia is estimated to be well over 40 percent. Ethiopia also has one of the lowest school enrollment rates in the world. Although wage employment is not visible in rural parts of the country, participation of children in work activities for long hours and often at the cost of school attendance is very common. Using a multinomial logit approach, this study has attempted to examine the link between making decisions about the use of children's time and the ownership of assets as well as the use of improved agricultural practices within the framework of a subsistence rural economy. A broader and more inclusive definition of child labor that includes domestic and farm work has been adopted in this study.

The results show that most children in rural Ethiopia perform some form of work either in the house or on the farm. Participation in the labor force is common even among those below the legal working age or those supposed to be in school. The evidence clearly confirms that rural households strongly emphasize the participation of children in work activities. Excessive work, be it on the farm, in the house or in the labor market, has serious implications for children's development. If work participation exceeds an acceptable threshold level, the educational development of these children can be seriously impaired. This paper shows that the adoption of improved agricultural practices and the physical and financial asset position of a household both strongly influence decisions about the allocation of children's time. Several other economic and social factors also affect the allocation of children's unit-time endowment between the competing activities of school attendance and work participation. In addition, the age and gender of the child, cultural factors, the educational status of the household head, the distance to school and the quality of education are important determinants affecting the choice between school attendance and work participation. It also has been observed that for almost all of the explanatory variables, the results of the work and school attendance equations are opposite and sometimes of similar magnitude, implying that economic and social policies aimed at combating child labor will simultaneously encourage schooling and vice versa. The followings are some of the major conclusions emerging from this study:

1. The results of the study strongly support the hypothesis that household's physical and financial assets play a crucial role in the allocation of children's time endowment. Contrary to the assumption that the accumulation of physical assets would raise household income and create an incentive for school attendance, our results show that ownership of some assets, such as land and livestock, can hinder school attendance significantly and increase children's probability of working. Thus, it is essential to encourage the accumulation of those assets that simultaneously increase household income and encourage school attendance instead of child labor.

2. The study also shows that the technologies used in the production process play important roles in decisions about the use of children's time. Apart from raising agricultural productivity, the adoption of labor-saving agricultural technologies, such as herbicides and mechanical power, can have important implications on children's likelihood of to attending school. Policies that encourage the adoption of land- and labor-saving technologies may have the additional benefits of reducing child labor.

3. The study also provides sufficient evidence for the hypothesis that both the perception of households about the return to schooling and the direct costs of schooling may induce households to encourage their children to participate more in work activities instead of attending school. Measures to improve the return to schooling, such as improvement in the quality of education and lower costs, are likely to help reduce child labor problems in rural Ethiopia.

4. Child and household characteristics influence decisions about the allocation of children's time. Characteristics of households that are more likely to encourage their children to specialize in work are literacy level, acquisition of remittances, participation in labor-sharing arrangements and having a larger number of dependents. Thus, parental education, for instance, can be one of the areas targeted for policy intervention.

5. The results also indicate some gender differences in the allocation of time. Boys are less likely to specialize in work and are more likely to attend school, or it is at least more highly probable that they will combine work with school attendance than girls. On the other hand, female children are more likely to take up home care tasks and are less likely to attend school than male children.

6. Finally, the findings show the need for geographic targeting of any intervention. Children in poor and famine-prone regions are much more likely to participate in work than to attend school. Targeted educational investment and investment in technological infrastructure may be options to improve the educational infrastructure and the economic base of these regions and to attract the children to schools.

On the basis of the broad findings of the study, the following tentative policy implications can be drawn:

1. An important policy implication emanating from the study is the importance of educational investment. There is an urgent need to broaden access to education in order to ensure that the country's human capital stock will not diminish and that future generations will be less impoverished than the present ones. Policies are needed to encourage school participation by reducing the direct and indirect costs of schooling and improving the quality of education. Complementary measures, such as targeted subsidies to poor families, financial support for schooling via educational scholarships and provision of non-formal or alternative learning programs for children who are not in school and for children who combine work with school attendance, could be critical elements in the fight against child labor and for promoting schooling.

2. Another intervention area is the improvement of the income-generating potential of the household through the creation of income-generating activities and through the provision of productive assets to create a more stable economic base. However, care should be taken about the type of asset to be provided to poor households if reducing child labor is an important part of the policy agenda. More importantly, ways to raise the productivity of assets may have the additional benefit of reducing child labor and poverty.

3. The results of this study have shown that changes in production technology, such as the introduction of mechanization and the adoption of agricultural chemicals as well as changes in the mode of agricultural operation, affect decisions about the use of children's time significantly. Therefore, programs that promote the adoption of such technologies obviously deserve a place in the list of policy instruments to reduce child labor.

4. Our results also show that many children combine work with school attendance. This practice can become acceptable only if children are not exploited through long hours of work or through exposure to dangerous working conditions and only if the work does not impair the child's school participation and class performance. Therefore, monitoring the working conditions of school-going children may be an important policy issue. The Ministry of Labor and Social Affairs, the Ministry of Education and the public at large should be the major stakeholders in this exercise.

5. The legislative framework and community awareness also contribute to the reduction of child labor. Therefore, measures to reduce child labor should be accompanied by advocacy campaigns, community participation and accumulation of vital statistics on child labor. In addition, mainstreaming the issue of child labor and child protection as important policy issues at the national, regional, zonal and district levels is also critical.

6.   Finally, it is not only the participation of children in work activities that could hinder children's intellectual development, but also the intensity of work participation. Since many children combine work with school attendance, additional research is needed to examine the impact or consequences of work participation on their scholastic achievement and on their health.

Table 1:Work-starting ages for children in rural Ethiopia

Age	Number	Participation rate (%)	Cumulative rate (%)
≤4	313	11.6	11.6
5	552	20.5	32.1
6	572	21.2	53.3
7	609	22.6	75.8
8	387	14.3	90.2
9	77	2.9	93.0
10	144	5.3	98.4
11	16	0.6	99.0
12	20	0.7	99.7
13	4	0.1	99.9
14	3	0.1	100
Total reporting	2697	100	100

Source: Fifth round rural household survey, 1999/2000

Table 2: Main activity of children across different age groups (%)

Type of main activity	All boys and girls			Both sexes
	4 - 7	8 - 11	12 - 15	4-15
School attendance only	5.10	16.95	19.22	13.93
Work only *	31.06	45.15	35.83	37.47
Schooling and work	5.71	31.54	43.73	27.42
Neither work nor schooling	57.96	6.11	0.90	20.94
Others**	0.17	0.24	0.33	0.25
Total (%)	100	100	100	100
Number of children	1156	1227	1228	3611

* work includes all work activities including farm work, domestic work, herding, crafts-work, trading, manual work, food selling, or any other type of work.
** others includes non-respondents and disabled children

Source: Fifth round rural survey 1999/2000.

Table 3: Main activities by sex and age groups (%)

Types of main activity	Boys			Girls		
	4 - 7	8 - 11	12 - 15	4 - 7	8 - 11	12 - 15
School attendance only	5.16	17.29	20.93	5.05	16.61	17.32
Work only *	31.95	44.54	32.25	30.09	45.77	39.79
Schooling and work	5.99	32.63	45.27	5.41	30.46	42.02
Neither work nor schooling	56.74	5.22	1.09	59.28	7.00	0.69
Others**	0.16	0.33	0.47	0.18	0.16	0.17
Total (%)	100	100	100	100	100	100
Number of children	601	613	645	555	614	583

* work includes all work activities including farm work, domestic work, herding, crafts-work, trading, manual work, food selling, or any other type of work.
** others includes non-respondents and disabled children

Source: Fifth round rural survey, 1999/2000.

Table 4: Type of work activities performed by children by age and sex (%)

Types of activity	Age 4 - 7		Age 8 - 11		Age 12 - 15	
	Male	Female	Male	Female	Male	Female
Farm work	4.40	2.73	11.07	2.69	47.37	3.18
Domestic work*	31.07	51.91	20.52	63.77	12.63	82.17
Herding	63.11	43.17	66.77	31.74	37.54	12.74
Others**	1.46	2.19	1.63	1.80	2.46	1.91
Total (%)	100	100	100	100	100	100
Number of children	206	183	307	334	285	314

* Domestic work includes activities like cooking, cleaning, child care, fetching water and wood, etc.
** Others include informal activities like food selling, trading, manual work, pottery, crafts work, etc.

Source: Fifth round rural survey 1999/2000

Table 5: Intensity of different types of work for 4- to 15-year-old children by sex (hours per week)

Type of activity	Boys				Girls			
	Mean	*Std. dev.*	*Min.*	*Max.*	*Mean*	*Std. dev.*	*Min.*	*Max.*
Fetching wood/water	10.4	8.4	0.25	56.00	11.4	8.6	0.25	49.00
Domestic work*	12.7	12.7	1.00	84.00	14.9	11.1	1.00	84.00
Farm work	18.5	12.8	1.00	70.00	13.6	10.8	1.00	80.00
Child care	14.7	13.7	1.00	70.00	17.3	12.9	1.00	70.00
Livestock herding	32.7	20.8	1.00	84.00	26.8	19.7	1.00	84.00
Others	10.7	8.4	1.00	42.00	10.3	8.7	1.00	49.00

Domestic work includes all housework except child care.

Source: Fifth round rural survey, 1999/2000.

Table 6: Description of the variables used in the analysis and descriptive statistics.

Variable	Description	Mean	Std.dev.	Min	Max
Activity	Dependent - (0) if child is inactive, (1) if child is only attending schooling, (2) if child is doing only work, and (3) if the child combines work with schooling	1.59	1.04	0	3
Child characteristics					
Biol_par	1 if child is son/daughter of head; 0 otherwise	0.85	0.36	0	1
Sex_chil	1 if child is male; 0 otherwise	0.51	0.50	0	1
Age_chil	Age of child in years	9.01	3.13	4	14
Age_sqr	Age of child squared	90.9	56.97	16	196
Ethnicity and religion					
Amhara	1 if household was an Amhara; 0 otherwise	0.24	0.43	0	1
Oromo	1 if the household was an Oromo; 0 otherwise	0.35	0.48	0	1
Tigrawi	1 if the household was Tigrawi; 0 otherwise	0.10	0.30	0	1
Ortho_Ch	1 if the household was an Orthodox Christian; 0 otherwise	0.55	0.50	0	1
Moslem	1 if the household was Moslem; 0 otherwise	0.25	0.43	0	1
Household characteristics					
Fem_head	1 if head of household is female; 0 otherwise	0.20	0.40	0	1
Age_head	Age of household head in years	47.63	13.19	20	95
Lit_head	1 if head is literate; 0 otherwise	0.46	0.50	0	1
Edu_head	Highest grade completed by head	1.41	2.74	0	12
Hhsize	Household size	7.55	2.71	2	18
Numb_fem	Number of female members in the household	3.79	1.83	0	11
Infants	Number of children below the age of 4 years	1.06	0.98	0	4
Dep_rato	Dependency ratio defined as ratio of the number of persons in the household who are less than 14 years and above 60 years to the number of persons between the ages of 15 and 59 years.	1.54	0.97	0	8
School-related variables					
Dis_scho	Distance to the nearest school in minutes	40.23	34.00	2	240
Qual_edu	1 if household was satisfied with the quality of education; 0 otherwise	0.64	0.48	0	1
PCP_exp	Household school expenditure per school-enrolled child	17.25	23.58	0	466.75
Household assets					
Roof	1 if roof is made of galvanized iron; 0 otherwise	0.33	0.47	0	1
Wall	1 if wall is made of stone, concrete, brick or cement; 0 otherwise	0.19	0.39	0	1
Farm_Ass	Expenditure on farm equipment over the last two years in Birr	6.27	19.29	0	312.00
Land	Size of own cultivable land in hectares	1.30	1.08	0	8.63
Number_p	Number of farm plots owned in 1999	3.37	2.26	0	15

Table 6: continuation...

Variable	Description	Mean	Std. dev.	Min	Max
Household assets (continued)					
Share_cr	1 if household practices sharecropping; 0 otherwise	0.29	0.45	0	1
Fertility	Average land fertility index; 1 if land was lem (good), 2 if lem-teuf (mediocre) and 3 if teuf (poor)	1.59	0.64	0.5	3.0
Slope	Average land steepness index; 1 if land was medda (flat), 2 if land was dagath-ama (moderately sloped), or 3 if geddel (steep incline).	1.28	0.46	0.5	3
Lu_cattl	Number of cattle owned by household in livestock units	3.20	3.06	0	23.50
Lu_smliv	Number of small ruminants owned by household in livestock units	0.36	0.67	0	6.50
Lu_equin	Number of equines owned in terms of livestock units	0.62	1.05	0	8.75
Off_farm	1 if household participated in off-farm activities; 0 otherwise	0.24	0.43	0	1
Incom_ac	1 if the household participated in income-generating activities; 0 Otherwise	0.44	0.50	0	1
Remitt	1 if the household received any remittances; 0 otherwise	0.30	0.46	0	1
Labor	1 if the household participated in any traditional labor-sharing arrangement; 0 otherwise	0.62	0.49	0	1
Improved practices					
Fer_Seed	1 if the household used fertilizer and/or improved seed; 0 otherwise	0.60	0.49	0	1
Herb_mac	1 if household used herbicides and/or machinery; 0 otherwise	0.26	0.44	0	1
Irrigat	1 if household practiced irrigation; 0 Otherwise	0.08	0.28	0	1
Loan	1 if household took a loan; 0 Otherwise	0.54	0.50	0	1
Soil	1 if household took soil conservation measures; 0 Otherwise	0.29	0.46	0	1
Exten	1 if household participated in the new extension program; 0 otherwise	0.21	0.41	0	1
Location clusters					
Location 1	1 if site was vulnerable to famine, hilly and use ox plow technology; 0 otherwise	0.08	0.27	0	1
Location 2	1 if site was vulnerable to famine and flat; 0 otherwise	0.29	0.45	0	1
Location 3	1 if site was rich and flat; 0 otherwise	0.36	0.48	0	1
Location 4	1 if rich and flat and hoe culture; 0 otherwise	0.09	0.29	0	1

Table 7: Marginal effect on the probability of SCHOOL attendance (All children)

Variable	Marginal effects	Std. error	P [|Z| >Z]
CONSTANT	-0.5669	0.1160	0.00
CHILD ATTRIBUTES			
BIOLOGICAL RELATION	0.0785	0.0229	0.00
MALE CHILD	0.0359	0.0155	0.02
AGE OF CHILD	0.0598	0.0207	0.00
AGE SQUARED	-0.0017	0.0011	0.10
ETHNICITY AND RELIGION			
AMHARA	-0.0304	0.0347	0.38
OROMO	-0.1084	0.0373	0.00
TIGRAWI	0.0652	0.0416	0.11
ORTHODOX CHRISTIAN	-0.0195	0.0289	0.49
MOSLEM	0.0074	0.0326	0.82
HOUSEHOLD ATTRIBUTES			
FEMALE HEAD	0.0320	0.0.218	0.14
HOUSEHOLD SIZE	-0.0014	0.0051	0.78
NUMBER OF FEMALE	0.0105	0.0065	0.10
AGE OF HEAD OF HOUSEHOLD	0.0000	0.0007	0.90
NUMBER OF INFANTS	0.0163	0.0085	0.05
DEPENDENCY RATIO	-0.0227	0.0089	0.01
LITERACY LEVEL OF HEAD	0.0163	0.0187	0.38
EDUCATION OF HEAD	0.0084	0.0033	0.01
SCHOOL-RELATED VARAIBLES			
DISTANCE TO SCHOOL	-0.0004	0.0003	0.15
QUALITY OF EDUCATION	0.0313	0.0161	0.05
PCP SCHOOL EXPENDITURE P	0.0002	0.0003	0.45
HOUSEHOLD ASSETS			
CONCRETE/BRICK/STONE WALLS	-0.0345	0.0253	0.16
IRON ROOF	0.0344	0.0159	0.03
FARM EQUIPMENT	-0.0003	0.0004	0.41
CATTLE	-0.0096	0.0038	0.01
SMALL RUMINANTS	0.0163	0.0144	0.25
EQUINE	0.0197	0.0091	0.02
LAND OWNED	-0.0367	0.0102	0.00
NUMBER OF PLOTS	0.0102	0.0041	0.01
PRACTICING SHARECROPPING	-0.0486	0.0193	0.01
FERTILITY OF LAND	-0.0074	0.0136	0.58
SLOPE OF LAND	-0.0178	0.0192	0.35
PARTICIPATION IN OFF-FARM WORK	0.0246	0.0193	0.20
INCOME-GENERATING ACTIVITY	0.0229	0.0153	0.13
REMITTANCES	0.0439	0.0197	0.02
LABOR SHARING	-0.0378	0.0179	0.03
LOAN	0.0036	0.0152	0.81

Table 7: continuation ..

VARIBLE	Marginal effect	Std. error	P [|Z| >Z]
IMPROVED AGRICULTURAL PRACTICES			
IRRIGATION PRACTICE	-0.0488	0.0326	0.13
PARTICIPATION IN EXTENSION	-0.0052	0.0213	0.80
PRACTICING SOIL CONSERVATION	-0.0262	0.0199	0.18
FERTILIZER - IMPROVED SEED	-0.0162	0.0217	0.45
HERBICIDES - MACHINERY	0.1021	0.0217	0.00
LOCATION CLUSTERS			
LOCATION 1	0.0072	0.0435	0.86
LOCATION 2	-0.0745	0.0299	0.01
LOCATION 3	0.0943	0.0353	0.00
LOCATION 4	-0.0232	0.0355	0.51
MODEL SUMMARY STATISTICS			
NUMBER OF OBSERVATIONS	3003		
NUMBER OF ITERATIONS	8		
LOG LOKILIHOOD FUNCTION	-2721.479		
RESTRICTED LOG LIKELIHOOD	-3907.795		
CHI -SQUARED	2372.63		
SIGNIFICANCE LEVEL	0.0000		
PERCENT CORRECTLY CLASSIFIED	60.51		

Table 8: Marginal effect on the probability of specializing in WORK (All children)

Variable	Marginal effects	Std. error	P [|Z| >Z]
CONSTANT	1.1289	0.1781	0.00
CHILD ATTRIBUTES			
BIOLOGICAL RELATION	-0.1141	0.0289	0.00
MALE CHILD	-0.0662	0.0209	0.00
AGE OF CHILD	-0.1250	0.0319	0.00
AGE SQUARED	0.0059	0.0016	0.00
ETHNICITY AND RELIGION			
AMHARA	-0.0134	0.0450	0.76
OROMO	0.0522	0.0503	0.29
TIGRAWI	-0.0774	0.0563	0.16
ORTHODOX CHRISTIAN	0.1588	0.0386	0.00
MOSLEM	0.1579	0.0449	0.00
HOUSEHOLD ATTRIBUTES			
FEMALE HEAD	-0.0405	0.0288	0.15
HOUSEHOLD SIZE	-0.0006	0.0069	0.93
NUMBER OF FEMALE	-0.0137	0.0087	0.11
AGE OF HEAD OF HOUSEHOLD	0.0003	0.0009	0.73
NUMBER OF INFANTS	0.0015	0.0114	0.89
DEPENDENCY RATIO	0.0730	0.0246	0.12
LITERACY LEVEL OF HEAD	-0.0730	0.0246	0.00
EDUCATION OF HEAD	-0.0163	0.0048	0.00
SCHOOL-RELATED VARIABLES			
DISTANCE TO SCHOOL	0.0004	0.0003	0.21
QUALITY OF EDUCATION	-0.0764	0.0218	0.00
PCP SCHOOL EXPENDITURE P	-0.0001	0.0004	0.80
HOUSEHOLD ASSETS			
CONCRETE/BRICK/STONE WALLS	0.0138	0.0332	0.67
IRON ROOF	-0.0105	0.0217	0.62
FARM EQUIPMENT	0.0005	0.0006	0.38
CATTLE	0.0002	0.0047	0.97
SMALL RUMINANTS	-0.0159	0.0179	0.37
EQUINE	-0.0067	0.0125	0.59
LAND OWNED	0.0215	0.0126	0.08
NUMBER OF PLOTS	-0.0096	0.0059	0.10
PRACTICING SHARECROPPING	0.0245	0.0243	0.31
FERTILITY OF LAND	0.0353	0.0179	0.04
SLOPE OF LAND	0.0020	0.0262	0.94
PARTICIPATION IN OFF-FARM WORK	-0.0288	0.0259	0.26
INCOME-GENERATING ACTIVITY	-0.0045	0.0205	0.82
REMITTANCES	-0.0988	0.0260	0.00
LABOR SHARING	0.0532	0.0238	0.02
LOAN	-0.0149	0.0200	0.45

Table 8: Continuation....

Variable	Marginal effects	Std. error	P [|Z| >Z]
IMPROVED AGRICULTURAL PRACTICES			
IRRIGATION PRACTICE	0.0522	0.0383	0.17
PARTICIPATION IN EXTENSION	0.0403	0.0280	0.15
PRACTICING SOIL CONSERVATION	-0.0035	0.0256	0.89
FERTILIZER - IMPROVED SEED	0.0129	0.0277	0.71
HERBICIDES - MACHINERY	-0.0864	0.0289	0.00
LOCATION CLUSTERS			
LOCATION 1	-0.0361	0.0582	0.53
LOCATION 2	0.0245	0.0379	0.51
LOCATION 3	-0.2449	0.0477	0.00
LOCATION 4	0.0482	0.0522	0.35
MODEL SUMMARY STATISTICS			
NUMBER OF OBSERVATIONS	3003		
NUMBER OF ITERATIONS	8		
LOG LOKILIHOOD FUNCTION	-2721.479		
RESTRICTED LOG LIKELIHOOD	-3907.795		
CHI -SQUARED	2372.63		
SIGNIFICANCE LEVEL	0.0000		
PERCENT CORRECTLY CLASSIFIED	60.51		

Table 9: Marginal effect on the probability of combining WORK with SCHOOL attendance (All children)

Variable	Marginal effects	Std. error	P [|Z| >Z]
CONSTANT	-1.4096	0.0867	0.00
CHILD ATTRIBUTES			
BIOLOGICAL RELATION	0.0379	0.0169	0.02
MALE CHILD	0.0519	0.0126	0.00
AGE OF CHILD	0.2072	0.0153	0.00
AGE SQUARED	-0.0086	0.0008	0.00
ETHNICITY AND RELIGION			
AMHARA	0.0139	0.0278	0.61
OROMO	0.0249	0.0307	0.41
TIGRAWI	0.0253	0.0356	0.47
ORTHODOX CHRISTIAN	-0.1380	0.0245	0.00
MOSLEM	-0.1730	0.0292	0.00
HOUSEHOLD ATTRIBUTES			
FEMALE HEAD	0.0219	0.0173	0.20
HOUSEHOLD SIZE	-0.0082	0.0041	0.04
NUMBER OF FEMALE	0.0098	0.0051	0.05
AGE OF HEAD OF HOUSEHOLD	0.0014	0.0006	0.01
NUMBER OF INFANTS	0.0002	0.0067	0.97
DEPENDENCY RATIO	-0.0019	0.0071	0.78
LITERACY LEVEL OF HEAD	0.0418	0.0146	0.00
EDUCATION OF HEAD	0.0110	0.0027	0.00
SCHOOL-RELATED VARAIBLES			
DISTANCE TO SCHOOL	0.0002	0.0002	0.27
QUALITY OF EDUCATION	0.0843	0.0138	0.00
PCP SCHOOL EXPENDITURE P	-0.0002	0.0002	0.41
HOUSEHOLD ASSETS			
CONCRETE/BRICK/STONE WALLS	0.0489	0.0193	0.01
IRON ROOF	-0.0145	0.0129	0.25
FARM EQUIPMENT	0.0005	0.0003	0.07
CATTLE	0.0111	0.0025	0.00
SMALL RUMINANTS	-0.0054	0.0102	0.59
EQUINE	-0.0080	0.0074	0.27
LAND OWNED	0.0008	0.0072	0.91
NUMBER OF PLOTS	0.0041	0.0033	0.21
PRACTICING SHARECROPPING	0.0388	0.0138	0.00
FERTILITY OF LAND	-0.0187	0.0111	0.09
SLOPE OF LAND	-0.0054	0.0164	0.74
PARTICIPATION IN OFF-FARM WORK	0.0102	0.0158	0.51
INCOME-GENERATING ACTIVITY	-0.0181	0.0122	0.13
REMITTANCES	0.0639	0.0153	0.00
LABUR SHARING	0.0102	0.0139	0.46
LOAN	0.0104	0.0119	0.38

Table 9: Continuation ...

Variable	Marginal effects	Std. error	P [|Z| > Z]
IMPROVED AGRICULTURAL PRACTICES			
IRRIGATION PRACTICE	0.0137	0.0210	0.51
PARTICIPATION IN EXTENSION	0.0150	0.0158	0.33
PRACTICING SOIL CONSERVATION	0.0079	0.0144	0.58
FERTILIZER - IMPROVED SEED	0.0157	0.0165	0.34
HERBICIDES - MACHINERY	-0.0050	0.0161	0.75
LOCATION CLUSTERS			
LOCATION 1	-0.0444	0.0384	0.24
LOCATION 2	0.0476	0.0216	0.02
LOCATION 3	0.0903	0.0277	0.00
LOCATION 4	-0.0746	0.0339	0.02
MODEL SUMMARY STATISTICS			
NUMBER OF OBSERVATIONS	3003		
NUMBER OF ITERATIONS	8		
LOG LOKILIHOOD FUNCTION	-2721.479		
RESTRICTED LOG LIKELIHOOD	-3907.795		
CHI - SQUARED	2372.63		
SIGNIFICANCE LEVEL	0.0000		
PERCENT CORRECTLY CLASSIFIED	60.51		

Table 10: Marginal effects on the probability of SCHOOL attendance only by gender

Variable	BOYS		GIRLS	
	Marginal effects	P [|Z| >Z]	Marginal effects	P [|Z| >Z]
CONSTANT	-0.4652 (0.1692)	0.00	-0.0645 (0.1428)	0.00
CHILD ATTRIBUTES				
BIOLOGICAL RELATION	0.0302 (0.298)	0.31	0.1352 (0.0342)	0.00
AGE OF CHILD	0.0317 (0.0304)	0.29	0.0846 (0.0256)	0.00
AGE SQUARED	-0.0000 (0016)	0.98	-0.0032 (0.0013)	0.01
ETHNICITY AND RELIGION				
AMHARA	-0.0094 (0.0498)	0.85	-0.0648 (0.0471)	0.16
OROMO	-0.1029 (0.0532)	0.05	-0.1384 (0.0505)	0.00
TIGRAWI	0.0351 (0.0605)	0.56	0.0778 (0.0545)	0.15
ORTHODOX CHRISTIAN	-0.0062 (0.0412)	0.87	-0.0185 (0.0385)	0.63
MOSLEM	0.0595 (0.0470)	0.20	-0.0222 (0.0431)	0.60
HOUSEHOLD ATTRIBUTES				
FEMALE HEAD	0.0172 (0.0314)	0.58	0.0559 (0.0276)	0.04
HOUSEHOLD SIZE	0.0037 (0.0073)	0.60	-0.0055 (0.0068)	0.41
NUMBER OF FEMALE	0.0189 (0.0093)	0.04	0.0015 (0.0085)	0.86
AGE OF HEAD OF HOUSEHOLD	-0.0009 (0.0009)	0.35	0.0011 (0.0009)	0.23
NUMBER OF INFANTS	0.0235 (0.0119)	0.04	0.0095 (0.0113)	0.40
DEPENDENCY RATIO	-0.0153 (0.0124)	0.21	-0.0220 (0.0119)	0.06
LITERACY LEVEL OF HEAD	0.0094 (0.0270)	0.72	0.0237 (0.0238)	0.32
EDUCATION OF HEAD	0.0005 (0.0050)	0.91	0.0143 (0.0041)	0.00
SCHOOL-RELATED VARIABLES				
DISTANCE TO SCHOOL	-0.0000 (0.0004)	0.93	-0.0004 (0.0004)	0.21
QUALITY OF EDUCATION	0.0630 (0.0244)	0.00	-0.0003 (0.0197)	0.98
PCP SCHOOL EXPENDITURE	0.0000 (0.0006)	0.97	0.0002 (0.0003)	0.58

Table 10: Continuation ...

Variable	BOYS		GIRLS	
	Marginal effect	P [|Z| >Z]	Marginal effect	P [|Z| >Z]
HOUSEHOLD ASSETS				
CONCRETE/BRICK/STONE WALLS	-0.0311 (0.0379)	0.41	-0.0323 (0.0309)	0.29
IRON ROOF	0.0498 (0.0233)	0.03	0.0226 (0.0203)	0.26
FARM EQUIPMENT	-0.0000 (0.0006)	0.99	-0.0003 (0.0005)	0.47
CATTLE	-0.0160 (0.0056)	0.00	-0.0029 (0.0046)	0.53
SMALL RUMINANT	0.0178 (0.0200)	0.37	0.0231 (0.0196)	0.23
EQUINE	0.0197 (0.0091)	0.02	0.0421 (0.0116)	0.00
LAND OWNED	-0.0513 (0.0147)	0.00	-0.0263 (0.0134)	0.05
NUMBER OF PLOTS	0.0093 (0.0064)	0.14	0.0089 (0.0049)	0.06
PRACTICING SHARECROPPING	-0.0782 (0.0284)	0.00	-0.0060 (0.0241)	0.80
FERTILITY OF LAND	0.0044 (0.0187)	0.81	-0.0226 (0.0186)	0.22
SLOPE OF LAND	-0.0012 (0.0273)	0.96	-0.0232 (0.0252)	0.35
PARTICIPATION IN OFF-FARM WORK	-0.0048 (0.0280)	0.86	0.0495 (0.0248)	0.04
INCOME-GENERTING ACTIVITY	0.04119 (0.0219)	0.05	-0.0082 (0.0198)	0.67
REMITTANCES	0.0461 (0.0285)	0.10	0.0409 (0.0253)	0.10
LABOR SHARING	-0.0152 (0.0269)	0.57	-0.0505 (0.0224)	0.02
LOAN	0.0057 (0.0221)	0.79	-0.0036 (0.0193)	0.85
IMPROVED AGRICULTURAL PRACTICES				
IRRIGATION PRACTICE	-0.0406 (0.0513)	0.42	-0.0296 (0.0382)	0.43
PARTICIPATION IN EXTENSION	-0.0287 (0.0320)	0.37	0.0219 (0.0263)	0.40
PRACTICING SOIL CONSERVATION	-0.0591 (0.0297)	0.04	0.0023 (0.0248)	0.92
FERTILIZER - IMPROVED SEED	0.0039 (0.0305)	0.89	-0.0570 (0.0284)	0.04
HERBICIDES - MACHINERY	0.0844 (0.0307)	0.00	0.1198 (0.0292)	0.00

Table 10: Continuation …

Variable	BOYS		GIRLS	
	Marginal effects	P[|Z| >Z]	Marginal effects	P[|Z| >Z]
LOCATION CLUSTERS				
LOCATION 1	-0.0223 (0.0646)	0.72	0.0167 (0.0549)	0.76
LOCATION 2	-0.0727 (0.0436)	0.09	-0.0666 (0.0380)	0.08
LOCATION 3	0.0757 (0.0514)	0.14	0.1284 (0.0454)	0.00
LOCATION 4	-0.0008 (0.0509)	0.98	-0.0523 (0.0463)	0.25
MODEL SUMMARY STATISTICS				
NUMBER OF OBSERVATIONS	1546		1465	
NUMBER OF ITERATIONS COMPLTED	8		8	
LOG LOKILIHOOD FUNCTION	-1390.09		-1247.28	
RESTRICTED LOG LIKELIHOOD	-2041.04		-1870.22	
CHI - SQUARED	1301.89		1245.88	
SIGNIFICANCE LEVEL	0.0000		0.0000	
PERCENT CORRECTLY CLASSIFIED	61.45		63.55	

Table 11: Marginal effects on the probability of WORK only by gender

Variable	BOYS		GIRLS	
	Marginal effects	P [|Z| >Z]	Marginal effects	P [|Z| >Z]
CONSTANT	1.3713 (0.2557)	0.00	0.7962 (0.2496)	0.00
CHILD ATTRIBUTES				
BIOLOGICAL RELATION	-0.0862 (0.0403)	0.03	-0.1339 (0.0432)	0.00
AGE OF CHILD	-0.1572 (0.0456)	0.00	-0.0821 (0.0456)	0.07
AGE SQUARED	0.0067 (0.0023)	0.00	0.0047 (0.0023)	0.04
ETHNICITY AND RELIGION				
AMHARA	0.0039 (0.0653)	0.95	0.0094 (0.0632)	0.88
OROMO	0.0533 (0.0719)	0.45	0.0985 (0.0723)	0.17
TIGRAWI	-0.0576 (0.0816)	0.48	-0.0555 (0.0793)	0.48
ORTHODOX CHRISTIAN	0.1626 (0.0586)	0.00	0.1469 (0.0521)	0.00
MOSLEM	0.1053 (0.0676)	0.11	0.1848 (0.0618)	0.00
HOUSEHOLD ATTRIBUTES				
FEMALE HEAD	-0.0468 (0.0428)	0.27	-0.0429 (0.0389)	0.27
HOUSEHOLD SIZE	-0.0070 (0.0102)	0.49	0.0066 (0.0096)	0.49
NUMBER OF FEMALE	-0.0163 (0.0132)	0.21	-0.0122 (0.0118)	0.29
AGE OF HEAD OF HOUSEHOLD	0.0018 (0.0014)	0.17	-0.0011 (0.0013)	0.40
NUMBER OF INFANTS	-0.0048 (0.0166)	0.77	0.0077 (0.0163)	0.63
DEPENDENCY RATIO	0.0026 (0.0164)	0.87	0.0174 (0.0166)	0.29
LITERACY LEVEL OF HEAD	-0.0624 (0.0363)	0.08	-0.0905 (0.0339)	0.00
EDUCATION OF HEAD	-0.0074 (0.0070)	0.29	-0.0239 (0.0069)	0.00
SCHOOL-RELATED VARIABLES				
DISTANCE TO SCHOOL	-0.0000 (0.0005)	0.96	0.0005 (0.0005)	0.31
QUALITY OF EDUCATION	-0.1370 (0.0332)	0.00	-0.0223 (0.0291)	0.44
PCP SCHOOL EXPENDITURE	-0.0003 (0.0008)	0.73	0.0003 (0.0005)	0.61

Table 11: continuation ....

Variable	BOYS		GIRLS	
	Marginal effects	P [|Z| >Z]	Marginal effects	P [|Z| >Z]
HOUSEHOLD ASSETS				
CONCRETE/BRICK/STONE WALLS	-0.0183 (0.0485)	0.70	0.0352 (0.0459)	0.44
IRON ROOF	-0.0451 (0.0315)	0.15	0.0295 (0.0307)	0.33
FARM EQUIPMENT	-0.0008 (0.0009)	0.33	0.0016 (0.0008)	0.05
CATTLE	0.0014 (0.0068)	0.83	-0.0003 (0.0066)	0.96
SMALL RUMINANT	-0.0153 (0.0246)	0.53	-0.0272 (0.0266)	0.30
EQUINE	0.0205 (0.0177)	0.24	-0.0438 (0.0182)	0.01
LAND OWNED	0.0436 (0.0184)	0.01	0.0077 (0.0178)	0.66
NUMBER OF PLOTS	-0.0123 (0.0089)	0.17	-0.0041 (0.0079)	0.59
PRACTICING SHARECROPPING	0.0423 (0.0358)	0.23	0.0080 (0.0333)	0.81
FERTILITY OF LAND	0.0082 (0.0257)	0.75	0.0735 (0.0259)	0.00
SLOPE OF LAND	-0.0136 (0.0382)	0.72	-0.0046 (0.0366)	0.90
PARTICIPATION IN OFF-FARM WORK	0.0111 (0.0375)	0.76	-0.0704 (0.0362)	0.05
INCOME- GENERTING ACTIVITY	-0.0268 (0.0300)	0.37	0.0201 (0.0285)	0.47
REMITTANCES	-0.0985 (0.0376)	0.00	-0.1179 (0.0366)	0.00
LABOR SHARING	0.0567 (0.0354)	0.10	0.0368 (0.0327)	0.26
LOAN	-0.0377 (0.0296)	0.20	0.0112 (0.0273)	0.68
IMPROVED AGRICULTURAL PRACTICES				
IRRIGATION PRACTICE	0.0012 (0.0579)	0.98	0.0809 (0.0514)	0.11
PARTICIPATION IN EXTENSION	0.0729 (0.0415)	0.07	0.0013 (0.0384)	0.97
PRACTICING SOIL CONSERVATION	0.0433 (0.0376)	0.24	-0.0542 (0.0355)	0.12
FERTILIZER - IMPROVED SEED	0.0029 (0.0397)	0.94	0.0343 (0.0392)	0.38
HERBICIDES - MACHINERY	-0.0651 (0.0414)	0.11	-0.1089 (0.0411)	0.00

Table 11: Continuation ...

Variable	BOYS		GIRLS	
	Marginal effects	P [|Z| >Z]	Marginal effects	P [|Z| >Z]
LOCATION CLUSTERS				
LOCATION 1	-0.0280 (0.0860)	0.74	0.0233 (0.0833)	0.77
LOCATION 2	0.0434 (0.0555)	0.43	0.0009 (0.0526)	0.98
LOCATION 3	-0.2451 (0.0689)	0.00	-0.2848 (0.0678)	0.00
LOCATION 4	0.0415 (0.0784)	0.59	0.0671 (0.0704)	0.34
MODEL SUMMARY STATISTICS				
NUMBER OF OBSERVATIONS	1546		1465	
NUMBER OF ITERATIONS COMPLTED	8		8	
LOG LOKILIHOOD FUNCTION	-1390.09		-1247.28	
RESTRICTED LOG LIKELIHOOD	-2041.04		-1870.22	
CHI - SQUARED	1301.89		1245.88	
SIGNIFICANCE LEVEL	0.0000		0.0000	
PERCENT CORRECTLY CLASSIFIED	61.45		63.55	

Table 12: Marginal effects on the probability of combining SCHOOL attendance with WORK by gender

	BOYS		GIRLS	
Variable	**Marginal effects**	**P[|Z| >Z]**	**Marginal effects**	**P[|Z| >Z]**
CONSTANT	-1.6019 (0.1393)	0.00	-1.1128 (0.1141)	0.00
CHILD ATTRIBUTES				
BIOLOGICAL RELATION	0.0477 (0.0266)	0.07	0.0309 (0.0210)	0.14
AGE OF CHILD	0.2448 (0.0244)	0.00	0.1617 (0.0197)	0.00
AGE SQUARED	-0.0102 (0.0012)	0.00	-0.0067 (0.0009)	0.00
ETHNICITY AND RELIGION				
AMHARA	-0.0070 (0.0452)	0.87	0.0208 (0.0333)	0.53
OROMO	0.0376 (0.0488)	0.44	0.0035 (0.0381)	0.92
TIGRAWI	0.0491 (0.0546)	0.36	-0.0287 (0.0492)	0.55
ORTHODOX CHRISTIAN	-0.1853 (0.0414)	0.00	-0.1017 (0.0287)	0.00
MOSLEM	-0.2041 (0.0469)	0.00	-0.1439 (0.0364)	0.00
HOUSEHOLD ATTRIBUTES				
FEMALE HEAD	0.0402 (0.0282)	0.15	0.0139 (0.0206)	0.50
HOUSEHOLD SIZE	-0.0087 (0.0658)	0.18	-0.0093 (0.0050)	0.06
NUMBER OF FEMALE	0.0079 (0.0084)	0.34	0.0129 (0.0062)	0.03
AGE OF HEAD OF HOUSEHOLD	0.0009 (0.0009)	0.27	0.0016 (0.0007)	0.02
NUMBER OF INFANTS	-0.0005 (0.0107)	0.96	0.0023 (0.0082)	0.77
DEPENDENCY RATIO	0.0116 (0.0108)	0.28	-0.0141 (0.0092)	0.12
LITERACY LEVEL OF HEAD	0.0468 (0.0237)	0.04	0.0366 (0.0178)	0.03
EDUCATION OF HEAD	0.0080 (0.0045)	0.07	0.0139 (0.0034)	0.00
SCHOOL-RELATED VARIABLES				
DISTANCE TO SCHOOL	0.0004 (0.0003)	0.14	-0.0000 (0.0003)	0.86
QUALITY OF EDUCATION	0.1145 (0.0229)	0.00	0.0594 (0.0161)	0.00
PCP SCHOOL EXPENDITURE	0.0002 (0.0005)	0.67	-0.0005 (0.0004)	0.14

Table 12: Continuation ....

Variable	BOYS		GIRLS	
	Marginal effects	P [|Z| >Z]	Marginal effects	P [|Z| >Z]
HOUSEHOLD ASSETS				
CONCRETE/BRICK/STONE WALLS	0.0661 (0.0302)	0.02	0.0413 (0.0247)	0.09
IRON ROOF	-0.0130 (0.0205)	0.52	-0.0135 (0.0158)	0.39
FARM EQUIPMENT	0.0011 (0.0005)	0.02	0.0001 (0.0003)	0.67
CATTLE	0.0141 (0.0041)	0.00	0.0083 (0.0030)	0.00
SMALL RUMINANT	0.0004 (0.0150)	0.98	-0.0060 (0.0142)	0.67
EQUINE	-0.0086 (0.0112)	0.44	-0.0059 (0.0095)	0.53
LAND OWNED	-0.0073 (0.0117)	0.53	0.0067 (0.0086)	0.43
NUMBER OF PLOTS	0.0056 (0.0057)	0.33	0.0029 (0.0038)	0.43
PRACTICING SHARECROPPING	0.0437 (0.0227)	0.05	0.0281 (0.0162)	0.08
FERTILITY OF LAND	-0.0203 (0.0174)	0.24	-0.0176 (0.0142)	0.21
SLOPE OF LAND	-0.0003 (0.0257)	0.99	-0.0144 (0.0206)	0.48
PARTICIPATION IN OFF-FARM WORK	-0.0161 (0.0254)	0.52	0.0378 (0.0192)	0.04
INCOME-GENERTING ACTIVITY	-0.0152 (0.0197)	0.44	-0.0197 (0.0147)	0.17
REMITTANCES	0.0709 (0.0241)	0.00	0.0584 (0.0194)	0.00
LABOR SHARING	-0.0105 (0.0225)	0.64	0.0229 (0.0173)	0.18
LOAN	0.0329 (0.0196)	0.09	-0.0076 (0.0142)	0.59
IMPROVED AGRICULTURAL PRACTICES				
IRRIGATION PRACTICE	0.0538 (0.0348)	0.12	-0.0197 (0.0248)	0.42
PARTICIPATION IN EXTENSION	0.0049 (0.0258)	0.84	0.0262 (0.0188)	0.16
PRACTICING SOIL CONSERVATION	0.0073 (0.0236)	0.75	0.0085 (0.0172)	0.62
FERTILIZER - IMPROVED SEED	0.0070 (0.0256)	0.78	0.0273 (0.0217)	0.20
HERBICIDES - MACHINERY	-0.0225 (0.0258)	0.38	0.0142 (0.0194)	0.46

Table 12: continuation ..

Variable	BOYS		GIRLS	
	Marginal effects	P [|Z| >Z]	Marginal effects	P [|Z| >Z]
LOCATION CLUSTERS				
LOCATION 1	-0.0305 (0.0590)	0.60	-0.0691 (0.0587)	0.23
LOCATION 2	0.0448 (0.0354)	0.20	0.0479 (0.0255)	0.06
LOCATION 3	0.1337 (0.0454)	0.00	0.0597 (0.0329)	0.07
LOCATION 4	-0.0964 (0.0549)	0.07	-0.0392 (0.0405)	0.33
MODEL SUMMARY STATISTICS				
NUMBER OF OBSERVATIONS	1546		1465	
NUMBER OF ITERATIONS COMPLTED	8		8	
LOG LOKILIHOOD FUNCTION	-1390.09		-1247.28	
RESTRICTED LOG LIKELIHOOD	-2041.04		-1870.22	
CHI - SQUARED	1301.89		1245.88	
SIGNIFICANCE LEVEL	0.0000		0.0000	
PERCENT CORRECTLY CLASSIFIED	61.45		63.55	

Appendix

Table A1: Household participation in improved agricultural practices

Types of improved practice	Percent of households participating
Irrigation practice	7.3
Participation in extension program	14.0
Undertaking soil conservation	22.61
Took loan	43.55
Fertilizer and improved seeds	46.16
Herbicides and machine	19.45

* 328 households did not report to the various questions

Source: Fifth rural round survey 1999/2000.

Table A2: Clusters of survey regions and their major characteristics

Location	Major Characteristics	Included survey sites	Number of households
1	- vulnerable to famine - hilly and mountainous - ox plow technology - kolla and Woina dega	Geblen, Dinki - Ankober	152
2	- vulnerable to famine - flat terrain - ox plow technology - Woina dega and Kolla	Haressaw, Shumsha, Korodegaga, Gara Godo, Domaa	504
3	- relatively rich - flat terrain - ox plow technology - Woina dega	Yetmen, Sirbana Goditti, Adele Keke, Turufe Kecheme, Eteya, Bako Tibe, Jimma - Somodo	577
4	- relatively rich - mountainous terrain - hoe culture - Woina Dega	Adado	134
5	- migrant-dependent - self-supporting - dega, woina Dega	Indibir, Aze Debo, Debre Birhan	314
Total		18	1681

Dega (>3000masl), Woina dega (1500 - 3000 masl) and kolla (<1500masl) are the major traditional agro-ecological zones in Ethiopia.

Source: Fifth round rural survey, 1999/2000

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