

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

**THE IMPACTS OF DEMOGRAPHIC AND ECONOMIC
VARIABLES ON THE RURAL HOUSEHOLD
SCHOOLING DECISION: *Evidence from Four
Kebeles around Bako Town in West Shoa Zone***

*A Thesis Submitted to the School of Graduate Studies of Addis Ababa
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Requirements for Masters Degree in Human Resource Economics*

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Abstract

Under a given education supply, household demand for child schooling is very important. Particularly, in rural areas where the child work contribution is commonly high, investigating the impacts of demographic and economic variables enable to understand the demand side determinants of schooling for males and females in detail. This paper investigates the primary schooling of 455 children of ages 7 to 18 years from 155 randomly selected households in four Kebeles around Bako Tow in April 2004. The central assumption is that child work - increasing household resources slow down schooling and vice versa in missing markets. The probit estimates of the reduced form schooling equation show greater systematic determination by the observed household characteristics for females than they do for males in general. This indicates greater effective choice between work and schooling for the former. On the other hand, there is no statistically different gender disparity in rates of schooling. This calls for further socio logical investigations to find out why a number of male children are out of school.

Next, with too meager incidence of paid work, especially for the children who are too young to be employed on international standard, the violation of child rights, in terms of right to primary education, is found to be associated with household workloads for female children. Whether excessive work compounds the problem in terms of health and psychological influences should be a future research agenda in order to reveal the incidence of the unacceptable forms of child labor. With regard to age categories as could be expected, there are distinct degrees of systematic relationships between child schooling and most variables as we move across age groups. Therefore, interventions that are meant to increase child schooling have to be aware of such differential responses across sex and age categories.

Key Words: *Bako, child schooling, economic and demographic variables*

I. INTRODUCTION

Although the fundamental human right, private return and social return arguments justify child education, the condition of many children in developing countries currently reflects a situation that is different from humanitarians' and economists' beliefs of what it should have been. Worldwide, about 250 million children aged 5-14 years are reported to be forced to work in developing countries (United Nations Children's Fund (UNICEF), 2004)). According to existing evidences from the fifth round Ethiopian Rural Household Survey of 1999/2000, about 11.6% of the rural children in Ethiopia start working even before celebrating their fourth year birth day (see, Assefa, 2002). It accounts for about 53.3% for the children up to six years. Activities ranging from childcare, collecting wood, fetching water and other home responsibilities to farm work are commonly undertaken by rural children.

1.1. The Legal and Policy Background of Education and Labor Aspects of Child Rights

Whereas investing in education is generally desirable for its various functions both for the individual and national development, it is a fundamental human right to be educated particularly for children. Among the factors that impede child education are household socioeconomic variables, costs, types and distance of schools, and child work contribution (labor). Broadly, the schooling status of children is determined by various demand variables under the given educational policy.

1.1.1. The Education Policy of Ethiopia

Concerning school supply side, education occupies a strategic position in Ethiopia's development priorities. According to the Federal Democratic Republic of Ethiopia (FDRE) and UNICEF (2002) the national policy directives contained in the constitution of the FDRE states that "to the extent the country's resources permit, policies shall aim to provide access to public health and education" and that education, public and private, shall be provided in the manner that is free from any political partisanship, religious influence or cultural prejudices". The Education Sector Development Program (ESDP) of the country aims to broaden access to education. It encompasses eight components: (1) Primary education, (2) Secondary education

(3) Technical and vocational education and training (4) Teacher training (5) Higher education (6) distance education (7) Institutional Development, and (8) capacity building.

The primary education is divided into two cycles. The first cycle contains grades 1 to 4 and the second grades 5 to 8. Students of grades 1 to 3 will have class promotion through continuous assessments. The promotion of students of grades 4 to 8 depends on both continuous assessment and exam results. A National Education Assessment (NEA) is carried out on grades 4 and 8 to assess the skill levels of the students in key subjects.

Both levels of public primary education are freely provided in the country. However, school distances are still long enough to be barrier to the provision of education for every child in Ethiopia. Even though there is no school fees, families still face direct schooling costs for items such as clothing, school supplies and text books. FDRE and UNICEF (2002) provide evidence from existing studies that the estimated expenditure per student per year was close to Birr 60 in 1996.

With regard to language policy of the country, the media of instructions are commonly the official languages of the regions with some flexibility in certain towns. According to Ministry of Education (MOE, 1998) a total of 19 languages were in use as of September 1998. This is believed to be an important step to facilitate classroom learning. According to Article 3/4 of the United Nations Scientific, Educational and Cultural Organization (UNESCO) proclamation on Education for All (1990), for example, an active commitment must be made to removing educational disparities. It also states that ethnic, racial, and linguistic minorities should not suffer any discrimination in access to learning opportunities. Furthermore, Article 13/2 of the 1989 Convention on the Right of the Child (CRC) states that the child shall have the right to freedom of expression through the media of one's choice. Article 30 of the convention also states that in those states in which linguistic minorities exist, a child belonging to such a minority shall not be denied the right, in community with other members of his or her group to use his or her own language.

Despite the recognition of the local medium of instruction, there are mixed outcomes in the reality of Ethiopia. On the one hand, it is human rights of the children to learn with their

mother tongue language. According to the Ethiopian Human Rights Council (EHRC, 2003), where there are no language differences between the home and the school, students are enabled to better understand and express concepts. Due to such situation, there is improved enrollment and reduced dropouts. On the other hand, the impact of federalization still remains with its limitations of making available instruction medium choice of every child in multilingual communities. EHRC mentions that although MOE has responded to the problems witnessed in many urban areas by passing circulars to regions to offer education in alternative ways, "...the circular was not positively considered in some regions, particularly Oromia, until recently." (Ibid).¹

1.1.2. The Legal Background of Child Labor

The next main factor that is important for its impact on the social, mental, moral and physical wellbeing by itself and its competition with schooling is the work that children perform. In drawing the line between the acceptable and the unacceptable forms of child labor, the International Labor Office (ILO) and the Inter-Parliamentary Union (IPU) state that, "Children's or adolescents' participation in work that does not affect their health and personal development or interfere with their schooling, is generally regarded as being something positive" (ILO and IPU, 2002). These activities are believed to contribute to children's development and to the welfare of their families; they provide them with skills, attitudes and experience, and help to prepare them to be useful and productive members of society during their adult life. These include helping their parents at home and own economic engagements or earning pocket money outside school hours and during school holidays. On the other hand, according to the ILO definition, child labor refers to work that:

- Is mentally, physically, socially or morally dangerous and harmful to children; and
- Interferes with their schooling:
 - by depriving them of the opportunity to attend school;
 - by obliging them to leave school prematurely; or

¹ According to EHRC (2003) when the new language policy was implemented, no arrangement was made regarding those students who did not speak the newly introduced languages of instruction. In response to this, MOE passed a circular to all regions (Ref. No. 15/ 1- 94/ 19334/ 11 Dated 28/2/85 E.C) instructing them to offer education in Amharic to such children by using alternatives such as setting some time aside, using shift system or assigning separate schools.

- by requiring them to attempt to combine school attendance with excessively long and heavy work.²

The ILO's Minimum Age Convention, 1973 (No. 138), states that minimum age for entry into employment should not be less than the age of completion of compulsory schooling, and not less than 15 years, or 14 in the case of countries "whose economy and educational facilities are insufficiently developed". Ethiopia has ratified the convention in 1999 accepting the minimum age of 14 years for the entry into labor force (ILO and IPU, 2002). Only light works that do (a) not be harmful to a child's health and development and (b) not prejudice attendance at school and participation in vocational training nor "the capacity to benefit from the instruction received" should be allowed below the minimum age. Accordingly, work that interferes with education, either through direct substitution or through excessive hours, is prohibited.

Although its perspective is primarily humanitarian, the ILO's International Program for the Elimination of Child Labor (IPEC) has recently made a cost and benefit analysis of educating children for eight less developed countries and found that investing in every child results in substantial net economic benefit, in terms of productivity and health gains overriding the costs ranging from opportunity cost of schooling to school construction and its all necessary outlays (ILO, 2004).³ According to ILO in Ethiopia, there is a lack of capacity in implementation some of the child rights although it is very actively working with Ethiopia in the labor legislation and civil service reform (IRIN, Thursday 17, 2005). IRIN, from interview with the head of the ILO in Ethiopia (on 2 Jul. 2003), points out that although the country is facing the gap between the legal instruments and enforcement, as in many developing countries, the convention is very

² In most extreme forms, ILO states that, child labor involves children being enslaved, separated from their families, exposed to serious hazards and illnesses and/or left to care for themselves on the streets of large cities-all of these often at a very early age.

³ According to IPU, "The child is to be respected as a subject of rights as a human being needing special attention and assistance from the state and society" (ILO and IPU, 2002). UNICEF shares the same idea that we better follow the approach that children are the subject of rights (among which is schooling) rather than the need approach. The need approach assumes sympathy rather than binding obligation, indicating that children are the objects of right. However, the approach that children are the subjects of right assumes binding obligation.

clear on what is just work and what is child labor and the main concern is with the worst forms of child labor. It recommends democratization and activities to strengthen the institutional capacity of social partners in promoting social dialogue in the context of the poverty reduction strategy paper are very important. Unless poverty is tackled, it cannot be reached anywhere in terms of labor laws. This is why ILO fully acknowledges that the major challenge is poverty. If there are no incentives, economic incentives, to enforce those laws, it is a waste of time because the parents will still send their children to the labor market (Ibid).

The Convention on the Rights of Child does not merely require ratification by countries, but there is also a need for making the national legal frameworks and policies compatible. In this regard, the Ethiopian Labor Proclamation No 42/1993 (Article 88) prohibits employment of under fourteens. The convention also recognizes that the family, as the first and last line of protection and care for the child, takes the primary role and responsibility in Articles 3/2 and 5. Consistently, the national Civil Code Proclamation No 165/ 1960 (Article 269) compels the “guardians” to their minors.

Commenting on the legal framework of the country, some scholars point out that the absence of and or non-implementability of child protective laws account for relatively high participation rates of the youth in Ethiopia. For instance, Assefa (2004) states that although the Ethiopian constitution and current legislative measures on child labor are compatible with international standards, they mainly focus on the manufacturing sector disregarding the rural economy. According to the author, "Ethiopian labor law does not make any reference to the problem of child labor in the agricultural sector and agricultural and household employment are exempt from laws", making an estimated 85 percent of national economic activity to fall out of the labor code as it consists of small scale and subsistence farming.

1.2. The General Background on Schooling and Work Determination Environment

Even though the issue related to child primary activity choice between work and schooling is widely discussed almost elsewhere around the world, the choice problem is manifested in its most hidden form in developing countries. In these countries, agricultural sector absorbs the

lion's share of children, whose labor is invisible to registration and, hence, to labor laws, regulations and their implementations. Ethiopia is a typical country whose large populations of rural children actively participate in labor force some of whom at the expense of their schooling. Although there is no much evidence on accurate measure of what children contribute, the existing high prevalence and incidence of child labor at the expense of their education gives great insight into their economic role in the country. According to a recent rural Ethiopian study by Cockburn (2004), children are perfect substitutes of adults in terms of labor marginal productivity, that of the former being one-third to one-half of the latter.

Although one of the children human right violations due to the works they perform arises when they are not educated as a result, not all working children who are currently out of school are so because of the mere competition between work and schooling. Several social variables such as cultural background and school availability are also the important factors in Ethiopia. Controlling for these variables is, therefore, mandatory while investigating the effects of economic variables through which child schooling and work presumably compete. In response to this necessity, controlling for cultural, school availability (mostly distance) and other household variables, some detail national studies show that these variables as well as several economic and demographic variables-through which work-schooling competition operate-affect child time allocation in rural Ethiopia (see Cockburn, 2001 and Assefa, 2002)⁴. Furthermore, an interesting finding is that not only adverse shocks to welfare of the households negatively influence children schooling, but also some kinds of favorable economic conditions discourage schooling. The reason is that more child labor is demanded on family farm when the favorable shock increases productivity opportunity. For example, Assefa (2002) finds negative effect of large land size on schooling for rural Ethiopia. Consistently, Boozer and Suri (2001) have found negative effect of favorable rainfall on child schooling in Ghana. Bhalotra and Heady (2003) also call such a positive correlation between household wealth (for example, land) and child labor in Ghana and Pakistan *wealth paradox*.

1.3. Background of the Study Site

This paper investigates the impacts of demographic and economic variables on school attendance of rural children in villages around Bako Town, where cereals dominate the

⁴ Assefa (2002) and Cockburn (2001) are repeatedly cited in this paper due to their relatively holistic study of the impacts of various variables for rural Ethiopia.

agricultural product in terms of both land coverage and household income. Bako Town is found 251 Km away from Addis Ababa to the West. It is the seat for Bako Tibe Woreda. The main road, stretching from the capital to the western parts of the country, passes through this two-Kebeles town. Surrounding the town are four Kebeles categorized to be called Bako Area Kebeles, called Dembi Dima, Dembi Gobu, Gajo Kuyi and Bari Abo. Three of these are selected, Bari Abo being excluded on judgment basis. For the sake of data variability, a Kebele relatively far away from the nodal town is included in addition to the three ones. This Kebele, called, Oda Haro is on average about 24 kms away from Bako Town, unlike the greatest distance of about eight Kms with regard to the other surrounding Kebeles. The total number of households in the four Kebeles is 3349 (see Table A1 in the appendix) of which about 84% and 16% are male and female headed, respectively. The nodal town interacts with the villages around via several ways. For instance, it is where several informal sector activities, administrative offices, clinics, market services, schools and other institutions are found. Schools are found not only in the town. Primary schools are found in each of the Kebeles selected, except in Dembi Dima, which is, of course, relatively near to the school found in the town.

The villages are characterized by several economic activities ranging from subsistence to surplus production. Some cereal products include teff, wheat, barley, etc. Sugarcane, red peppers, and fruits such as mango and papaya are produced by some of the households. Animals ranging from poultry to cattle are important assets of the farm households.

Maize is the common and dominant cereal product of the households followed by sorghum. The dominance of maize is supported by the result of the particular survey that about 42% of the households cultivated only maize in the 1995/96 E.C. Besides the government extension program in the country, the villages do have access to maize innovation adoption through the nearby research center. National level impact studies show that the improved seed technology has resulted in about 250% rise in yield in the country on average (Mosisa, *et al.*, 2002). In such intervention, whether the variation in inter-household cereal income or /and cereal diversification results in child schooling variation is of an empirical question. Furthermore, short-term rural credit and saving services that reach some of the households are other interventions. Whether more or less child schooling is associated with them is an empirical appeal.

Unfortunately, the site is not without negative shocks. Price and production risks and prevalence of malaria, which may influence school attendance, age-grade distortion and school enrollment, are not uncommon. Existing studies show that the farmers in this cereal surplus area in general and in Bako area in particular are prone to substantial fluctuations in weather conditions and product prices. With regard to price fluctuations, for instance, the Ministry of Economic Development and Cooperation (MEDaC, 1997) Bako area was found to be associated with the greatest maize price variation as compared to other surplus areas such as Shashamane and Jimma for the period of Apr. 1990 to Jun. 1996. Dechassa (2001) also finds a variation of as much as 70% in Bako between maize prices of just two consecutive years. That is, maize price that had been 92 Birr in Apr. 2000 dropped to 28 Birr in Apr. 2001. Consequently, a higher cereal production is not necessarily equivalent to higher income in the area. The negative impact of higher production arises in two important ways. Firstly, it is not uncommon that under a given weather condition, high production is the result of higher usage of inputs that are associated with higher costs. When the combined effects of lower product prices and input costs contradict the net crop value, the rise in production in a given year cannot be necessarily equated to the rise in farmers' income. As if that were not enough there is a dynamic effect on the future production decisions through speculations that result in lower products of a certain cereals and/or improved inputs (Dechassa, 2001).

All the preceding and other conditions justify an inquiry into the child primary activity decision. Demand side studies become the imperative to understand the rural child work and schooling participation in this area. The approaches and results of other inquiries are important in this paper too. They are related to the effect of own land size and certain mechanisms such as, renting assets, sharecropping arrangements, labor sharing, or/and wage labor that lubricate inter-household and-community relations in such a way that intra-household adjustments are only partly relied upon. However, the strength of these mechanisms to effectively operate, in turn, depends on the demographic and socioeconomic factors, which are themselves directly important in determining children primary activities on theoretical bases. Finally, the possibility of social norm differences of child work and schooling between communities reinforces the present paper for the particular villages.

1.4. Statement of the Problem

On the one hand, even without relying on specific justifications in the wide range of returns to schooling, the fundamental human right of children to be educated by itself justifies child primary education. On the other hand, although the literature shows that even the high private and social returns to particularly lower level of education could have made child education the reality, a number of children in the world are currently out of school. Particularly, in less developed countries like Ethiopia the majority of the working children are working in the household farm and other activities, that are usually invisible to registration and hence to labor laws, regulations and their implementations. Most of the works are done at the expense of schooling and /or other education related activities (see, for example, Assefa, 2002, 2003 and 2004 and Cockburn, 2001). In such circumstances, where the households face several interacting factors, the investigation of household demand for schooling is very important in order to identify the policy and advocacy needs that help to raise child schooling. In response to this necessity, we find some national studies that find school distance, regional clusters, child-and household-specific socioeconomic variables to significantly affect child schooling in rural Ethiopia (see, for example, Assefa, 2002 and Cockburn, 2001).

However, these and similar studies have been limited to wide area analyses that may not be fully capable of identifying differing effects of the variables in different small homogeneous villages, beyond considering them in terms of regional dummies. This has been due to the nature of the data that does not allow detail village level studies. However, villages are self-contained autonomous units (Connel, 1977) that necessitate separate investigations at the expense of larger data requirement. Particularly, three important demand and supply related factors seem to reduce our confidence in replicating the results of national or regional studies to smaller communities like villages around Bako Town.

The first demand related variable is the possibly associated intercommunity multiple equilibria that arise from the community specific social norm of sending a child to work rather than to school (Basu and Tzamnatos, 2003 and Felipe-Calva, 2003). According to these authors, school attendance is directly related to social stigma of forcing a child only to work without attending school. To illustrate, the social stigma that a household faces is theoretically a direct function of the number of children sent to school in the community, which is in turn persistent

once the equilibrium is historically established. Hence, multiple equilibria are plausibly expected for different communities even if the latter are currently characterized by identical environments. Next, the existence of some none demographic child-specific attributes that are distinct between communities with identical observable characteristics necessitate small area investigation. For instance, even if all child specific demographic, household socioeconomic and location variables are controlled, other some social problems particularly among the older children might make child schooling substantially distinct between communities.

The second supply related variables that seem to be overlooked by studies so far are school supply lags and age-grade distortions. That is, previous studies frequently find the correlation between current school availability or nearest distance to available schools and the school participations of children. However, past activity persistence of a school age child might render a new school irrelevance for, say, a 14 years old age child, who has been out of school before. This can be due to, among other things, sibling substitution in schooling and work, household labor time diversification, and human capital consideration that may persistently keep an older child with high age-grade distortion to be out of school. Fortunately, the Kebeles around Bako Town are characterized by the condition that all the five primary schools in the study site have served for above 15 years, wiping out the possible attribution of non-attendance to service lag. In a rural society where school availability, rather than quality, influences the decision to send a child to school, the absence of availability lags can be used as an important identification strategy of demand side attributes.

A further problem associated with existing studies is that ethnic dummies are used to proxy socioeconomic variables such as culture and systematic variations in regional economic variables. However, in multilingual societies with different degrees of heterogeneity that are not commonly coincided with schools of individual preferences, tending to attribute the variations to cultural and economic variables should be seen with caution. For example, according to EHRC (2003), where there is no difference between the home and the school, there are high enrollment, low dropout and high enabling environment of understanding and concept expression among the children. Fortunately, village level studies allow controlling for the non-school attributes of ethnic dummies due the possible similarity in other intra-community cultural variables. Consequently, the variation of schooling in a community, with a single medium of instruction, is used to better identify the impact of differences in mother

tongue. Besides the importance of the language variable by itself, even at the absence of related sufficient detail data, the parameters of other relevant variables are better reliable when they are separately estimated for communities with different language heterogeneity and school types.

Therefore, the special reality of the villages, combined with the reduced trust in replication of a large area study, makes this detail investigation imperative. Finally, the leading questions are: firstly, what are the main demographic and economic variables that determine the probability of a child to attend education in general; and are there differential impacts for sex and age groups? Secondly, what do the effects of productive assets look like in indicating the incidence of universally defined forms of child labor other than just work activities? Lastly, what measures can be taken to raise the basic education of the children and are they equally effective over sex and age groups?

1.5. Objectives of the Study

Under the given education policy, the impacts of intra-household labor substitution and the household productive assets on child schooling will be the general focus of this paper. More specifically, the main objectives are:

- i. to investigate the impacts of household demographic and economic variables on the school attendance of the children,
- ii. to examine the distinct effects of the economic and demographic variables across sex and age groups,
- iii. to identify the advocacy works needed and
- iv. to draw policy implications from the results.

1.6. Significance of the study

Due to the small area investigation, variations in schooling are better identifiably attributed to household demand for schooling. Such an investigation serves to point at collaborative measures that should be taken in order to facilitate the household decision to send children to school. The knowledge created by the study can also be used with some modifications to understand children primary activities in similar agro-ecological areas of the country.

1.7. Scope of the Study

Rural child schooling condition cannot be disassociated from several household tasks that the child performs. Although in rural Ethiopia it is common for children under seven years to participate in work, how much it impedes formal schooling might not be clear for these young children because the official enrollment age in Ethiopian is seven years. The upper limit (i.e., 18 years) is used, firstly, to avoid the exclusion of some of the primary school children who are the victims of age-grade distortion. Secondly, it is in conformity of the legal upper limit for child age. The study uses the data from the survey of 155 randomly selected households in four rural Kebeles around Bako Town in West Shoa Zone.

II. METHODOLOGY

2.1. The Household Decision Making and the Model

Household heads are the dominant decision makers by virtue of management ability, some other reason of age or respect. The Convention on the Rights of Children also recognizes that the family, as the first and last line of protection and care for the child, takes the primary role and responsibility (FDRE and UNICEF, 2002). Whereas they are generally dominant over most household activities, the decisions of the heads over child time allocation are particularly binding. The traditional classical models of work participation and human capital formation that assume individual free choices do not provide a reliable framework for the study of child time allocation, which is actually decision of the household head. This study deals with primary activities of village children of ages between seven to 18 years, who are assumed to be under the guardian of household heads.

In such societies it is not just a choice as among inactivity, work and schooling, but also combination of work and schooling is possible. For example, from Ethiopian Rural Household Survey data, Cockburn (1999) reports that only 8% of four to 15 years old children are inactive (neither working nor attending school). This suggests that inactivity is very small for age group of this study, i.e., seven to 18 years, since it declines with age. About 84.3% of children who are participating in work are out of school in rural Ethiopia. The most surprising figure is that 97.3% of children in school also work, while only 2.7% of them specialize in school attendance. In other words, the two single largest categories of children activities are only working and combining work with schooling in rural Ethiopia (Ibid).

Furthermore, not just utility of an individual child, but rather that of the household as a whole is considered by the head in the household utility maximization. In doing this, there might arise weak agency. That is why, other things being equal, different children in a single household are quite differently treated. A good example is that among household members, school age sons or daughters of heads have privileged position for education as compared to other children in the household in rural Ethiopia (see, for instance, Assefa, 2002 and

Cockburn, 2001). There seems to be no more plausible justification that only sons and daughters of the heads prefer education and others work than showing the binding nature of the household heads' decisions on which children's primary activities depend.

Particularly, in rural societies like the four Kebeles around Bako Town, where households are both producers and consumers, not only voluntary decision is difficult with regard to the children under the heads, but also are households as a whole are liable to market imperfections and institutional problems. In other words, beyond demographic variables, a lot of socioeconomic and institutional factors affect the activities of children. To illustrate, firstly, market imperfection for productive assets such as land creates equilibrium that could have been different at the presence of such markets. The reason is that household labor (among which is child labor) is complemented with these assets in the process of production. That is why the greater these assets are owned, the smaller becomes child schooling in Ethiopia (Cockburn, 1999; Cockburn, 2001 and Assefa, 2002), although the former are equivalent to wealth. Secondly and related to asset market imperfection is the labor market imperfection that limits households only to intra-household relation rather than inter-household ones (see, for instance, Brown, *et al*, 2002). Thirdly, credit market imperfection constrains households not to do what could have been their best, otherwise. For instance, Baland, *et al*, (2001) show that credit constrained households make inefficient decisions with regard to child education versus work.

Fourthly, education supply side also plays its own role. Both facility lags and heterogeneity in quality raise an importance of supply side consideration even in a small area study. However, the schools in the study area are all old enough (greater than 15 years) even for an 18 years old child, who could have been first enrolled about eleven years ago. This suggests that no one of the study age group (7 to 18 years) has ever faced before any different school distance from today. Consequently, in a rural community where school availability, than quality, is presumed to have more crucial impact on households' decisions to send children to school, the non-existence of supply-age discrepancy strengthens the importance of demand side inquiry by attributing most of the variations to school demand variables, once school distance is controlled.

Yet, in multilingual societies, the demand side variations may also be attributed to the medium of instruction in the prevailing schools. Even though the dominant child population of the area speaks the Oromo Language, which is the instruction media in all the schools, there are some for whom the language is less convenient. Whether these children less attend school or not is worth empirical investigation, because policies that are meant to increase schooling are effective when the choices of an individual are not at the corner.

To summarize, both the status of the individuals under investigation and the environment that the households as a whole face cast doubt on the application of traditional model of free choice. This calls for a household model that allows for consideration of children, household and location characteristics with particular emphasis on household demographic and economic variables. Consequently, unitary household model will be utilized in order to investigate the probable effects of these variables on child primary activity. The data that are used in the econometric analysis are completely obtained from household heads responses.

2.2. Assumptions of the Model

Since decision of schooling of children is mainly done by the guardians who are themselves constrained in several ways due to imperfect markets and weak institutions, the traditional model of returns to schooling optimization is not a relevant framework.⁵ Any activity in home, on farm or off farm is operationally defined to be child work in this paper. The first and main assumption in this paper is that the competition between work and schooling is categorized into nil, mild, substantial and extreme. The distinction between the three lower categories and extreme competitions is assumed to be the work threshold that determines whether a working child is able to attend school or not. Therefore, it is assumed that a negative relationship between school attendance and productive assets and other work intensity indicators represents that the latter makes schooling difficult and vice versa. However, whether the competition is nil, mild or substantial cannot be identified since there is no data on actual hours of work, hours of education related activities at home and education performance of the children. Of course, it might not have been necessary to have data on hours of work had there been enough

⁵ The literature on returns to education in this paper is mainly meant to present the economic justification background for primary education rather than explaining the decision framework of the rural households of the particular study.

observation that enable multinomial analysis similar to Assefa (2002) even for the study of the effect of multiple levels of work intensities.⁶

Secondly, the households, like the other agricultural households in less developed countries, are assumed to make joint decisions over production and consumption (labor versus leisure time allocation). Consequently, unitary household model provides a framework for analyzing household behaviors that integrate these decisions. It should be noted that in the particular study, child education is assumed to be a single period decision outcome rather than a dynamic investment consideration one. Finally, once preference-shifting variables and household human resources other than that of children are controlled, it is assumed that the effective choice in response to productive asset variations are made between education and work by the children.

2.3. Formal Presentation of the Theoretical Framework of the Study

The adoption of the model for this study is made step-by-step by first presenting the individual choice decision making in the ideal case of classical model in (i). Next in (ii) the household as the decision maker is presented based on different assumptions of the markets and the separability of consumption and production decisions.

i. The Individual as the Decision Maker on Labor and Leisure Times in Perfect Markets

According to the labor supply and demand theory that is based on the assumptions of perfect markets, production and consumption decisions are separately made. Whereas individuals are motivated by the labor earnings that enable them make expenditure on the consumption bundles (C), firms are motivated by the values of the marginal productivities of labor and other inputs. An individual derives utility not only from consumption (C) of goods and services that are purchased for the labor market earnings, the leisure time (t_l) is also important as:

$$U = u(C, t_l) \dots\dots\dots 1$$

Subject to the budget constraint,

⁶ Assefa (2002) uses multinomial logit model in investigating the impacts of child, household and location variables on the likelihood of a child to be in either of the four choices: Inactive, Work only, Combining Work with schooling or schooling only.

$$PC = Wt_a + E \dots\dots\dots 2$$

Where, P is the price vector of consumption goods and services; W is the market wage; t_a is total disposable time that the individual supplies; and E is non-labor income.

$$PC = W(t - t_\ell) + E \dots\dots\dots 3 \text{ since } t_a = t - t_\ell \quad ; \text{ where } t \text{ is the total time available}$$

The equilibrium is established at the equality of the rate at which the individual is ready to exchange consumption of leisure for that of other commodities (U_ℓ/U_c) and the real wage (W/P). Since the principal objective of supplying labor is in order to earn the income that enables one consume purchased commodities, it is theoretically unambiguous that non-labor income (E) reduces labor time while it raises leisure. Formally, it shifts the W/P curve in the commodity-labor space, like Figures (1 and 2). Whereas the wage that the individual faces is exogenous, several characteristics might affect the tastes of different individuals. The vector of individual characteristics (X) represents this set of variables. Formally, the individual labor supply function is:

$$t_a = f(w, E; X) \dots\dots\dots 4$$

From the labor demand (L^d) side, the employing firm is concerned with the relative prices of inputs, given the demand for its products:

$$L^d = L^d(w, k) \dots\dots\dots 5; \text{ where } k \text{ is price vector of capital inputs}$$

More specifically, the producer employs as long as the value of marginal productivity of the worker is not less than the market wage.

ii. The Household as the Decision Maker: the Farm Household Model

Up to now, we have seen the individual decision making in perfect markets where the laborers and the producers are distinct. However, the fact that in the rural societies household's production and consumption decisions cannot be separately made necessitates the adoption of household production function approach in order to study the schooling decision of children.⁷

⁷ In this paper, even if we use 'family' alternatively with 'household', the terms actually represent 'household' as defined in Ellis (1993). According to the author, whereas the household is a social unit defined by the sharing of the same abode or hearth, the family is the social unit defined by the kinship relations between people. He adds that since in different societies the major lines of kinship which constitute a family differ markedly, it is not possible to state the general rule concerning the boundaries of the term 'family' and consequently it is not the most appropriate when the focus is on income, consumption, resources and decision making. Therefore,

Children's time allocation can best be captured by the approach, which is demonstrated by Becker. Early application of the model had been to market economies so as to provide predictions about the time allocation between home activity and labor market. It can also be extended to agrarian society household's time allocation between leisure and work. This extension has been widely used for empirical works. Of particular interest, child time allocation has also been studied under this framework by some researches (for instance, Cockburn, 2001 and Assefa, 2002).

Child schooling actually consists of immediate consumption and investment aspects. The former is that the household derives satisfaction from a child sent to school, i.e. an intrinsic value. The latter is that future return to education increases future consumption of the child (altruism) and possibly future transfer to parents through reverse altruism (exchange hypothesis). Even the present consumption is positively influenced by future increased return in the world of perfect credit market on pure theoretical basis. However, in the case of imperfect credit market and due to other reasons, we ignore the investment aspect. It should be stressed here that the household heads are assumed to be the dominant decision makers. Further assuming their altruism, they consume the utilities of educating their children. However, this altruism is assumed to be impure since there is the possibility of the presence of disparity of the appropriate levels of work and schooling between the points of view of the children and the heads.

Suppose a typical household faces the utility function in (1), $U = u(C, t_l)$ 6,

now represents that of the household where C is a vector of consumption goods; t_l is a vector of leisure times of household members (not of just a single person as in (1)).

In maximizing the utility, the household faces three constraints: the production function, the time and the household budget constraints. The production function is the function of labor (L), variable inputs (V), Fixed land (D) and fixed capital (K).

$$Q = f(L, V; D, K) \dots\dots\dots 7$$

The total household time (t) is allocated between labor (t_a) and leisure (t_l) as before. Leisure includes schooling and other non-work activities.

household is a useful unit of analysis given the assumptions that within the household resources are pooled, income is shared, and decisions are made jointly by adult household members.

$$t = t_a + t_l \dots\dots\dots 8$$

The budget constraint is that the household expenditure does not exceed its income.

$$PC = PQ - w(L - t_a) - P_v V + E = w t_a + \Pi + E \dots\dots\dots 9, \text{ Where } \Pi \text{ is the household 'profit'; and } E \text{ is non-labor income}^8.$$

Substituting for t_a from Equation (8) Equation (9) becomes

$$PC = w(t - t_l) + \Pi + E \dots\dots\dots 10$$

The schooling variable that is not explicitly shown in the equation enters into both the objective (utility) and the constraint functions. Whereas the schooling variable part that needs direct expenditure constitutes the C variable, the opportunity cost implicitly enters into the household expenditure side in similar way as the value of the time allocated to other leisure times in terms of $w t_s$.⁹

Finally, the First Order Condition (FOC) from the household optimization problem shows that the equilibrium is established at the locus where the wage rate (or equivalently the value of marginal product) is equal to the marginal rate of substitution of leisure for consumption of other commodities that are made available by the household production and hence household labor. This is represented by the partial derivatives where the slope of the production function is equal to that of the utility function.

$$f_L = U_t / U_C \dots\dots\dots 11$$

Now, turning to the predictions of this model in different circumstances, different results will be found for the shocks to household socioeconomic conditions and for the inter-household variations. There are two extreme cases of the decision environments of households. The first one and the assumptions underlying the theoretical frameworks that explain the households' decision making behaviors assume perfect markets and infinite choices. On the other extreme, markets (particularly of labor and land) are assumed to be non-existent and individual choices are not infinite. The eclectic position is that markets are imperfect rather than being nonexistent. Furthermore, certain traditional mechanisms are there in order to mitigate the outcomes of market failures.

⁸ Non-labor income, here, refers to the income from other than current own production. Perhaps, wealth accumulated over years, such as livestock, permanent crops (plants) and other inherited wealth partly manifest themselves in such income since much of their values have been the results of previous labor and other inputs.

⁹ Further disentangling C into other goods (C') and schooling (S) variables as well as leisure (t_l) into other than schooling (t'_l) and schooling (t_s), Equation (10) becomes

$$PC + w t'_l + w t_s = w t + \pi + E$$

The Case of Perfect Markets and Availability of Infinite Choices

In this case, the labor supply (consumption) decisions are separable from the labor demand (production) decisions. The difference between the previous individual case and this model is that the latter acknowledges the presence of own productive assets that require household labor up to certain level. Hence, any shock to household production in terms of an increase in labor productivity is reflected in more profit so that the marginal value product becomes greater than the real wage rate. Provided that

- (a) leisure, including schooling, is normal good; and
- (b) any extra labor is hired-in rather than intra-household reallocation of labor,

the household unambiguously consumes more of schooling. Whereas the infinite choice between schooling and other activities assume that an appropriate school type of one's choice exists without limitation, the perfect market assumption is that markets exist at least for the number of input types minus one in that economy. In most cases where markets for fixed productive assets, such as land are incomplete, it is plausible to assume the existence of perfect market for labor that complements those other assets in production. Focusing on Equation (9), suppose a household faces a shock that shifts the production function up and increasing the marginal productivity of household labor. In this case, f_L increases. In response to this favorable condition, the separability of the model ensures that the effect on labor supply comes through its effect on household profits and that its effects will be unambiguously increased labor hiring. As the market wage rate is exogenous, the only change on the household will be the resulting increase in profits. Assuming that non-labor time is a normal good, this will unambiguously reduce the labor supply of the household members. However, in reality, choices are not infinite and markets are incomplete in rural economies such as the Kebeles around Bako Town.

The Case of Imperfect Markets and Limited Choices

In the eclectic case, markets are not non-existent. They are rather imperfect. In the extreme case, the labor that complements the household assets comes from the household only and there is no other market or inter-household relation for labor deficits and surpluses. For the simplicity of the model presentation, we deal with this extreme case. If so and ignoring the non-labor variable inputs, Equation (9) becomes,

PC= PQ +E..... 12, because $L= t_a$

This is an extreme case of peasant economy where labor market is not only imperfect, but it is also non-existent. It is similar to the Chayanov farm household model with the fundamental exception that land is assumed to be fixed in our case unlike the flexibility assumption in Chayanov model. As long as labor supply and demand are not separable; and household utility is an increasing function of both leisure and consumption of other goods and services produced by the household labor, the result of any shock to the household production function cannot be unambiguously predicted by the household model. The ambiguity is seen in figures (1) and (2) that are similar to the presentation of Cockburn (2001) in which the detail rigorous mathematical derivations of these cases are also available. Keeping the household utility function constant, when the production function shifts up, the household faces increased marginal productivity of f_L' rather than f_L^0 at the initial labor allocation. This, initially, results in reduced household leisure with the movement on the utility curve. With the assumption that the effective choice for the children is between work and schooling, the latter decreases due to the productivity opportunity. In both cases of labor increasing and labor decreasing shocks (figures 1 and 2), such a productivity opportunity effect similarly increases leisure consumption by the movement from E_1 to E_2 . However, the final result is made ambiguous by the contrasting effect coming from the income effect which increases the consumption of leisure. The final results are depicted by the equilibrium points, E_3 's in the figures. These depend on the net of the opposing effects. If the income (yield) effect overrides the substitution (productivity) effect as in *figure 1*, the household increases its leisure from t_1 to t_3 . The reverse is true in *figure 2* that the leisure time decreases from t_1 to t_3 . Concerning the prediction about the effect of non-labor income (E), if it increases, the position of the particular production of the particular production function will shift upwards since C is the sum of Q and E . The equilibrium is established at the tangency with the higher utility curve found above and to the left. As long as its curvature does not change and productivity opportunities have not changed, the new equilibrium would unambiguously become at the right of any reference old equilibrium.

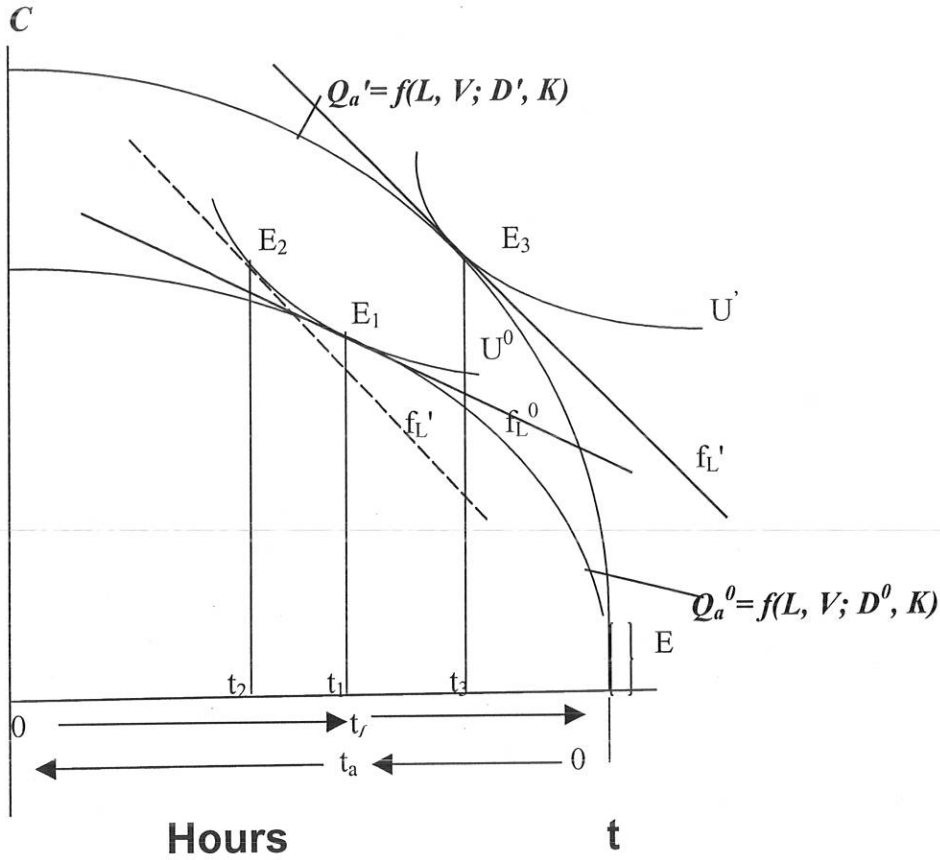


Figure 1. Household Labor Supply Decreasing Productive Asset

Had it been in the case of perfect labor market, the household could have hired-in labor with the presumably exogenous market wage. However, in our case labor market is not allowed for the sake of simplicity. There are theoretical constructs that fall in the eclectic position based on imperfect market assumptions. The Chayanov model that assumes land flexibility has no predictive power concerning the response of the household to factors that affect the production function. However, its predictive power lies in the impact of factors of family size and composition that affect the slope and composition of the indifference curves. A further point of this model is that it explicitly assumes that each peasant community has a social norm for the minimum acceptable consumption level below which no leisure can compensate the value of household product. In other words, the indifference curve becomes flat ($U_t / U_c = 0$) at that threshold of income. The relevance of this prediction in our case is that although the wealth effect on child schooling is not unambiguous in general, below some point it seems unambiguous that poverty reduces child schooling. In conformity with this, Cockburn (2001) concludes that both productivity opportunities and poverty reduce the chance of child schooling in rural Ethiopia.

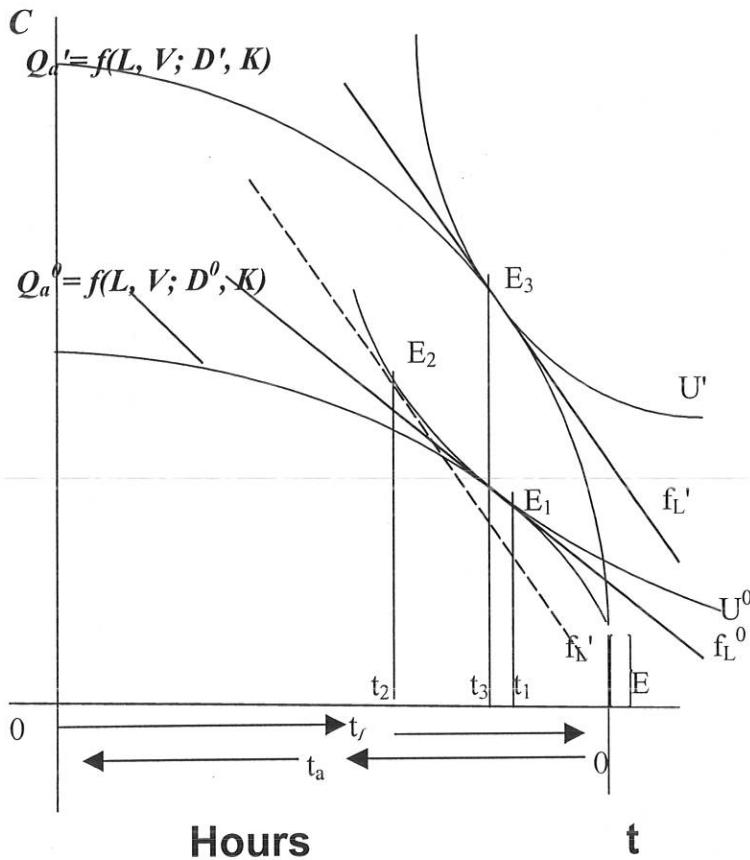


Figure 2. Household Labor Increasing Productive Asset

Although the absence of labor market is the key assumption of the simplified model presented in the figures above and in the Chayanov model, some developments of farm household model have relied on the assumptions of the presence of competitive labor market and flexible access to land. The prediction is that the household either hires in or out labor whenever the labor time the household is ready to supply at the subjective wage deviates from the labor time required by own production. It has to be mentioned here that the assumption of flexible access to land in both the Chayanov and the later development is in order to defer the onset of the diminishing returns to land. However, in both cases the effect of the shift in production function is not clearly predicted and this is also true in model of figures (1 and 2) that assumes the absence of labor market and fixed access to land.

In conclusion, whereas equation (12) is based on the extreme case of non-existent labor markets, in reality, some incidences of inter-household labor relations and wage labor are not nil. Besides, out of the boundaries of some thresholds of productive asset ownership (particularly land), it is not uncommon for the households to enter into sharecropping or/ and

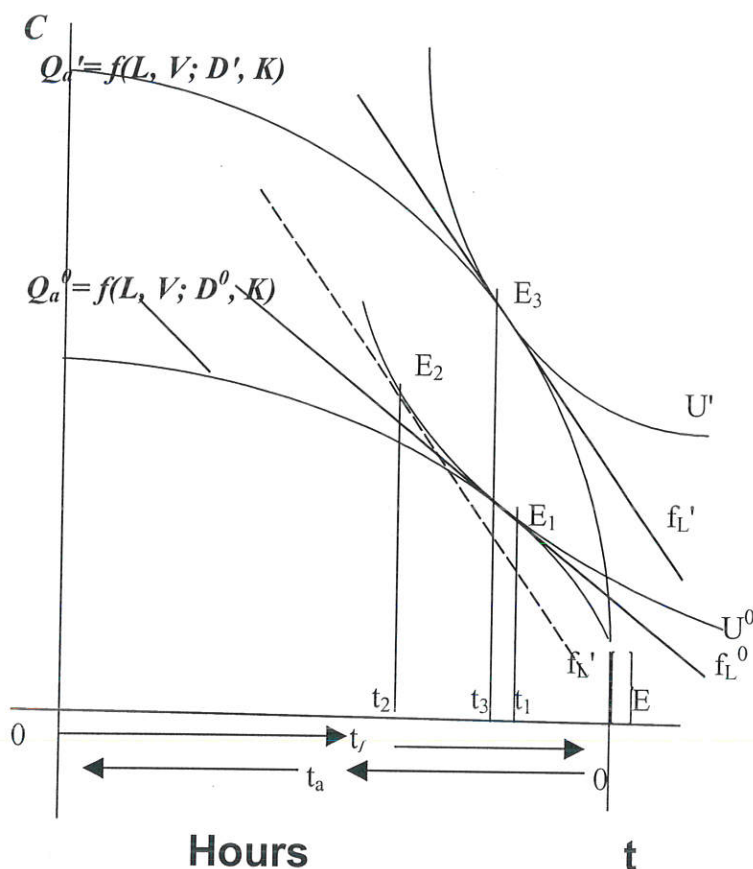


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rent. These considerations, therefore, call for an eclectic position of incomplete markets and limited choices once predictions are investigated by simplifying assumptions.

Finally, the pictorial representation is for a typical household. However, in the reality, households are not identical in several ways. Even if the households were identical in their utility and production functions, the demographic compositions and the inequalities in productive assets ownerships cause the inter-household variations of time allocation in general and child schooling in particular. Furthermore, the households are indeed heterogeneous in their utility functions and hence this is reflected in various weights assigned to particular elements even by households with identical economic characteristics. A further relaxation is that the production functions themselves are heterogeneous in a community not all of whose members own certain productive assets. For example, in Kebeles around Bako, not all households own irrigable land; not all households own permanent plant crops and so on. In particular, it is plausible to presume different weights attached to child schooling by different households of certain cultural, economic and other characteristics. It is also worth mentioning that not all shocks identically affect the leisure of the individual household members. Particularly, school age children in the household may not be identically treated due to certain cultural and demographic reasons. One specific possibility is that the income effect whose dominance over substitution effect reduces the labor supplied. Or else, increase in marginal productivity of adults might more than compensate the withdrawn child work and then the latter is released to schooling.

Therefore, the heterogeneities with the households and the children call for the statistical investigation of the demographic and cultural characteristics in addition to the economic variables. It is worth mentioning that among the most important variables that may affect schooling are culture, parental education, costs and so on. In the case of costs, in addition to the direct expenditures of education (which might not vary in a small area), school distances constitute much of the total direct cost. Besides, the unique nature of the available schools, combined with certain fundamental differences of the children in a particular area might primarily limit the individual choices both at the household and the child levels. In the final analysis, S enters into the utility function as consumption variable.

More specifically, a variable either:

- is used as a control variable,
 - affects the shift of the household utility function and its functional form variations across households,
 - affects the movement along the household utility function,
 - affects the shift of the household production function and its variations across households,
- or
- affects the movement along the production function

In summary, where directions of influence of some variables are predicted unambiguously, their magnitude of probabilities needs empirical investigation. These include availability of other household members with different age groups who substitute child labor contribution, household non-labor income (E) that raises consumption and hence child schooling, school distance and control variables such as child sex. To add to the trouble, several effects are not predictable even concerning their directions. These include land size, livestock and others whose effects on child schooling operate through wealth and substitution mechanisms on theoretical basis as well as location variables that are characterized by different rates of schooling and different household economic variables. Other household characteristics whose effects are ambiguous and most importantly included for controlling mechanisms are sex of the child, religion, micro-finance membership and sex of the head. Therefore, we should estimate the magnitudes and directions of the influences caused by changes in the variables on child schooling with great emphasis on the assumption that the effective choice for the children is between education and work in response to the changes of relevant variables. Of particular interest in this paper are the demographic and economic variables.

It follows that an exogenous variable vector, say X , should enter the utility function. This paves the way to take the theory as the framework that lends itself to empirical analysis of several exogenous variables in the allocation of child time. In doing so, again heterogeneity in household response behaviors brings in variations that are attributable to random errors (u) in addition to the systematic determination. Now the utility function that lends itself to econometric analysis is:

$U = u(C', S, t_e, X, u)$ subject to the budget constraint. But in the following mathematical presentation it is just $U = u(C, t_e)$

Mathematical Presentation

Assuming the extreme case of non-existent hired labor and following the same procedure as Cockburn (2001), we consider a model of a one-member agricultural household that produces and consumes one marketable good. If the produced and consumed goods are different, both their prices appear in the supply and demand functions. If these prices are exogenous, the results will not change.

(a) To begin with separable household model where production decisions are independent of consumption decisions.

$$PC = w(t - t_1) + \Pi + E$$

Production is a function of only one endogenous variable by the following profit-maximizing condition:

$$f_L = W/P.$$

The value of profit is substituted into the full-income constraint and determines consumption and labor supply according to the following utility maximization condition:

$$f_L = U_{t_1} / U_c$$

The separability of the model ensures that any variation in productive asset such as land (D) will only affect labor supply through its effect on household profits and that its effects will be unambiguous. An increase in improved inputs or household assets will increase the marginal productivity of labor in household production leading to increased labor hiring in. However, as the market wage rate is exogenous, the only change on the consumption/labor supply side of the model will be the resulting increase in profits. Assuming that non-labor time is a normal good, this will unambiguously reduce the labor supply of the household member.

(b) Let us see how these results change in the absence of labor market. In this context, all household labor is devoted to household production ($L = t_a$):

$$PC = PQ + E, \quad L + t_l = T$$

With the first order condition $f_L = W/P$

Assuming an interior solution for l and C , the two first-order conditions (FOC) for utility maximization are the following:

$$f_L = U_t / U_c = MRS_{tlc} \text{ (marginal rate of substitution of leisure for consumption)}$$

$PC = PQ + E$; P = price of household good.

Comparative Statics

In order to distinguish substitution and income effects, we first derive the effect of a change in non-labor income by totally differentiating the two FOCs with respect to E:

$f_{LL}(\partial L/\partial E) = (\partial MRS/\partial L)(\partial L/\partial E) + (\partial MRS/\partial C)(\partial C/\partial E)$; because MRS is a function of both labor supply and consumption which are in turn functions of the non-labor income (E).

$$P(\partial C/\partial E) = Pf_L(\partial L/\partial E) + 1$$

Substituting and simplifying, we obtain:

$$\partial L/\partial E = (-1/\gamma)(1/p)(\partial MRS/\partial C)$$

$$\partial C/\partial E = (1/\gamma)((\partial MRS/\partial L) - f_{LL}), \text{ where } \gamma = MRS(\partial MRS/\partial C) + \partial MRS/\partial L - f_{LL}$$

We assume that $(\partial MRS/\partial C)$ and $(\partial MRS/\partial L)$ are both positive. That is, given the convexity of the indifference curve, the marginal rate of substitution of leisure for consumption (the slope of the indifference curve) increases as labor supply and consumption increase. The assumption of fixed productive asset and consequent diminishing returns to household labor leads to negative f_{LL} . This implies that the sign of the income effects on labor supply and consumption depend on the sign of γ , which can be determined from the second-order condition (SOC) for utility maximization,

$$\text{SOC: } df_L/dL - dMRS/dL < 0$$

$$\partial f_L/\partial L - (\partial MRS/\partial L) - (\partial MRS/\partial C)(\partial C/\partial L) < 0$$

$$f_{LL} - (\partial MRS/\partial L) - MRS(\partial MRS/\partial C) < 0$$

Hence, $-\gamma < 0$ ($\gamma > 0$). This leads to the conclusion that $\partial L/\partial E < 0$ and $\partial C/\partial E > 0$.

Whereas the formal presentation of the impact of non-labor income on consumption and labor supply by Cockburn (2001) confirms the common intuitive appeal, his presentation of the effects of a change in productive asset holdings such as land is more important for our particular investigation. Totally differentiating the FOC with respect to D, which is the shift variable of the production function.

$$f_{LL}(\partial L/\partial D) + f_{LD} = (\partial MRS/\partial L)(\partial L/\partial D) + (\partial MRS/\partial C)(\partial C/\partial D); \text{ because, } f_L = f_L[L(D, E, V), D, V]$$

$$P(\partial C/\partial D) = Pf_L(\partial L/\partial D) + Pf_D$$

To solve, we substitute for $\partial MRS/\partial L$ and $\partial MRS/\partial C$ from the expressions for $(\partial L/\partial E)$ and $(\partial C/\partial E)$ and simplify to obtain:

$$\partial L/\partial D = Pf_D(\partial L/\partial E) + (1/\gamma)f_{LD} < 0 \text{ *ambiguous*}$$

$$\partial C/\partial D = Pf_D(\partial C/\partial E) + (1/\gamma)f_{LD}MRS > 0 \text{ *unambiguous*}$$

The first terms on the right-hand side of each equation are the income (yield) effects. The second terms represent the substitution (productivity opportunity) effects. The substitution effects are positive whereas the income effect is negative in the labor equation but positive in the consumption equation. Consequently, the net effect on labor supply is ambiguous and depends on the relative importance of the conflicting income and substitution effects. When a smoothly functioning labor market exists, increased access to physical assets will unambiguously increase income and reduce child work. However, in the absence of a labor market, we cannot predict the effects on child work, schooling and leisure time. Another issue is that different types and/or quantities of products are produced using different assets and variable inputs, which are activity-specific. In this case, different equilibria happen with corresponding labor supply decisions. See Cockburn (2001) for detail.

2.4. Modeling and Estimation Strategy

From the theoretical and empirical literature, it has been seen that several cultural, socioeconomic, demographic and institutional factors are found to determine rural child time allocation between work and schooling. It is undeniable, however, that the explanatory variables are not purely exogenous. In consequence, structural equations system best represents the logical reasoning of the framework. Nevertheless, attempts to develop this structural system might result in worse than better. Cockburn (2001) suggests reliance on reduced form econometric specification. He argues that reduced form equation avoids the danger of several misspecification possibilities associated with the equations of the structural system. A lot of studies so far have also used reduced form equation (see, for instance, Assefa, 2002; Cockburn, 2001; Bhalotra and Heady, 2000; etc.). In relation to dependent variables, it is not uncommon to use hours to capture child time allocation (see, for instance, Boozer and Suri, 2001; Bhalotra and Heady, 2000; Heady, 2000 and Assefa and Bedi, 2004). However, for the sake of convenience and reliability, several authors (e.g. Assefa, 2002; Cockburn, 1999; Cockburn, 2001; etc.) have used discrete choice of child time allocation. This paper makes use of probit model in order to estimate the probable effects of household demographic and economic variables on the discrete primary school attendance. Other socioeconomic and cultural characteristics are also included as controlling variables.

The first terms on the right-hand side of each equation are the income (yield) effects. The second terms represent the substitution (productivity opportunity) effects. The substitution effects are positive whereas the income effect is negative in the labor equation but positive in the consumption equation. Consequently, the net effect on labor supply is ambiguous and depends on the relative importance of the conflicting income and substitution effects. When a smoothly functioning labor market exists, increased access to physical assets will unambiguously increase income and reduce child work. However, in the absence of a labor market, we cannot predict the effects on child work, schooling and leisure time. Another issue is that different types and/or quantities of products are produced using different assets and variable inputs, which are activity-specific. In this case, different equilibria happen with corresponding labor supply decisions. See Cockburn (2001) for detail.

2.4. Modeling and Estimation Strategy

From the theoretical and empirical literature, it has been seen that several cultural, socioeconomic, demographic and institutional factors are found to determine rural child time allocation between work and schooling. It is undeniable, however, that the explanatory variables are not purely exogenous. In consequence, structural equations system best represents the logical reasoning of the framework. Nevertheless, attempts to develop this structural system might result in worse than better. Cockburn (2001) suggests reliance on reduced form econometric specification. He argues that reduced form equation avoids the danger of several misspecification possibilities associated with the equations of the structural system. A lot of studies so far have also used reduced form equation (see, for instance, Assefa, 2002; Cockburn, 2001; Bhalotra and Heady, 2000; etc.). In relation to dependent variables, it is not uncommon to use hours to capture child time allocation (see, for instance, Boozer and Suri, 2001; Bhalotra and Heady, 2000; Heady, 2000 and Assefa and Bedi, 2004). However, for the sake of convenience and reliability, several authors (e.g. Assefa, 2002; Cockburn, 1999; Cockburn, 2001; etc.) have used discrete choice of child time allocation. This paper makes use of probit model in order to estimate the probable effects of household demographic and economic variables on the discrete primary school attendance. Other socioeconomic and cultural characteristics are also included as controlling variables.

2.5. Formal Presentation of the Econometric Model

The dependent variable, whether the child is attending school or not is specified as the function of vector of relevant variables, X with corresponding parameters, β .

$\text{Prob}(\text{Child schooling}) = F(\text{Relevant variables; Parameters})$

The corresponding regression model is

$$y_i = \beta_0 + \sum \beta_j x_{ij} + u_i$$

Among the common econometric models of dichotomous outcome regression are the Linear Probability Model (LPM), the Logit Model and the Probit Model (PM). Probit and logit are almost exclusively used for estimating the effects of a set of independent variables on a binary (or dichotomous) dependent variable. When OLS is used to estimate a binary dependent variable (BDV) model, the model is often called a linear probability model (LPM). Probit and logit avoid several statistical problems with LPMs and generally yield results that make more sense. Whereas in the LPM we analyze the dichotomous variables as they are, we assume the existence of an underlying latent variable for which we observe a dichotomous realization in the logit and the probit models (Maddala, 2001). Such a latent variable assumption is particularly important for this particular study where some levels of competition between child work and schooling are not observed unless when a child is out of school (as described in the assumptions of section 2.2).

The choice between Logit and Probit models depends on the assumptions of the distributions of the error terms. These assumptions are logistic and normal distributions, respectively, for the logit and the probit models. The logistic distribution is similar to the normal distribution in the middle, but is thicker at the tails. Although logit and probit results are comparable with certain correction factor, there is a case where the conventional correction factor (see in Maddala, 2001 for the factors) may not make them comparable. This particularly occurs when there are extremely larger or extremely fewer responses of one of the dichotomous choices. In this paper, the probit model is used to estimate the parameters of the effects of the relevant variables.

$$P_i = \text{Prob}(y_i = 1) = \text{Prob}[u_i > -(\beta_0 + \sum \beta_j x_{ij})]$$

$$= 1 - F[-(\beta_0 + \sum \beta_j x_{ij})], \text{ where } F \text{ is the cumulative distribution function of } u.$$

Assuming symmetric distribution of u ,

$$P_i = F(\beta_0 + \sum \beta_j x_{ij})$$

Probit estimation follows the principle of maximum likelihood. For a dichotomous choice, where probabilities of choosing the two activities are, respectively, p_0 and p_1 , the likelihood function is:

$L = \prod_{ij} P_{ij}^{Y_{ij}} = P_{i0}^{Y_{i0}} P_{i1}^{Y_{i1}}$; Where, P 's are probabilities; Y 's are the discrete choices; i represents the particular child ($i=1,2,3, \dots, n$); 0 and 1 are, respectively, being out of school and in school. The principle of maximum likelihood provides a means of choosing an asymptotically efficient estimator for a set of parameters. The values of the parameters that maximize the maximum likelihood functions are maximum likelihood estimates. However, the maximum likelihood function is not readily subject to computation. Since monotonic transformation does not change the solution that maximizes the probability, it is common to transform it into Log-Likelihood function and make it to lend itself to computation.

In the probit model, we assume that u_i 's (the random errors) are independently and normally distributed with expected value of zero and constant variance, $IN(0, \sigma^2)$ and we have, β/σ^2

$$F(-\beta X_i) = \int_{-\beta X_i}^{\infty} \sigma^{-2} (2\pi)^{-0.5} \exp(-t^2/2) dt.$$

Where, β is the coefficient of the relationship between the likelihood of child's schooling and the relevant variables. X_i 's are the vector of explanatory variables that determine the positions and curvatures of the indifference curve and the production function. Here we can estimate β/σ^2 rather than β or σ^2 separately. Therefore, the assumption that $\sigma^2=1$ leaves as only with β

In computing the effect of variations on the outcome,

$$\partial E(y/x) / \partial X = [dF(\beta X) / d\beta X] \beta = f(\beta X) \beta = \phi(\beta X) \beta$$

$f(\cdot)$ is the density function that corresponds to the cumulative function, $F(\cdot)$ and $\phi(t)$ is the normal density.

As can be seen from above, the derivative of the expected probability of child schooling with respect to a relevant variable is not constant. It rather varies with the value of the variable at which we calculate the effect. The marginal effects in this paper should be understood in similar way. Specifically, the marginal effects of dummy explanatory variables represent the effect on the likelihood of schooling as we move from a child belonging to a group assigned zero to the one assigned 1. Whereas for the continuous variables the effects will be computed with respect to the mean values.

2.6. Sampling Design and the Data

The systematic random sampling method is used to generate the required data from four Kebeles in April 2004. Households are the sampling units, from which the required units of analysis are obtained. From the pilot survey it was learnt that the conditional households were found to contain about 3.0 children of ages 7 to 18 on average. Before this pilot survey, however, looking at a sub set of the Fifth Round of Ethiopian Household survey revealed that the average size of required age group children was about 2.67 per conditional household. This was used to initially decide upon 168 households in order to obtain the minimum number of 450 children. Finally, 156 households are surveyed with 12 non-responses. Although the exact quotas of what the proportionate sampling dictates (see Table A1 of the appendix), the random sampling followed strengthens the reliability of the observations.

Whereas the sample size from Dembi Gobu is largely lower than what could have been had it been under to the proportionate sampling, that of Oda Haro is largely greater. The larger sample size for Oda Haro is justified on the basis of its location and the likely consequent difference in socioeconomic characteristics as compared to the three Kebeles. The total number of 476 children is already obtained from 156 households, one of which is automatically dropped due to several missing data and some extreme cases. After preliminary data assessment, the rigorous analysis is made for 455 children, i.e., 226 girls and 229 boys. Finally, due to the nature of the data that two or more children frequently share some common household characteristics, the cluster effect will be considered in the rigorous econometric analysis.

III. LITERATURE REVIEW

Related literature on the issue of child labor and education ranges from descriptive materials to rigorous theoretical and empirical literature. In this section, the economic roles of children, basic reasons for child education and current status are given precedence while theory and evidence on the determinants of child work and schooling will be seen in the next subsection. In particular, the literature provides a background for the analysis of the impacts of demographic and economic variables on the household decision on primary education of children.

3. 1. Economic Roles of Rural Children

Although it is difficult to get evidence on the accurate measure of what children contribute, the existing high prevalence and incidence of child labor gives insight into their economic roles. Their contribution in the developing countries, which are characterized by low skill production techniques, seems important since children are expected to substitute adults. According to Rogers and Swinnerton (2000) for a low productivity economy, child labor is not a matter of choice. It is rather mandatory for both the society level economic activity and rate of schooling. Ethiopia is one of the developing countries whose children undertake several activities. According to existing evidences, 11.6% of the rural children in Ethiopia start working even before celebrating their fourth year (see, Assefa, 2002). Activities ranging from child-care, collecting wood, fetching water and other home responsibilities to farm work, are commonly undertaken by rural children. A recent study for rural Ethiopia shows that children are perfect substitutes of adult labor (Cockburn, 2004). Using a variety of functional forms and alternative child labor variables, the quantitative result is found to exhibit that the marginal productivity of children is roughly one-third to one-half of male adults. In terms of the household income contribution by each working child, Cockburn estimates it to be 4% to 7% while also admitting that it sometimes accounts for 50%.

Caldwell's theory, that wealth in traditional societies flows upward from children to their parents, has induced some empirical studies (Caldwell (1976), cited in Lee and Kramer, 2002).

According to Cain's study (1977, cited Lee and Kramer, 2002) of a village in Bangladesh, cumulative production by male children exceeds their cumulative consumption by the age of 15, lending support to Caldwell's view. Lee and Kramer (2002) document, however, recent empirical works that have questioned Cain's results for the age at which the net upward flow of wealth from children to parents sets in. Along with the recent works, Lee and Kramer show that children are costly to their parents. Using time allocation data from a group of Mayan agriculturists in Yucatan, Mexico, they found that children, nonetheless, do have an important economic role in the family's life, even if their net asset value up to the time of leaving home is negative. Whereas their individual economic contributions of children offset a substantial portion of their individual costs, enabling parents to continue child bearing during family life cycle stages further compounds the contributions of the early-born children. Otherwise, the parents themselves might not have sufficient time to support their family. Not only has this finding confirmed Chayanov's economic-demographic framework, it is also in line with human capital theories (see, for instance, Brown et al, 2002 and Linder, 1976). An important conclusion of the Mayan study is that the older children heavily subsidize the consumption of younger children. Without these contributions, to have large family, parents would have to work 2.5 times! as hard over much of the family life cycle.

Rogers and Swinnerton (2000) also argues that only in high productivity societies we can get rid of child labor without endangering the economy. The authors argue that by minimizing inequality in such a society, it is possible to enable the poor to release children to school from labor that could have been the consequence of lower living standard. They add that in a low productivity society, child labor is inevitable and striving to ban it threatens the economy. Yet, there are basic reasons for educating children rather than forcing them to work.

3. 2. Rationale for Educating Children and Current Status

Economic benefits of education are not the necessary conditions for educating children, because it is their basic human right to be educated. That is why even Pritchett (1999), whose cross-national study of developing countries shows lack of positive contribution of educational growth to per worker GDP growth, explicitly refrains from rendering education useless. Pritchett's finding does not seem to confirm the growth theories that human capital (among

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which is education) plays a great role in the process of development. One of his explanations is the possibility of high education levels that accompany individual returns rather than socially desirable activities. In most other literature (see Acemoglu and Angrist, 2000; Romar, 1990 and Fafchamps and Quisumbing 1998) the accumulation of human capital sustains long-term growth. Microeconomic evidences documented in this material and others, such as O'Cllaghan (2002) and Naderi and Mace (2003) show positive roles of schooling on modern wage earnings. Cognitive ability has also been supported to contribute to one's welfare (e.g. Cawley, *et al*, 2001). Cognitive ability, defined by these authors, is the trait that is partly built through education and informal human capital investment. This implies that children whose development is impaired and whose schooling is impeded lose a lot today and tomorrow. From humanitarian side too, Article 29 of the Convention on the Rights of Children states that, "The education of the child shall be directed to the development of the child's personality, talents and mental and physical abilities to their fullest potential" FDRE and UNICEF (2002).

Whereas both social and private returns of education in general are supported by most empirical evidences, separate analyses of education levels, however, exhibit inconclusive results of the social welfare contribution of higher education. Fortunately, unlike the contention found in higher level of education, there is consensus on the positive and significant net social return of lower-level education (O'cclaghan, 2002; Naderi and Mace, 2003 and Psacharopoulos, 1993). With particular emphasis on the education of girls, the argument that states that the social benefits of girls' education exceeds that of others is supported by strong evidences (see, for instance, UNESCO, 1992). Accordingly, where there has been heavy investment in female primary education, benefits for all occurs through higher productivity, lower infant and maternal mortality, longer life expectancy for both men and women, and lower fertility rates. If females' education is not promoted, the children whose lives would have been saved if their mothers had been educated continue to die. Those boys and girls who would have been healthier had their mothers been educated continue to suffer needlessly (Ibid).

The justification for ILO for eliminating child labor and enhancing child education is largely ethical and social in nature, although the economic consequences are also taken into account. Hence, it does not anticipate that countries should wait until economic development "solves" child labor, if indeed this could ever be expected. Rather, it calls for immediate action by all

countries at all levels of development. It also ensures that investing in child schooling results in substantial discounted benefits. The ILO perspective is that child labor is not only, nor perhaps even primarily, an economic problem. Even though its perspective is humanitarian, the IPEC's recent economic cost and benefit analysis strengthens this position (see, IPEC, 2004).

Therefore, both the humanitarian and social return arguments justify child education elsewhere around the world. On the other hand, the condition of many children in developing countries currently reflects a situation that is in contrast to humanitarians' and economists' beliefs of what it should have been. Worldwide, about 250 millions children of ages 5-14 are reported to be forced to work in developing countries (ILO, 1996). 120 millions are full time workers. UNICEF's current report adds that about three quarters are engaged in hazardous work and about 155 millions school age children are out of school.

With such description of current child status in Ethiopia and other developing countries, one might wonder about the specific sectoral contribution of education with regard to agricultural society. Fafchamps and Quisumbing (1998) mention that the effects of education on farm productivity vary substantially by geographic regions. Studies from Asia support the positive and significant relationship between education and farm productivity. These authors investigated the role of human capital on farm productivity in rural Pakistan. They find that education has no significant effect on farm productivity and livestock production. According to their finding, the effect of human capital on income is partly realized through the reallocation of labor from low productivity activity to a higher one. The study for rural Ethiopian by Weir, *et al* (2000) shows the result that education results in high social return for the economic return to the specific agricultural society. Even though they have not dealt with the technical efficiency, which Fafchamps and Quisumbing directly tested to be insignificant, Weir and Knight have found that education does have a significant economic role in terms of modern technology adoption diffusion. In other words, let alone in terms of the modern sector benefit that it creates, education plays a role in rural economies. Education might be partly in public good nature in rural sector where, according to Weir and Knight for instance, later technology adopters might learn from early ones who are probably more educated. Accordingly, the rural specific benefit of education spills over to neighborhood and even the community as a whole beyond the individual person or family. Therefore, education seems to have the double role of development in rural Ethiopia – enhanced productivity with less

inequality. This reinforces the generally held views about the significantly high social benefits of primary education whose universal access should be ensured.

In conclusion, despite child labor economic contribution, both humanitarian support and dynamic consideration of child education give important insight into the probable welfare gain of educating children. In contrary to the benefits of education, however, high incidence and prevalence of child labor exists in competition with education. Since internalizing future economic benefits and ensuring child right in rural Ethiopia depends on household joint decision, assessment of the determinants of this decision is very important.

3. 3. The Overview of the Competition between Work and Schooling in Different Economies

Even though the primary variable that determines child schooling is the availability of appropriate school itself, the related theoretical and empirical literature as the background of the particular study is more concerned with the demand side determinants. With regard to child labor too, not just working precludes schooling. The competition between work and schooling differ, for instance, with the type of the economy. Most studies for developed and urban sectors of developing countries find that child labor and schooling extremely compete, one excluding the other (see for example, Brown,*et al.*, 2002). In other words, in economies where wage labor is relatively high and hence large proportion of children undertake jobs out of the households, a child at work would more likely be out of school.

However, in other economies where substantial proportion of children undertakes household activities, combining work and schooling becomes less difficult. With varying degrees, this is common character of urban slums and rural areas of developing countries. For instance, Heady (2000) makes a comparative assessment of work and schooling combination for three countries: urban slum of Dhaka City of Bangladesh, rural Pakistan and rural Ghana. In the urban slum case, where work out of household is with the highest incidence, the work-schooling combination is the least. This inverse relation applies to the remaining countries, resulting in the most convenient possibility of work-schooling combination in rural Ghana, where most children undertake household activities.

Table 3.1. The Incidence of Work-Schooling Combination in Four Developing Countries (% out of the total children in the corresponding age group)

	Slum area of Dhaka City, Bangladesh* 1995-97 survey		Rural Pakistan 1991 survey	Rural Ghana* 1988/9 survey	Rural Ethiopia** 1999/2000 survey		
	8-11years	12-16years	10-14years	7-14years	4-7years	8-11years	12-15year
Boys	6.6	6.4	10.75	38.1	5.99	32.63	45.27
Girls	1.8	1.4	2.5	32.9	5.41	30.46	42.02

Sources: * *Heady, 2000*

** *Assefa, 2002*

A further comparable report by Assefa (2002) with reports for other developing countries shows that although substantial children are out of school, combining work with schooling is very common in rural Ethiopia. The case for Ethiopia seems to exhibit greater convenience of combination even than rural Ghana (Table 3.1). From rural Ethiopian Household Survey, Cockburn (1999) reports that while 8% of 4-15 years old children are inactive (neither working nor attending school), 97.3% of the children in school also work. Only 2.7% of them specialize in schooling. The surprising figure is that about 84.3% of children who are participating in work are out of school.

3. 4. Determinants of Rural Child Work and Schooling: Theory and Evidence

Studies that find the relationship between child schooling, education related activities and outcomes on the one side and the work activities of children can be categorized into two major strands. They are direct and reduced form statistical investigations where the latter need more strong theoretical background.

3.4.1. The direct forms: *Work Intensities (hours worked) and Education Outcomes*

The first strand directly finds the relation between hours worked and schooling and education outcomes. In a study for Peru, Patrinos and Psacharopoulos (1997, see in Heady, 2000) included child labor as an explanatory variable and found that higher work intensities result in

increased chance of age grade distortion, meaning that the child becomes too old for her/his grade. Using data of Bolivia and Venezuela, Psacharopoulos (1997) shows that child work reduces educational attainment by about two years. However, the result is statistically insignificant partly due to the non-uniform standards that schools might apply (Heady 2000). Heady goes further and investigates the relationship between hours of work and education performance of rural children using Ghana Living Standard Survey (GLS2), conducted in 1988/9 and finds significantly negative impact. A study for rural Ethiopia by Assefa and Bedi (2004) investigates the effect of hours worked by children on their Reading and Writing Ability (RWA) in addition to school attendance. It shows that the latter is not affected by some hours of work not exceeding threshold of about 16 to 22 hours per week while the RWA highly suffer. In other words, it is beyond this threshold that school attendance is observed to highly suffer.

Although the investigation of the effect of work on education performance is not the main concern of this particular study, its assessment gives insights into the possible directions of biases of the coefficients for the school attendance. In other words, if hours of work negatively affects the education performance of children who are attending school, negative coefficient of a variable representing the impact of a certain variable deviates from reflecting the actual effect when only school attendance is considered. It possibly understates the actual effect since the purpose of schooling is effective learning.

3.4.2. The reduced Forms: *Axioms, Theory and Evidence*

The General Axioms: *Luxury and Substitution*

In most empirical investigations and the assumptions that underlie their theoretical frameworks, the luxury and substitution axioms are dominant. According to the *luxury* axiom, households send their children when only driven to do so by poverty since, by presumption, a child non-work (schooling and leisure) is a luxury good. According to Bassu and Tzannatos (2003), implicit in the axiom is that parents or guardians do not like to send their children to labor (rather than to school) unless compelled by circumstances. Although they document the evidences that confirm this axiom (such as Edmonds, 2001; Admassie, 2002; Wahba, 2002 and Grootaert and Patrinos, 1999, 2002), the authors point out that in the situations of market

imperfections for labor, the luxury (poverty) axiom is less important. In other words, owning or controlling large productive assets means the opportunity for use of the household's labor including child labor.

The next important axiom is the *substitution* axiom according to which adult and child labor are substitutes subject to some adult equivalency correction. One wage labor study cited in Bassu and Tzannatos (2003) is Levison, et al. (1998) that lends support to the substitution axiom implying that adults can do what children do. Besides, studies for limited wage labor economies too confirm the assumption. Particularly, Cockburn (2004) finds out that child and adult labor are perfect substitutes, the former being one-third to one-half of the former in rural Ethiopia. Even though evidences from both market and less market economies support the substitution axiom, their emphasized recommendations for child labor reduction differ. Whereas a ban on child labor is theoretically Pareto superior in a wage market economy previously with equilibrium of higher child labor, productivity enhancing, labor saving modes of production is mostly recommended for the agricultural sector of developing countries and particularly for Ethiopia. A theoretical investigation of Bassu and Tzanatos (2003) show that a ban on child labor in high labor demand economy, withdrawing children from the labor market raises the wage for the adults through simultaneously ensuring higher income and lower child labor in the economy. However, a caution is that in poor societies, where the demand for labor is very low, the only equilibrium is possibly the situation where the economy is sustained by tolerating child labor. Otherwise, a ban on child labor can backfire poverty, leaving the children and their parents impoverished and risking starvation let alone ensured schooling. This view is also supported by Rogers and Kenneth (2000), who argues that only in high productivity societies we can get rid of child labor without endangering the economy.

Although the luxury and substitution axioms are widely used by several studies to derive policy implications that reduce child labor and increase schooling, changing social conceptions of childhood is also important. If the social conception of child labor and schooling vary between different communities even with identical legal and economic environments, there exist multiple equilibria of child labor and schooling. The gap between international standard for acceptable level of child work and what the society considers may vary from society to society. Similarly, the decision of a household to educate its child or not may partly depend on

the social norm. Based on this background, the theoretical development by Lopez-Calva (2003) shows the existence of multiple equilibria of child labor and hence child schooling in different societies. The crucial variable that is used to represent the social norm in the theoretical construct is the stigma cost of a household from sending a child to labor, which is inversely related to the number of children in the society sent to labor market. If so, the estimated coefficients of the determinants of child schooling and labor for separate communities better represent the actual parameters than when they are estimated for the nations and regions.

So far, we have seen the general axioms and the consequent theoretical framework for the study of the determinants of child work and schooling activities. Now we turn to detail assessment of the theory and evidence.

Theory and Evidence

In the section about the rationale for educating children, one of the basic reasons has been pointed out to be the returns to education. However, beyond justifying child education, the dynamic return consideration is less applicable to the studies of children whose choices are limited at two stages. Firstly, the activities of children are decided upon by their guardians as an outcome of household maximization. Secondly, the households as a whole are constrained by several factors that force the guardians to take actions that deviate from what they think to be desirable for their children at the ideal state. Therefore, the theoretical and empirical background for the determination of child schooling and work as a competing factor deals with the framework of households as producers and consumers and the empirical works under it.

The most widely presumed mechanism through which household socioeconomic characters influence child schooling is the work intensities that they cause. For instance, Heady (2000) documents studies that found that several factors that contribute to child labor (age, gender, language and number of siblings) reduce school attendance and increase the chance of grade repetition in Paraguay. According to this study, not just productive assets, but also are demographic and other variables the determinants of the choice between child labor and schooling.

land is an important wealth of a rural household and work and schooling compete, it is plausible to expect schooling of males to be more likely sacrificed than that of females, other things being equal. This expectation is based on the common biased inheritance share in rural Ethiopia.

The second element of household wealth is livestock ownership. This includes oxen, cows, heifers, calves, bulls, sheep, goat, donkey, horse, mule and others. Because of the distinctive role they have in crop production, oxen should be separately seen. Oxen are relatively fixed assets compared to labor inputs. Needless to repeat, the theoretical predictions of oxen ownership follow similar, if not identical, reasoning of that of land. Empirical evidences by Assefa (2002) and Cockburn (2001) show that oxen ownership results in increased child labor in Ethiopia. Whereas oxen are mostly in the form of inputs in the household crop production, other sets of livestock can be seen in the way of livestock production or store of wealth. Since both wealth and labor demand are increasing functions of livestock, child time allocation is ambiguous on theoretical basis. Furthermore, while the wealth effect is more likely to evenly operate among members of the household, the substitution effect might be biased in favor of child labor. Consistent with common observation in rural Ethiopia, Cockburn (1999) points out that lower age children highly participate in herding than any other age group in rural Ethiopia. There are also other empirical studies that resolve the theoretical ambiguities. For instance, Assefa (2002) has found that small animals ownership do not have significant effect on child time allocation. He adds that larger livestock result in decreased specialization in schooling and increased combination of schooling and work. On the other hand, Cockburn (2001) has found that while small animals are associated with increased child labor, larger animals reduce it. Furthermore, Cockburn has separately seen the impact of cows to be significantly negative on child labor, suggesting important wealth store function of cows in rural Ethiopia.

The economies of scale is expected to exist in rural Ethiopia in production of livestock. Simple observation of rural Ethiopia shows that conditional on ownership, with an increase in the number of livestock, child labor does not proportionally increase. The existence of community land and herding activities undertaken by the community members through moving turn might make the work intensity effects of livestock distinct between communities with distinct cohesion and common land.

Next, favorable rainfall and improved technology adoption are among farm productivity increasing factors. To begin with evidences of the impact of rainfall on child time allocation, Boozer and Suri (2001) investigate the choice involved in the trade-off between a children's labor outside of household work and their schooling hours from a sample of data from Ghana in the late 1980s. The authors take advantage of the distinct long run rainfall patterns of Northern and Southern Ghana as a good power of identification strategy. This enables the investigation of the child labor decisions made by households in the context of an exogenous shock to the productivity of the children in question. The result is that there is a significant trade-off between child labor and schooling caused by favorable rainfall. An equivalent study for Ethiopia is that of irrigation, which raises and reduces, respectively, child labor and schooling (Assefa, 2002).

Secondly, for better understanding of the theoretical prediction of the impact of technological adoption on children, it is common to divide technology into biased and neutral technological innovation with regard to labor use. With particular reference to labor input, a biased technological innovation is that type of innovation requiring more or less proportion of labor input than at the absence of such technology. In the neutral case, the proportion does not change. Biological innovations such as fertilizers and improved seeds are land saving, whereas mechanization is labor saving.

However, a technology that is labor saving in some stage (season) might demand more labor in the other. This is a crucial concern for child labor and education. Even a net labor saving technology might result in inhibited child education if child labor is saved when schooling is not in session and is increased during schooling session. Alternatively, it might save that of adult rather than child labor. So far, we have seen one side of the theoretical prediction. The remaining one is the income effect of technological adoption. Even though it is labor increasing or labor neutral under pure substitution, income (yield) effect reduces labor. Consequently, biological innovation effect is ambiguous in a missing labor markets. Assefa (2002) finds that mechanization results in decreased work specialization. The author also finds that biological innovation increases the probability of specializing in work vis-à-vis, combining with schooling, similar to the materials he cites that the Green Revolution has resulted in increased child labor. The site of the particular study is known for its biological

Next, favorable rainfall and improved technology adoption are among farm productivity increasing factors. To begin with evidences of the impact of rainfall on child time allocation, Boozer and Suri (2001) investigate the choice involved in the trade-off between a children's labor outside of household work and their schooling hours from a sample of data from Ghana in the late 1980s. The authors take advantage of the distinct long run rainfall patterns of Northern and Southern Ghana as a good power of identification strategy. This enables the investigation of the child labor decisions made by households in the context of an exogenous shock to the productivity of the children in question. The result is that there is a significant trade-off between child labor and schooling caused by favorable rainfall. An equivalent study for Ethiopia is that of irrigation, which raises and reduces, respectively, child labor and schooling (Assefa, 2002).

Secondly, for better understanding of the theoretical prediction of the impact of technological adoption on children, it is common to divide technology into biased and neutral technological innovation with regard to labor use. With particular reference to labor input, a biased technological innovation is that type of innovation requiring more or less proportion of labor input than at the absence of such technology. In the neutral case, the proportion does not change. Biological innovations such as fertilizers and improved seeds are land saving, whereas mechanization is labor saving.

However, a technology that is labor saving in some stage (season) might demand more labor in the other. This is a crucial concern for child labor and education. Even a net labor saving technology might result in inhibited child education if child labor is saved when schooling is not in session and is increased during schooling session. Alternatively, it might save that of adult rather than child labor. So far, we have seen one side of the theoretical prediction. The remaining one is the income effect of technological adoption. Even though it is labor increasing or labor neutral under pure substitution, income (yield) effect reduces labor. Consequently, biological innovation effect is ambiguous in a missing labor markets. Assefa (2002) finds that mechanization results in decreased work specialization. The author also finds that biological innovation increases the probability of specializing in work vis-à-vis, combining with schooling, similar to the materials he cites that the Green Revolution has resulted in increased child labor. The site of the particular study is known for its biological

technology adoption. Besides, the government extension program in the country, Bako area has access to maize innovation adoption through the nearby research center. According to Mosisa,*et al* (2002), about 49% of households in Bako Tibe Woreda were maize technology adopters. Impact studies also show that the technology has resulted in about 250% rise in yield in the country on average (Mosisa,*et al.*, 2002). Hence, both theory and evidence necessitate an inquiry into the impact of inter-household variations in maize and other cereal products on child time allocation in villages around Bako town.

In addition to the productivity enhancing shocks, the theoretical literature on credit constraints to human capital formation is not uncommon (see Baland, et al., 2001). It is commonly believed that imperfect capital market sustains the inefficient equilibrium of child labor. Similarly, Baland and others hypothesize that child labor exists in its inefficient equilibrium because either bequests are zero or families are credit constrained.

Firstly, where there is no wealth that will be transferred from parents to children in the future, there is nothing from which deduction is made in order to educate the latter today. Secondly, even if bequests were positive, credit constrained families are rational to allocate more of their children's time to work than it would have been at the presence of perfect capital market. To use words of Brown,*et al* (2002), credit constrained families borrow from the future generation in the form of child labor. Further evidence is that a cross national study of Dehejia Gatti (2002) shows the fact that in countries of less financial development, households resort on child labor in order to cope with limited income variability.

As a comment on Baland's and Robinson's conclusion, Bommier and Dubois (2004) have developed a theoretical framework in which preferences are made to account for the fact that children have a disutility for work. According to the authors, the utilities of parents and children are not transferable and hence the existence of altruistic family transfer does not guarantee that the family chooses an efficient level of child work. The reasoning of Bommier and Dubois has not neglected the collective decision processes involving household members. Rather they stress on the condition that cooperation across generations within the family may not be entrusted for the child welfare. According to the authors, the weak bargaining of children in the household still sustains the inefficient level of child labor due to the existence of rotten parents which they define as the existence of some sacrificed childhood utility and

hence an inefficiently high level of child labor that is rationally chosen by parents who are not altruistic enough.

Beyond the direct relationship between credit and human capital formation (child education and labor decision), short term production credit has never gotten attention in its role of influencing child work and schooling. In this decade of rural credit expansion, neither related theoretical developments nor rigorous empirical works are found in relation to child welfare. It might interact through the mechanisms of household activity choice and lubricating markets for land, oxen, labor and other farm inputs. Besides, it might cause changed preferences between activities with short run and long run benefits. In the site of this particular study, rural credit clients are found to utilize the credit from a local micro-finance service for diverse economic activities and different farm inputs (OCSSCO Bako Branch Credit Utilization Report, 2001).

Some impact assessment studies that seem to lack rigor show increased child schooling among rural credit clients in Ethiopia (see Tsehaye and Mengistu ,2002). Nevertheless, such descriptive analyses may not be free from sample selection problems, because households of certain characteristics might have selected themselves into the program. The correlation between such characteristics and child schooling renders the result from a descriptive analysis a certain bias due to the possible attribution problem. To cut the long story short, simultaneous consideration of rural credit access with other household characteristics fills the gap in the literature. Even if it were still correlated with some unobservable characteristics such as individual derives, this variable remains important at least for controlling mechanism.

The role of labor market is being discussed under different subsections. Restating some of the theoretical predictions, under imperfect labor market, the net effects of factors that influence the marginal productivity of labor are ambiguous with regard to household labor supply. Among sources of labor market imperfections are information asymmetry and mobility barriers. Supervision costs also determine the amount of wage labor to be employed (see, for instance, Brown,*et al*, 2002). It might be in response to this imperfection that rural communities enter into traditional institutions such as Debo, Dado, sharecropping, and other interlinked arrangements. These are the mechanisms that serve to ease tight household labor demand as well as to increase labor supply of the others with surplus labor. In Ethiopia,

traditional arrangements are common (see, for instance, Assefa, 2002). With regard to child time allocation, the author has found that these arrangements raise the probability of child work and reduce that of child education.

Both normative and positive issues necessitate the emphasis given to rural non-farm sector. Firstly, in integrated types of rural development programs we find non-farm activities to be recommended as strategy areas. Secondly, arguments are forwarded for the contributions this sector has already made. This sector is an important source of income and employment in rural Ethiopia. While this sector is believed to be the source of both income generation and diversification, there are contrasting expectations with regard to child time allocation. Firstly, the sector might attract children themselves, raising child labor. Secondly, reduced risk from diversified and increased household income from the sector possibly encourages child education rather than labor. Thirdly, off farm labor supply of adults might call for more child labor on farm or other household activities. Empirical study from rural Ethiopia shows that participation of household in the sector is positively related with child education and discourages child labor (Assefa, 2002).

With regard to demographic variables, we face contrasting propositions. According to Chayanov's (1966) economic-demographic theory, the dynamic process of family maturation results in an interaction where consumption demand and labor supply decisions of households depend on family size as well as its age-sex composition. To begin with family size, it is expected to be negatively related to child labor, given limited farm size (Bhalotra and Heady, 2000). On the other hand, larger family size results in smaller per person consumption, among which is child education. In response to such competing hypotheses, Bhalotra and Heady (2000) have found no relation of family size and schooling for Pakistan and Ghana. Assefa's (2002) study shows that the higher the family size, the lower is the probability of combining work with schooling in rural Ethiopia. He adds that child labor increases with dependency ratio, in conformity with prediction of Chayanov's economic-demographic framework.

Secondly, it is reasonable to expect a child's time allocation to vary according to age, because a person's consumption demand and production capacity varies over the course of life. Empirical evidence is that both school attendance and work participation probabilities increase with age in Ethiopia (Assefa, 2002 and Cockburn, 2001). With regard to sex also, these

authors point out that the importance of education for boys and girls in Ethiopia are different, being in favor of boys' education (Assefa, 2003).

Thirdly, not just age and sex of a particular child per se influence its time allocation between schooling and work, but also is the relative position of the child according to birth order, known as sibling position. Theories in this regard are based on four considerations: biological factors, increasing returns to household production, maternal attention and household budget constraint. To begin with biological consideration, Brown,*et al* (2002) mention that first born children, and those born to older mothers are less in weight at birth and genetic ability compared with middle siblings. The logical consequence of this reasoning puts middle siblings at privileged position in terms of higher IQ and educational achievement.

Empirical studies cited in Brown,*et al* (2002), however, show sequential fertility decision of parents based on average expected genetic ability, which results in abandoned birth to the last sibling that could have been biologically disadvantaged. This implies that lastborn are biologically the ablest. Nevertheless, in rural societies of LDCs, where fertility is more of natural one, it is reasonable to expect biologically ablest siblings to be the middle ones. In addition to biological reason, families diversify children time allocation when there is increasing returns to household production. As a result, some children in a family may be educated while others are made to work on household responsibilities. Unlike the clear prediction of the biological bias in favor of middle siblings, the production scale consideration tells us only that child time allocation is not identical across all the siblings. The third consideration is the maternal attention that a child enjoys during early ages. According to this reasoning, the first siblings are born to the smallest families. To use the word of Brown and others, they receive their "bonus" in the form of maternal attention. The fourth and most important factor of siblings' differential is the household budget constraint. According to Brown,*et al* (2002) and sources cited therein, even if parents wanted to evenly make expenditures for all the children, they might be too constrained to do so. Since the first-born are in the smallest families during early ages, they enjoy the greatest early age expenditure by their parents in addition to the maternal "bonus". Unfortunately, however, they quit schooling earlier although they are the ones to be educated early. The young siblings are in smaller families at their schooling age. Besides, they are subsidized by the earnings and contributions of the oldest. According to Brown and others, the youngest siblings receive their "bonus" in

the form of educational attainment. The middle ones are in competition for time and budget resources with others through out their childhood. We observe here that the prediction of the impact of household budget constraint on siblings is the reverse of that of biological factor.

Due to the contentious predictions, the impact of sibling position on a child's time allocation between work and schooling is ambiguous on theoretical basis. Although it is difficult to disentangle the coefficients of the underlying individual factors, Assefa (2002) and Cockburn (2001) have found that sibling position plays a significant role. According to Linder (1977), birth order and family size studies show similar effects that parental resource constraint results in uneven distribution over siblings. He suggests that reduction in family size leads to improved educational achievements. Besides, any reduction in the dispersion of family size, a common accompaniment of reduction in average family size, will tend to equalize the educational achievement and attainment of children.

Similar to the household demographics, illnesses among the household members affect child time allocation. This is done in three major ways. Firstly, the child itself might suffer from the illness. Secondly, illness increases dependency ratio. Thirdly, loss of a head to death disturbs the family structure. To put in a single statement, even if a child is not sick, sickness and mortality in the household increases child labor. For instance, Fox, *et al* (2003) mentions that child labor is substantially used to compensate adult labor loss to HIV/AIDS related cases in a Kenyan plantation. Assefa (2003) also suggests that there is an expectation of increase in child labor in Africa due to loss of adults to HIV/AIDS. As a particular concern, the study site of this paper is known for widespread of malaria. Therefore, the impacts of related sickness and mortality on child time allocation around Bako Town call for empirical investigation.

3.5. Summary of the Literature and the Necessity of Community Level Study

So far, we have concentrated on demand side variables without the school side determinants in place. Regional or national level studies, that seem to overlook the divergence between instruction medium of schools and the mother tongue heterogeneities that vary from one community to another, possibly less accurately attribute the coefficients of ethnic dummies to cultural and other socioeconomic factors. Secondly, frequent considerations of education supply are found in large area investigations (see, for instance, Assefa, 2002 and Cockburn,

the form of educational attainment. The middle ones are in competition for time and budget resources with others through out their childhood. We observe here that the prediction of the impact of household budget constraint on siblings is the reverse of that of biological factor.

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2001). Such studies tend to capture school variables in terms of distances, or area dummy variables. Furthermore, even in a small area, where these variables are with less variation among the households at a given time, education supply variable should be considered in the way that captures supply-lags. Studies that neglect such lags possibly underestimate the negative impact of school distance on child education. Consequently, the lag between enrollment age of the child and school availability matters in studies with heterogeneous age groups particularly when past activity persistence plays a role for child time allocation. Therefore, lagged school facility availability should have been considered in addition to current ones. In conclusion, the possible presence of facility lag raises an importance of supply side consideration even in a small area study. However, this is commonly overlooked. The particular study avoids such possible bias due to the old enough minimum service age of the existing schools. Furthermore, the fact that all the children in the area face a common secondary school mitigates any possible bias due to cross effect of secondary school.

In the literature so far, although both economic benefits and humanitarian supports of child education are in place, the prevailing conditions of children show that children are inefficiently out of school. For children to be out of school and being engaged in work, there are theoretical explanations and empirical evidences for the roles of demographic and socioeconomic factors. However, not only such observable variables explain why a child is in school or not, or equivalently why a child is more intensively made to work than another. The reason is that besides the observable characteristics, social norms are very important for a household to educate its child or not. Recent theoretical explanations by Basu and Tzamnatos (2003) and Felipe-Calva (2003) explicitly show the associated intercommunity multiple equilibria that arise from the community specific social stigma cost levels of sending a child to work rather than to school. According to these authors the level of child labor and hence education can be very different between communities of identical other characteristics. They introduce the possibility that multiple equilibria are partly historically determined in such a way that they persist even if other intercommunity differences are equalized in the real world or accounted for. Therefore, village studies are inevitable to better understand the exact impacts of certain variables in the particular village rather than simply relying upon aggregate studies. That is why this study is carried on at the expense of relatively larger data requirement rather than extrapolating the results of similar and even more holistic previous national studies (such as Assefa, 2002; Cockburn, 1999 and 2001).

IV. DATA PRESENTATION AND ANALYSIS

4. 1. Introduction

The survey covers 155 households from four Kebeles in April 2004, i, e., in the second semester school session. Whereas only seven to 18 years old boys and girls are the ultimate units of analysis, demographic and economic activity data of all the household members are collected due to the joint decisions made by households over consumption and production. Totally 1037 individuals are found in the 155 households, indicating average household size of about 6.7 persons. This is larger than the average household size of about 4.9 shown by the 1994 population census for rural Bako Tibe Woreda. Perhaps, it is partly due to the nature of the conditional population that only households containing members of age group of 7 to 18 years are included in the sample. About 45.7% (474) of the total are children of age seven to 18 years (see Table A11 and Figure A1 for the demographic structure).

The survey data show that except four households the remaining 151 are agricultural households in the sense that at least one member of the household is currently engaged in growing crops and /or breeding and raising livestock in private or in combination with others. These households undertake agricultural activities either on their own or transacted land. Among 14 households who do not own cultivable land other than garden plots, ten have currently cultivated transacted-in land, most of which is sharecropping. The descriptive statistics for 139 households, who own cultivable land, shows average land size of 1.92 hectares with Standard Deviation (SD) of 1.38. About 75% of them own less than three hectares, whereas the upper quartile own three to eight hectares with higher inequality. From the sample data about 24.4 hectares of cultivated land is sharecropped-in or rented-in land.¹⁰ Land as an important productive asset is, therefore, used to produce varieties of crops and livestock. The productive assets are, in most cases, exclusively complemented with household human recourses among which are the school age children.

¹⁰ Totally, 31 households have cultivated land of other households whereas 23 households have responded that they have let out to others. The Total figure for transacting out land is 29.6 hectares. Whether this is greater than transacted in land is by chance by chance or due to inherent characteristics of the sample households (Vis-à-vis, the households that do not contain the age group of interest) is not unknown. A further or alternative possibility is that whereas the data on transacting in is only for cultivated land, that of transacting out is not restricted.

Most of the children are found to be active during the past 12 months. Some 4.0% (19) are inactive, i.e., neither working nor attending school. Most of these inactive children are seven and eight years old, whose guardians have responded the inactivity to be due to young age. A few older children are inactive due to illness. The remaining 96.0% (455) have been active for the last 12 months during the survey. The activities are categorized into two, as primary and secondary activities. Those attending school are assigned schooling as the primary activity. Accordingly, 57.5% of the children are attending school. Their secondary activities show that most of them (45.1%) combine school attendance with domestic or family farm work. Only 4.4% (21 students) combine school attendance with no secondary activity. The startling figure is that 42.5% of the children are out of school. Most of them take domestic or family farm work as their primary activity. Relatively, fewer children combine these activities with income generating activities. The paid work participation for males and females are, respectively, 14% and 8%. Using the overall participation rate of 57.5% as a comparison level, firstly, child related variables, such as sex and age play their own roles. Among the females, 54.1% are attending school. The figure is about 60.0% for males. The male participation rate is greater at every age except the very lower age. In general, the overall participation rate takes its peak between 12 and 13 years of age with a rate of about 78.7%.

Table 4.1. School Participation Rates of the Working Children by Sex and Age Groups

	School participation rate (%) [*]		
Age	Male	Female	Total
7-9	36	38	37
10-12	75	63	67
13-15	73	58	66
16-18	60	59	59
Total	60	54	57.5

^{*} School participation rate here is measured by percentage of school attendants out of the corresponding age and sex groups

Source: Survey Data

The current school participation rate is the combined effect of current enrolment and attainment of previous enrolments. Using the enrolment age of seven as a comparison for the deviation from potential grade, Table 4.2 shows that the average age-grade distortion, that a child gets too old for her /his grade, increases with age in general. Both participation rate and age-grade distortion show that the tendencies of greater gender disparity seem to exist at older ages. Here, special attention should be given to the older children who are out of school. Attempts of providing primary education for all may not succeed by reaching every child even though both the supply side and the decision-making environments of households are made favorable for child education. In other words, with increasing age-grade distortion, policies and non-discriminatory advocacy measures are less effective unless the children with high age-grade distortion are particularly targeted.

Tabl 4.2 Age-Grade Distortion by Schooling Status and Sex Group

Age	Currently school		Out of school	
	male	female	male	female
7.00	0.0	0.0	0.0	0.0
8.00	0.0	0.0	0.0	0.9
9.00	0.4	0.4	0.4	1.5
10.00	0.9	0.4	0.4	3.0
11.00	1.0	1.6	1.6	3.7
12.00	1.7	1.7	1.7	2.8
13.00	1.0	2.2	2.2	4.0
14.00	2.2	2.3	2.3	5.0
15.00	2.7	3.0	3.0	4.9
16.00	2.8	3.1	3.1	6.8
17.00	3.1	2.0	2.0	5.0
18.00	4.1	4.3	4.3	7.8
Total	2.0	1.9	1.9	3.4

Source: Survey Data

The environment that governs the sex and age participation differences consists of several variables that are themselves interrelated. Besides age and sex of the child, close biological relation is accompanied by high school participation rates of both sex and age groups.

Therefore, before statistically investigating the determinants of child schooling, the qualitative responses are presented in Table 4.3. The most single important qualitative response is the too young age reason by the household heads. It accounts for 66 children, while the data on overall child activity show that only 19 of them do not work. In most cases, these children are those of ages 7 and 8 years. The age as the reason must have captured some of the effects of child work contribution that is decided with additional consideration of the school distance whose effect might also be captured by the parents' valuations that a young child better stay around home where she/he contributes in terms of some activities. The school distance is directly responded to be the reason only for one child.

Work contributions, in terms of household activities and family farm together account for the largest frequency to represent the direct reasons of being out of school. The combined response results of the young age, school distance and work activities seem to suggest that for some heads indicating young age as the reason, it may mean that a child whose work contribution is positive is too young to go to school. It does not necessarily mean that work contribution has not reinforced being out of school. Besides, illness and paid work are important reasons, followed by other different factors.

Table 4.3. The Qualitative Responses by the Households Why the Children are Primarily Not Currently in School

Reasons for not	Total		Oromiffa speakers		Others	
	Frequency	percent	Frequency	percent	Frequency	Percent
Too young	66	33.17	63	34.05	3	21.43
Was required for farm activities	37	18.59	34	18.38	3	21.43
Was required for other household activities	31	15.58	29	15.68	2	14.29
Was required to work for wages	14	7.04	11	5.95	3	21.43
School too distant	1	0.5	1	0.54	0	0
Too sickly to attend	22	11.06	22	11.89	0	0
No places Available in local school	1	0.5	1	0.54	0	0
Other reason (language, orphanage, overage, security of the way etc.)	12	6.03	10	5.41	2	14.29
No idea	15	7.54	14	7.57	1	7.14
Total	199	100	185	100	14	100

Source: Survey Data

Next, the impact of instruction medium on different groups of children is an important variable. One of the central assumptions of this study is that the solution for schooling is interior. In other words, it is found in well-behaved utility function of the households with varying weights attached to schooling according to the socioeconomic characteristics of each household. However, the school type, in terms of instruction medium that is different from the child's mother tongue, might influence more of 'whether to have schooling in the utility bundle' than 'how much weight is attached to it'. The qualitative response that the child is out of school primarily due to language is made for two (14.3%) of the particular children currently out of school.

Further Looking at the descriptive result, school attendance rates of the children, whose mother tongue is different from the instruction medium-Oromiffa-is relatively lower. There are 28 such children who belong to eight households. Excluding one child who belongs to a household in Gajo Kuyi Kebele, the remaining 27 children are in Dembi Gobu,which is relatively with better average of school participation rate. Since several correlate variables may influence children differently in different Kebeles, school participation rates of the two groups of children have to be limited to the particular Kebele in which the heterogeneity exists. The result is that while they face even less school distance, only about half of the children whose mother tongue is different from the instruction language are in school. This is by far lower than 65.6% of the others (see Table 4.4).

Table 4. 4. School Attendance by Mother Tongue in Dembi Gobu Kebele

	Mother tongue				Total No.
	Oromiffa		Other than Oromiffa		
	No.	%	No.	%	
In school	63	65.6	14	51.9	77
Out of school	33	34.4	13	48.1	66
Total	96	100	27	100	123

Source: Survey Data

Although the comparison is within a single Kebele, still there might be some difficulty in precisely identifying the impact of language. The reason is that whether this difference is due to other variables that are systematically correlated with both schooling and mother tongue is not automatically clear. This is made so by the combined nature of a few observation and high disproportion. In response to this, a one by one comparison of the means of the explanatory

variables between the two groups of children is made (see Table A9). The variables are selected from the next sub-sections, all of which are relevant in the saturated econometric model. Therefore, it is mandatory to bypass and test the significance of the differences between the means of the variables for the two groups of children.¹¹

Among child schooling decreasing factors, transacting land-in is more experienced by the households of the children belonging to the smaller group. However, no satisfactory attempt is made here to identify whether being out of school has affected the activity choice or vice versa. Of course, the lower average land size of these households indicate that this has at least partly caused land transaction. Therefore, as long as land transaction-in is to fill the shortfall rather than to cultivate above the overall average, land transacting in as the reducing factor of schooling is doubtful. The next schooling increasing household characters that are less for the particular children are head's education and permanent crop ownership. On the other hand, households of theses children are characterized by greater cereal diversification, which is tested by the econometric result to increase child schooling. With regard to cultural consideration in terms of religion and other relevant variables, the two groups of children are similar.

Finally, the coexistence of several variables and the smaller observation nature of the cases leave the identification of the impact of the single instruction medium unresolved.¹² However, the gap between the groups of children in a single Kebele served by a single school and governed by almost similar socioeconomic environments should be a future research agenda with larger and detail observation. Although identifying the attributions to each variable is not easy, the qualitative reasons and descriptive results of the preceding discussion do have their own better explanations in other child-specific and household-related variables. Therefore, since such descriptions with regard to other household characteristics do not precisely tell us their impacts on school participation rates, statistical tests, that take the variations from the means into account, have to be made. The Analysis of Variance (ANOVA) is used in investigating the strength of associations between several variables and child schooling.

¹¹ For detail understanding of the relevance of the variables, one is advised to refer to the ANOVA results, the narrative justification and the econometric results.

¹² The problem due to a few observation is that even a minor change in the composition of the sample can show an apparently equality or more difference.

4. 2. The Analysis of Variance (ANOVA) and Likelihood Ratio (LR) Test

ANOVA tests whether the means of two or more groups are truly different. The procedure is that it takes the ratios of between-group weighted sum of squares to within groups weighted sum of squares and uses the F values for the decision rule in testing the hypothesis. The sums of squares are weighted by the corresponding degrees of freedom (df). For the between groups sum of squares, the df is equal to the number of groups minus one. It is the total observation minus the number of groups for the within sum of squares. In this case, there are two groups-children who are currently attending school and those out of school. Since the main purpose of the investigation is for primary schooling determinants, 14 children who have completed this level are excluded. This exclusion is particularly important since the consideration of some of the variables in the later econometric model is determined by their significance here. Further exclusions are made with regard to extreme cereal crop, land and livestock data. This includes two households containing five children. Therefore, the statistical investigation is made for 455 children whose school participation rate is 56 %, the remaining 44% being out of school.

In most cases statistical investigations assume normal distribution of the variables. However in practice, observations violate this assumption even if extreme cases (outliers) are excluded. In other words, some variables are characterized by the nature that the median and mean are divergent. It is in response to this drawback that the transformations for some variables are made (see the description in table A2 of the Appendix-1).

Finally, ANOVA tests whether the means of a certain variable for the two groups of children are statistically different. For the dummy explanatory variables, it specifically tests whether significantly more or less of the children with certain attributes are currently in school. Therefore, based on the F-value, the result shows that several child-specific and household related variables are significantly associated with the school attendance of children. This set of variables corresponds to the variables in table A4 of Appendix-1 with F statistics greater than the critical value.

The results of ANOVA are not sufficient for understanding the relationships due to two important reasons. Firstly, most of the variables are commonly shared with two or more children in a household. This necessitates cluster consideration. Secondly, several household

characteristics are themselves so interrelated that attribution problem arises with a partial correlation analysis, because an association does not necessarily mean justifiable relationship. This necessitates cluster consideration. Therefore, both the attribution and cluster problems should be avoided in order to understand the real effects of household characteristics. This can be achieved by rigorous regression analysis that simultaneously considers several variables while clustering the standard errors of the coefficients on households.

Fortunately, ANOVA is particularly important for preliminary screening of some of the variables that should be included into the rigorous econometric model of this paper. Strictly speaking, the variables for which judgment rather than strong theoretical base is utilized in the study, are decided upon for removal or inclusion into the econometric model based on ANOVA results. For the theoretically relevant variables and the other variables that are expected to be correlated with some opposing forces on schooling, the ANOVA results are not binding for their removal or inclusion in to the econometric model. That is why some variables, whose F-values show insignificant results, are maintained for the next econometric model.

Firstly, the child sex dummy will not be dropped from the next rigorous statistical investigation due to its crucial controlling function. The coefficients of the explanatory variables that distinctly affect the schooling of males and females will be biased unless sex is controlled in the multiple regression analysis. Consistent with the expectation, the LR test shows that the variable is relevant for the econometric model.

Secondly, the effect of sex of the head is ambiguous due to its possible correlation with household demographic and economic variables. Specifically, male headship might be associated with two sets of other variables: one set favoring child schooling and the other disfavoring it. For instance, the data show male-headed households are associated with greater number of adult members, which in turn favors child schooling. On the other hand, the data show that female heads are characterized by better education, which in turn may favor child schooling. However, the final LR test for the relevance of the variable has shown that sex of the head is an irrelevant variable to explain the child schooling even when the other variables are simultaneously controlled.

Thirdly, the dummy variable for the presence of infants in the household is not automatically excluded. The reason is that although task burdens unambiguously reduce schooling, the dummy variable might also carry the effect of other variables that favor schooling. For instance, for the upper age children the presence of an infant in the household might proxy older sibling and hence the consequence effect that sibling position theories predict. Finally, the test for its relevance in the rigorous model is supported by the LR test result.

Fourthly, one of the major characters of the area is the incidence of malaria. About 65% of the all age and 63% of the children under investigation are reported by the respondents to suffer from malaria in the year. The mechanism through which it increases dependency ratio and increased burden of attending a sick member call for consideration of this variable. However, neither the proportion of the household members caught malaria during the year nor whether the child itself has suffered is found to systematically determine school attendance in the year. The ANOVA result shows the negative relation as expected, although it is not significant. Perhaps, this is due to the overall community effect of malaria other than household level. Traditional labor sharing is a mechanism that might reduce the effectiveness of malaria on the household level. Particularly, Debo is one type of insurance for households in emergency need of labor without the requirement of reciprocity. Whereas the dummy for whether the particular child has suffered is automatically excluded, the incidence, as measured by the proportions of household members who suffered in the current year, is maintained for further multivariate analysis. The degree of the incidence varies with location of the household, which might in turn be associated with favorable conditions for child schooling. However, at the presence of all other important variables too the result that the household level incidence of malaria does not matter for child schooling has not changed.

Fifthly, for irrigation access and cash crop variables, whose theoretical prediction is ambiguous, the ANOVA results are insignificant. Irrigation access, whose relation is insignificantly negative, is highly related to the cash crop production by the households, whose relation is also insignificantly positive. Cash crop production commonly arises with irrigation access. Red peppers, green peppers, and sugar cane are the cash crops produced in the area using irrigation. Hence, the high correlation between cash crop and irrigation access precludes the inclusion of both in an equation. Although chat is produced using irrigation when it arises, it is included in the permanent type plant for a special concern of the effects of none annual

plants. This contributes to the none perfect correlation between cash crop production and irrigation access although the major reason for the departure from perfect correlation has emerged from the natures of the data relating to the two variables. The irrigation related one represents whether the household had access to irrigation for the last two years. Whereas the cash crop related data represents whether the household have currently produced cash crop or not. In addition to whether the household has produced or not, its imputed value is available. However, no attempt is done to include these values because only a few have produced and the majority has been assigned value of zero. Here, only the dummy for irrigation utilization is included as an explanatory variable despite the final result that shows its irrelevance.

The sixth variables are the set of household assets one of which is land size. The effect of land size is theoretically ambiguous. Not only theoretical ambiguity precludes the exclusion on this variable, but also it is significant for separate female group even based on the analysis of variance. The dummy for sharecropping - or renting out land follows the same reason as land size that it is significant for female children. Even though it is not significant, the dummy for sharecropping or rent in will also be included for the model adequacy. Besides to land asset, oxen and other livestock units will be included in the econometric model.¹³ Their theoretical ambiguity justifies the inclusion although the results of Table A4 are insignificant. Finally, while both land related variables are found to explain the model, there is no evidence for the importance of the oxen and other livestock unit variables in the saturated model.

Next, the monetary value of annual cereal crop products is maintained despite its insignificance in the analysis of variance. The reason is that it might carry the opposing effects such as negative effect of larger land size, the positive effect of higher living standard, and so on. The luxury assumption is that children are sent to work if only the family welfare falls below the socially acceptable level of subsistence at the absence of child work. In other words, poverty is the driving force of child labor. Although this is particularly limited to wage work rather than to the rural households, who utilize family labor on their productive assets, we still need to test the proposition. With the presumption that the additive crop value increases with units of crop produced and that the latter in turn increases with land fertility or /and land size, the importance of the crop variable is compounded particularly at the absence of land fertility data, because at the absence of these quality data, the coefficient of land size is biased. Fortunately,

¹³ For the detail of livestock units computation, see Table A3

if not eliminated, the bias is reduced by inclusion of the product along with the units of land at least in the initial saturated model although it is not finally found to be relevant.

Next, the school related variables such as divergence of mother tongue from the instruction medium and distance are retained for further modeling although their negative relationships with child schooling are insignificant. It is very important particularly to avoid false attribution problems that might arise due to other relevant variables that are correlated with both child schooling and these variables. Although this expectation has led to the inclusion of the variable into the econometric model, the LR test shows that there is no strong evidence for their importance in the determination of schooling of the children aged 7 to 18 years. This is against the results of existing studies that both mother tongue (EHRC, 2003) and school distance (Assefa, 2002 and Cockburn, 2001) reduce child schooling in Ethiopia. With regard to the language variable, the insignificance is perhaps due to the associated high variance of greatly disproportionate data. Three main possibilities may explain the result of this paper for the school distance. Firstly, the school distance that could have been traveled by very young children not currently in school might be undermined by the household heads if they report the time it takes based on their own experiences, which might be less than the time it could have taken for young children. On the other hand, for those going to school, the report might better represent the time it takes to travel to school. Secondly, the actual distance variable might be masked by none objective responses of households. Households in a coherent social interaction may report the distance from some nucleus location. Such locations might commonly gravitate to locations of social service provisions one of which is school. Thirdly and most important, there might be some sample selection problem. This particularly happens if parents, who board their children with certain relatives nearer to a school, give responses that represent the longer distance between themselves and the school. On the other hand, there is no such a bias for children not currently in school. While there is no available data for these possibilities, the existence of one or all of them dilutes the significance of expected negative relationship between schooling and the time it takes to travel.

The final econometric model will be arrived at by first specifying the saturated econometric model, which is the direct consequence of theory and ANOVA results. However, due to the common nature of the household demographic data, correlations between the explanatory variables need special consideration before specifying the saturated model.

Table 4.5. Log-likelihood Ratio (LR) Test Values

variables	Log likelihood of the restricted model (LL_R)	χ^2	Significance Level	Does the LR test provide the evidence that the variable is relevant in explaining the reduced form rigorous model?
Dum_sex	-247.54137	3.09	0.0788	Yes*
Age	-266.76493	41.54	0.0000	Yes
Age_sq	-263.6759	35.36	0.0000	Yes
rel_head	-249.0253	6.06	0.0138	Yes
inf	-247.38919	2.79	0.0951	Yes
Girls	-250.03899	8.09	0.0045	Yes
Adults	-248.32987	4.67	0.0307	Yes
ed_head	-250.98469	9.98	0.0016	Yes
hsex	-246.12246	1.90	0.1883	No
Malaria	-246.04345	0.03	0.7591	No
Land	-248.77939	5.57	0.0183	Yes
dumlin	-247.02354	0.25	0.6155	No
dumlout	-246.9454	2.05	0.1518	Yes
irr	-246.34116	0.69	0.4063	No
oxen	-246.09859	0.20	0.6512	No
livest	-246.13934	0.229	0.5929	No
Mic_fin	-248.08574	4.18	0.0409	Yes
wage	-248.50906	5.03	0.0250	Yes
Dcrop	-251.08738	10.18	0.0014	Yes
vcrop	-246.26992	0.55	0.4595	No
pplant	-251.17998	10.37	0.0013	Yes
Orth	-246.13289	0.27	0.6014	No
Lang	-246.2802	0.57	0.4512	No
sc_dist	-245.99833	0.00	0.9507	No
oharo	-248.32639	4.66	0.0309	Yes

**All the effects of the variables, whose values in the fourth column are less than 0.15, are simultaneously investigated for separate sex and age groups.*

The results are presented in Table A8 with the corresponding statistics. Using the backward estimation procedure, the variables for which there are no evidences to be relevant are excluded. The procedure is that a variable is removed at a time and then the consequent

restricted model is tested against the unrestricted model using the Likelihood Ratio (LR) test. This tests whether the Log Likelihood is significantly affected by the removal of the variable. The results for this test are listed in Table 4.5. The decision rule for inclusion is using the probability level up to 15 % (0.15) in column 4 of Table 4.5. Using this decision rule for inclusion, the null hypothesis that a particular variable does not significantly affect the model is rejected for the variables whose corresponding significance levels are above 15%.

The backward estimation is made for the aggregate observation, because the variables of the saturated model are too many for the size of an individual sex group to enable the estimation. It is an intuitive appeal to expect situations in which a systematic relationship between an explanatory and the dependent variable for one group is masked by a completely random relationship for the other group. This happens particularly when the former group is substantially smaller than the latter. Fortunately, in our case, we are guaranteed by the balanced size of the sex groups.

A further problem of using the aggregate observation, which is even aggravated (let alone resolved) by the balanced proportion of the groups, arises when an explanatory variable is related with the dependent variable in sharp contrasting ways for the two groups. In other words, a variable that positively affects schooling of one sex group might negatively affect that of the other. Indeed, the problem is most possible with two balanced groups making up the aggregate. Consequently, a highly significant variable is incorrectly excluded based on the result of the aggregate estimated result. In order to cope with this possible problem, forward estimation is made for the separate groups once the final model with fewer variables is arrived at. Of course, the forward estimation is done not for all the variables previously excluded by the LR test. It is done only for the variables that the descriptive results have shown the contrasting associations for males and females. Although the role of reduced observation is not deniable, the LR tests for the separate forward estimations have shown that the model already resulted from the backward procedure is robust. With the separate estimations that is accompanied with reduced observations, consequent increases in the standard errors and poor fits of the predicting equations are inevitable. However, the balanced sizes of male and female groups enable the comparison of differential impacts of the variables. Not in all cases do increased standard errors result in reduced precision. In some cases the increases in the coefficients override and result in even larger precisions in the separate models. This can be

seen particularly in the result, for separate female group. The comparison across age groups is not distinctly done for upper and lower ages. The reason is that attempting to do so results in too few observations to make the estimated results reliable. Consequently, separate estimation is done only for males and females up to 16 years of age. The comparison is, therefore done against the sex specific aggregate results.

4. 3. The Econometric Results

The probit model regresses the discrete child school attendance on the relevant variables. Since in most cases two or more children are found in a single household and commonly share values of some household related variables, the standard errors are clustered on households. The first child related control variable is **age of the child**. School attendance is found to be a down turning quadratic function of age, where it gets its peak between 12 and 13 years. Secondly, the dummy for **sex of the child** shows the tendency of favoring males' schooling. The probability of a boy to be sent to school exceeds that of a girl by about 7%. However, this gender disparity is not statistically significant. A caution here is that there is no direct observation of the effort intensities on work and education activities, beyond the assumption that work intensity for a child out of school is higher. Hence, the insignificance of sex dummy tells us lack of significant gender disparity in school participation only. Moreover, the result may not mean that males' and females' school participations are identically determined. In other words, the strength of a variable to determine children school participations might differ between males and females.

In order to test such a proposition, separate estimates are made for males and females in addition to the aggregate estimate. The consequent results are not qualitatively different. Although substantial differences in magnitudes are found, the direction of determination of each variable in all the three estimates is the same, except for the land transaction variable, whose sign of coefficient becomes negative for males. Descriptions for the variables are found in Table A2.

Firstly, while the **presence of infants** in the household significantly reduces the likelihood of school attendance for female children, this negative impact is insignificant for male children. This supports the commonly expected practice that taking care for infants is in most cases undertaken by female children.

Table 4. 6. The Econometric Results

	Aggregate			Males		Females	
Variables	Coeff icien ts	Margi nal Effects	Z	Margi nal Effects	Z	Margi nal Effects	Z
dum_sex	0.19	0.07	1.43				
Age	0.95	0.37	6.11***	0.46	5.62***	0.26	2.60***
age_sq	-0.04	- 0.01	-5.63***	-0.02	-5.29***	-0.01	-2.35**
rel_head	0.53	0.21	2.36**	0.02	0.16	0.30	2.81***
Inf	-0.28	-0.11	-1.84*	-0.02	-0.28	-0.20	-2.05**
girls	0.35	0.14	2.91***	0.14	2.23*	0.19	3.08***
adults	0.33	0.13	1.54	0.18	1.66*	0.20	1.56
ed_head	0.52	0.20	3.53***	0.06	0.73	0.36	4.08***
Land	-0.43	-0.17	-3.28***	-0.04	-0.64	-0.43	-4.38***
dumlout	0.35	0.13	1.66*	-0.02	-0.19	0.25	2.58**
mic_fin	-0.36	-0.14	-2.40**	-0.08	-0.90	-0.27	-3.16***
Wage	-0.46	-0.18	-1.77*	-0.21	-1.50	-0.16	-1.15
dcereal	0.36	0.14	2.51**	0.14	1.72*	0.14	1.66*
pplant	0.52	0.20	3.87***	0.18	2.65***	0.31	3.55***
oharo	-0.36	-0.14	-2.31**	-0.10	-1.05	-0.22	-2.58**
Statistics							
Obs.	455			229		226	
L.Likel.	-250.20841			-120.2912		-114.65424	
Wald chi2	108.54			64.04		67.54	
Prob>chi2	0.0000			0.0000		0.0000	
Pseudo R2	0.1975			0.2222		0.2661	

***Significant at 1%, **significant at 5% and *significant at 10%

Thirdly, with the substitution axiom that adult and child labor are substitutable with a certain correction factor, one expects a rural child to be more probably sent to school as the **number of adults** in the household increases. Even though the nibble finger argument that children are more suitable to certain tasks than adults exists, there is no plausible reason to expect a significant positive relationship between child work (and hence reduced schooling) and adult size in the household of a rural community unless greater direct complementarity is found between adults and children than between productive assets and children in household production. In conformity to the expectation, the number of adults in the household increases the school attendance probabilities of both female and male children, with lower precision for females.

With regard to the **inter-child relationships** at work and schooling, initially, the school age children were tested by the analysis of variance in their different forms, such as other girls and boys out of school. However, neither of these two variables is found to be individually significant to support the presence of cross effect of being out of school by some child on the schooling of another child in the household. While all girls and boys (other than a child at a time) are tested regardless of their schooling, the effect of the boys variable remains to be insignificant. However, the number of **school age girls** in the household encourages the schooling of both boys and (other) girls. This shows that for a boy or girl to benefit from the number of other girls in the household, the latter need not be out of school. The more surprising result is that the relationship is asymmetry in the sense that the number of boys in the household is not found to encourage the schooling of girls. The result for females is slightly higher both in magnitude and precision. This indicates that while males benefit from female children in the household, this does not symmetrically happen for the latter to benefit from the former. In the site, where the family farm works are undertaken by both females and males, labor constraint that the household faces might have in most cases, made the school attendance of girls to be sacrificed.

Although in most cases children are found with their biological parents as heads of the households, it is not uncommon to find some children to be found with heads who are not their biological parents. Although there is no sufficient data about why this is so in this study, it might be due to push factors such as loss of parents to death, family disintegration and so on. It might also be due to pull factors such as better living standards of the households joined in terms of economic measures or/ and other social indicators. Furthermore, there is the

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possibility of finding daughters-in-law and spouses of the heads. For instance, two females of ages 14 and 17 and three females of age 17 to 18 are found in particular survey to belong to, respectively, daughters-in-law and spouses of the heads. Even excluding these and separately estimating does not change the result. While in both cases the coefficients of the dummy variable of being a **direct offspring of the head** are positive, that of boys is insignificant. It is highly significant for females. In other words, the likelihood of school attendance of a female child who is not the daughter of the head is significantly less than that of the females whose heads are their biological parents. The finding of this result, that being the son of the head or not does not matter, is in contrast to existing result of the national level studies such as Cockburn (2001) and Assefa (2002) whose findings show positive relationships both for boys and girls. The result for female children is robust even when the observations for the five married females are not used in the regression. Therefore, while this finding is interesting by itself, there is still a need for detailed sociological studies to understand why females are adversely affected while males are not, with particular emphasis on investigating the push and pull factors for being with none biological parents.

The importance of **head's education** with regard to children schooling is very diverse. Firstly, an indirect effect through allocative efficiency is expected to raise the schooling of children. There have already been empirical evidences that economic returns to education in rural societies are significantly high. Therefore, with the presumption that better educated heads are more efficient in their household labor utilization, an indirect positive affect on child schooling is expected. In fact, the study for rural Ethiopian by Weir and Knight, *et al* (2000) shows the result that education results in high social return for the economic return to the agricultural society in terms of improved technology adoption. Furthermore, if higher living standards (in terms of nutrition, shelter, health, etc.) are caused by head's education, and the former in turn raises child education, the indirect effects are multiplied. Besides, if children of educated heads benefit in terms of better cognitive abilities and education performance that in turn encourage households to maintain school attendance of these children, school attendance is again expected to be positively related to head's education. In addition to the diverse indirect effects, formal education appreciation might differ between heads with different levels of education. Unfortunately, identifying all the individual effects of head's education from one other is beyond the scope of this paper. The result of this paper in general shows that heads with one or more years of formal education more probably send their children to school with marginal

effect of above 21.5%. Other than revealing that about 47% of the heads have experienced some formal education, the data do not identify heads that have been literate through other alternative means to formal education. Provided that those heads also favor child schooling, the marginal effect of heads' literacy in general would be greater than the result for only formal education. In fact, there is no plausible reason that while formally educated heads favor child education, none formally educated ones do not. The result shows not only the effect of heads education on the current children, it also suggests the possibility of perpetuated advantages and disadvantages in the dynamic context. Educating the current children benefits the future generation in terms of schooling of the future children, in addition to other social and economic benefits.

Theory predicts that while the wealth effect of larger **land size** encourages leisure and hence education, its labor complementarity in the household production discourages these choices. It is not clear from mere theory, therefore, which sign the coefficient of land takes. The empirical test for the site under study shows that larger land size disfavors school attendance of female children while the effect for boys is insignificant. Here, substitution effect must have exceeded the wealth effect. According to Bhalotra and Heady (2000), such an effect is due to imperfect labor market. It could have also been added that it is partly due to imperfect asset market. In line with this expectation, the dummy for land sharecropping and rent are tested.¹⁵ The result is that **sharecropping- or renting-in land** is not even a relevant variable although it is negative in sign (see in Table 4.5). On the other hand, **share cropping-or renting-out land** positively and significantly raises the probability of a female child to be sent to school. Letting out land raises the probability to attend school by about 25%. Although rent is very rare in this community sharecropping is relatively better practiced. It is an interesting result that while own total land disfavors education, sharecropping-out favors it without sharecropping-in being significant. The asymmetrically none systematic relationship between sharecropping or renting-in land and schooling on the one hand and strong relationship with regard to letting out on the other hand might be due the less favorable choice in letting out land than the reverse. Perhaps, due to adverse selection or /and moral hazards, the expected farm return is better if the available household human resources are first exhausted for a household to sharecrop out

¹⁵ In order to mitigate any possible existence of endogeneity that land transaction depends on child schooling, the data is made to represent two years unlike the school attendance data of this year. In fact, the study for Ghana by Bhalotra and Heady (2000) find that the endogeneity does not exist in rural Ghana. For the own land variable, the current year size is utilized assuming that land ownership is usually exogenous.

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land. On the other hand, for a household to sharecrop-in land, doing so is decided in the way that does not require so exhaustive utilization of own human resources that child schooling is sacrificed. Therefore, had it not been for the traditional land transaction, this community could have sent fewer girls to school. This result, furthermore, points out the favorable potential for releasing more children to school.

If land size increases the work burden on girls and land transaction out reduces it, we are in the position to strive for enhancing land transaction, particularly, rent that avoids the possible adverse selection and moral hazard associated with a household that would sharecrop out land. However, although the role of land transaction is clear, it will not be ubiquitous enough to resolve all the discrepancy between none child labor and productive assets of individual households. The reason is that while land transactions in terms of sharecropping and rent are usually made for single season terms, the decisions to send children to school and maintain their schooling are decisions of longer time considerations. It is clear that for n factors of production, the existence of markets for $n-1$ factors are sufficient for efficiency to be attained. Therefore, enhancing adult labor market plays great role in societies where labor is the most important complement of the land variable.

In Ethiopian rural communities, where labor market is very rare, traditional labor sharing plays its own role not only in times of particular emergencies. But also productive capacities and labor differences over time and between households raise its importance. In this study site, the greater proportion of households has engaged in traditional labor sharing in the year. The variable is almost random with child schooling. It is an intuitive appeal that in a small area of cohesive community, labor-sharing involvement is selectively determined rather than being a constraint. The plausible reason for the departure of this result from the significant negative result for a national study by Assefa (2002) or from the expectation that it increases schooling through reducing the different inter-household labor tightness seems, at least partly, the possible lower intercommunity variation in this paper. Perhaps, traditional labor sharing is a stronger constraint when compared between households in a wider area than between households in a cohesive community. Besides, the low incidence of crop diversification by the household and between households reduces the role that labor sharing could have played. In fact, it is not uncommon that moving turns, namely Dado are made among friends or neighbors for the matter of increased drive rather than the direct resolution of inter-household difference

of labor tightness. Therefore, since only land transactions and traditional labor sharing are not entrusted, there should be measures that enhance adult wage labor and crop diversification.

Theories that relate child labor to capital market imperfection state that credit constrained parents borrow from the next generation in terms of child labor meaning that making children work today rather than accumulating human capital through education. However, the relationship of schooling with being client of short-term production credits is not widely discussed. Short-term production credits might interact with child education through several mechanisms. They might affect it through the change in household living standard. Furthermore, the type of investment that such short term credits encourage might change the household labor demand and hence, the child's schooling. It was mainly meant to control for the households, who are the clients of this service. This is done based on the results of some studies that the impact of micro finances services on child education is significant. Before including this variable into the econometric model, its relation with observed household characteristics is tested not to be strongly determined by such variables as head's literacy, heads sex, land, oxen, and other demographic variables. Therefore, its inclusion into the model does not carry false attributions of the other variables of interest. Further inquiry of what characteristics determine the membership is beyond the scope of this study. But it worth mentioning that females' school attendance is negatively associated with the household's being client of the service in the past two years. No significant association is found for male children although it is still negative. The result is qualitatively similar to that of land, except the magnitudes that are higher for the land variable. The micro finance variable might have proxied certain unobserved variable(s) correlated with the client households.¹⁶ Since the relevance of the variable is to control for its role in this paper, there is a need for further study for why the relation is negative.

Next, the dummy for participation of the children in paid works in the last 12 months is included in the final model. Although its precision declines with the separate estimates for the sex groups, this is likely due to reduced observation. It shows significantly negative effect on child education. The incidence is about 14% and 8% for boys and girls, respectively. Among the children below the minimum age of employment of 14 years, two males and one female are found in the sample. If the ILO's standard for lower minimum age for light works is referred,

¹⁶ Only at the early times of establishment, the branch concentrated on lower wealth class. Recently, however, there is no such a restriction.

what is categorized to be child labor might further decline, ignoring its competition with schooling. However, since it competes with schooling substantially, the fact that the children in paid work are above the minimum age of employment does not preclude the incidence of the paid work that is categorized to be child labor. Although there is no available data, a common observation shows that piece rate payment is practical particularly in the activities of maize harvesting. If able household members are considered to be the wage-workers while they are accompanied by the child household members, hidden forms of child labor might prevail. This can be made clear only through further researches. The result for paid work activities by any household member other than the children under investigation, whose data have not clearly identified the kind of employments and payments, is not found to be a relevant variable in the model of this study.

Cereal diversification is found to be positive in general and for young age groups in particular. Households that have ever diversified their cereals other than the dominant maize production in the current year are found to send their children to school better than those who have not diversified. Cereal diversification causes work intensity diversification across seasons. Of course, how much of the crop diversification effects are attributed to land quality, risk diversification and so on cannot be identified by the existing data. However, the result that there is no support for the value of the current cereal crop production gives more insights into the importance of diversification.

For the sake of disentangling **permanent plants (crops)** that are characterized by infrequent labor demand and more of wealth component, some of the cash crops are grouped together with other plants that are none annual. Only red peppers, sugar cane and red peppers production history of the household in the last 12 months is specified to define whether the household has produced cash crop or not. On the other hand, even though they are meant for cash, mango, chat papaya and, in rare cases, the ownership of coffee are categorized as permanent plants along with Gesho and eucalyptus tree that have ever been sold at least once in the last three years. Operationally defined in this way, permanent plant ownership is found to favor the chances of both boys and girls by, respectively, 18% and 31% marginal effects.¹⁷

¹⁷ Cockburn (2001), who has found unexpected negative result for rural Ethiopia suggests the possibility of some unobservable site characteristics. He argues that permanent plants are site specific, and if those sites with permanent plants have some unobserved characteristics that disfavors child education, it becomes clear that the coefficient of the permanent plant is biased downward. In our case of the small homogeneous ecological area study, the intra-community effect is as expected.

The final caution is that whether the impact of these plants is through insurance mechanisms that reduce added labor effects or through the commonly known wealth and substitution mechanisms or both is not identified. Fortunately, whatever the mechanism is, the suggestions to encourage such permanent type plants have always been there even without this particular result. What this finding emphasizes is that they do have so multiple benefits that their cost-benefit analysis should take into account the effect on child schooling too.

Although all the four Kebeles are characterized by their own nearest primary schools, the distances traveled are not the same. **Oada Haro**, a relatively far site from Bako Town, is also a site with greater primary school distance that would be traveled. Not only primary school distance distinguishes this site from others. It is also characterized by statistically larger household land size, larger livestock units and greater malaria incidence. However, the qualitative result that children in Oda Haro less likely attend education is robust even when these variables are simultaneously controlled.

The high school distance might force households to board their high school children at a town far away, to pay for house rents, to forgo part time child work contribution, to face psychic cost of departure, and so on. The presence of such expectation, perhaps, affects child primary education particularly that of children of households, who aspire for high school education. The result of this paper that a distant site less probably encourages primary education is perhaps due to the cross effect of high school direct and indirect costs, assuming constant social norm. The presence of cross effects of costs does have an interesting implication for education policies. Not only school distance by itself is considered for cross effects, but also other costs of education level beyond primary education might play their own roles for the decisions made by households on primary education.

The z- values that get reduced while moving from the sex specific aggregate results to that of lower age groups cannot be unambiguously interpreted (see Table 4.7 and A10). The reason is that it is not certain whether the reduction is due to either the poor fit, reduced observations or actually reduced systematic relationship. Of course, if the marginal effect is found to increase, it raises the likelihood that the reduction in the z-value is due to decreased systematic correlation. On the other hand, unchanged or increased z-values of the smaller observations of

the lower age groups are unambiguously interpreted to be the consequence of better fit of the relationship.

Table 4.7. Econometric Results for the 7 to 16 years

Variables	Males		Females	
	Marginal Effect	Z	Marginal Effect	Z
Age	0.65	4.59***	0.35	2.35**
age_sq	-0.03	-4.20***	-0.01	-2.12**
rel_head	-0.09	-0.64	0.22	1.62*
infants	0.09	0.94	-0.19	-1.82*
Girls	0.17	2.28**	0.29	4.03***
Adults	0.17	1.35	0.14	1.03
ed_head	0.05	0.52	0.43	4.80***
Land	-0.03	-0.33	-0.57	-5.45***
Dum_lout	-0.06	-0.57	0.33	3.51***
mic_fin	-0.11	-1.05	-0.28	-3.03***
Wage	-0.28	-1.75*	-0.22	-1.41
dcereal	0.11	1.17	0.13	1.38
Pplant	0.23	2.78***	0.45	5.20***
Oharo	-0.09	-0.93	-0.32	-3.68***
Statistics				
Observations	190		201	
L.Likelihood	-91.1500		-92.380	
Wald chi2	56.05		78.163	
Prob >chi2	0.0000		0.0000	
Pseudo R2	0.2894		0.3349	

Based on this comparison procedure, firstly, relationship to the head that is insignificant for all boys gets its precision to slightly increase for the separate younger boys. The marginal effect turns to negative although it remains insignificant. With regard to girls, the z-value falls although its positive coefficient gets larger. Probably, at least most of the fall in z-value is due to the reduced observations. In general, relationship to the head seems to be more important for younger children.

Secondly, the insignificantly negative effect of the presence of infants in the household turns to be insignificantly positive for the younger boys with increased precision. For girls, the negative coefficient gets smaller with reduced z-value. Therefore, we can conclude, at least for boys, that the presence of infants in the household is associated with greater likelihood of schooling for younger children. The result is in contrast to the common expectation that younger boys are more probably burdened with the associated tasks of childcare and other responsibilities due to the presence of infants at home. Perhaps, the infant dummy variable carries the positive impact of the work substitution role of young children of age six and less. Of course, in some cases where they are considered by their parents to be too young to attend schools, they yet undertake some home activities. In the survey of this study, the household heads' qualitative responses for not attending are "too young" for 66 children while inactivity is responded only for 19 children.¹⁸

Thirdly, the effect of adult variable seems to decrease for both younger boys and girls. Although ambiguity arises due to reduced z-values, the marginal effects are less. This must have, at least, been due to less labor substitution between younger children and adults. The same trend applies to cereal diversification that its marginal effects are less for both younger boys and girls than their older counterparts.

A further comparison shows that the effects of head's formal education, land size and being from Oda Haro become lower for younger boys and higher for younger girls with unchanged signs. For the latter group the z-values, too, are greater. The result shows that these three variables are more gender discriminatory for the younger children. Next, the coefficient of

¹⁸ According to existing evidence from the fifth round Ethiopian Rural Household Survey of 1999/2000, about 53.3% of rural children in Ethiopia the children up to six year of age undertake some activities (see, Assefa, 2002).

micro-finance service increases both in magnitude and predictive capacity for younger boys while it increases and decreases, respectively, in magnitude and predictive ability for girls.

Finally, with unchanged signs, the effects of the remaining four variables become unambiguously stronger for the younger children. In other words, both their magnitudes and precisions are greater than the corresponding sex specific aggregate results. These variables include the number of girls, the dummy for land transaction, paid work and ownership of permanent plants. Therefore, as commonly expected, most interventions that aim at raising child education are not equally effective across age categories although there is no strong evidence for contrasting effects.

Collaborative actions, in terms of creating the environment that encourages child education might work better for the lower age children than they do for the upper age ones due to main important reasons. Firstly, the household characteristics are stronger for the younger children than they are for the upper age ones in influencing the primary activities. Secondly, and most related to the problem of the current youth (upper age) is that those who are already out of school, completed very low grades or none are not expected to benefit much from primary education enhancing efforts. This is reinforced by the evidence of higher age-grade distortion (Table 4.2 in section 4.1). Therefore, collaborative measures, i.e., actions that enhance the environment of household decision-making on schooling are better relied upon for the younger children.

V. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

In this paper the main focus variables are the household demographic and economic variables that are the mechanisms through which work and schooling compete. With the presumption that work and schooling compete and hence factors that increase child work reduce schooling, the reduced form equation parameters are estimated separately for boys and girls. Consequently, the variables that are expected to affect child work are found to inversely affect schooling with varying degrees for boys and girls.

Since the analysis is based on school attendance and work participation, rather than exact hours allocated, the extent to which work intensities affect education performance cannot be investigated from the data at hand and it is also beyond the scope of this paper. Yet, there are important insights from the results. Particularly, the result for female children, that shows high sensitivity of schooling to the variations in household demographic and economic variables, suggest the equivalently greater hours worked by them, as compared to the male children. If so, some of the female children currently in school might have sacrificed some of their education related activities at home. Furthermore, if they feel tired in class due to some chores just before going to school, the education performance likely declines. In turn, poor performance might reinforce dropout in some future time. Under such conditions, studies like the particular one not only underestimate the impact of work on education, but also even the coefficients of the variables explaining the school attendance probability themselves are undermined. The reason is that dropouts due to poor performances are, at least partly, cumulative outcomes. To illustrate, a variable that negatively affects the current child school attendance, say land, might have revealed even greater magnitude had future dropouts, that are partly cumulative outcomes of poor performances, been considered. However, such investigations require longitudinal data. Finally, the higher sensitivity of schooling of girls to the demographic and economic environments suggest the presence of higher effective choice between work and schooling for girls than for boys. In relation to the comparison across age groups, the effects of several variables are found to be stronger for younger children. Furthermore, the distinct effects of productive assets on males and females, who could have equally been educated, reveal the worse human right violation against girls' education.

The main findings are:

- ❖ The size of adult household members is one of the variables favoring the likelihood of schooling for both boys and girls, indicating child-adult substitution at work. Next, the test for inter-child cross substitution at work and has schooling failed to be supported in the sense that there is no significant effect on schooling of a child due to (an) other out of school child (ren) in the household.
- ❖ A more interesting result is that the chances of schooling of both girls and boys are favored by the number of (other) girls in the household. This is an asymmetric relationship that the presence of boys is not found to favor schooling of girls or (other) boys-asymmetric inter-sex complementarity in schooling or / and substitution at work. Despite these inter-sex relationships that seem to be biased in favor of boys, no statistically significant gender disparity is found in the rate of school attendance. The implication becomes clearer while looking at the result that the size of land, which is commonly a productive asset of the households, negatively affects the schooling of only girls.
- ❖ It is an interesting result that while own total land disfavors schooling, sharecropping-out favors it without sharecropping-in being even relevant. We find asymmetric results with regard to land transaction. On the one hand, there is no significant systematic relationship between sharecropping or renting in land and schooling. On the other hand there is a strong positive relationship with regard to letting out own land. This might be due to the less favorable choice in letting out land than the reverse. Perhaps, due to adverse selection or /and moral hazards, the expected farm return is better if the available household human resources are first exhausted for a household than sharecropping out land. On the other hand, for a household to sharecrop-in land, doing so is decided in the way that does not require exhaustive enough utilization of own human resources that cause significant sacrifice in child schooling. Therefore, had it not been for the traditional land transaction, this community could have sent fewer girls to school. This result, furthermore, points out the favorable potential for releasing more children to school.

- ❖ Therefore, the three results together - asymmetric inter-sex relationship, lack of numerical gender disparity in the rate of schooling and the substantially negative impact of productive assets on schooling of girls - indicate the higher work intensities for girls than they are for boys. If households are forced to rely on own children in order to take advantages of available productive assets, particularly larger land size, the initial step to gender discrimination might set in by increasing farm task burdens on girls who have already been undertaking household activities. If that is not enough, further higher work intensities might raise the chance of being out of school. The evidence for this logical consequence is reinforced by the positive impact of land transaction-out for girls.
- ❖ Furthermore, being from clients of the local micro-finance is associated with lower chances of being in school both for boys and girls, with greater marginal effect on the latter.
- ❖ Being none closely related to the head, the presence of infants in the household and being from Oda Haro Kebele are found to reduce the chance of school for girls only. If there is any negative impact that is worse for the schooling of boys, it is only the paid work participation whose incidence is actually too low (14%) to explain why a number of boys are out of school. Regarding other variables with positive impacts, formal education of the head is found to be randomly related with the schooling of boys while it positively influences that of girls.
- ❖ The variables such as crop diversification and permanent plants (crops) raise the likelihood of all children. Whereas crop diversification almost equally affects both groups, the effect of permanent plants is greater for girls.

5.2. Recommendations

1. The combined results of high age-grade distortion at the upper age, out of school children (the youth category) and the econometric result that the household characteristics are weaker for

this group in influencing the primary schooling suggest two important ways of interventions. To begin with, collaborative measures, i.e., actions that enhance the environment of household decision-making on schooling are better relied upon for the younger children. Furthermore, alternative basic education and non-formal education seems to be a good way of educating the older group, particularly, the youth. Non-formal education includes education in agricultural extension, HIV/AIDS and other health related, family planning, and other productivity and welfare enhancing provisions. Whereas their own basic education right deserves the provision of an appropriate education by itself, the multiplied effects are also generated from educating the youth in two ways. Firstly, productivity enhancing and rural wage labor promotion ease the community level labor shortage, among other things. This contributes to a favorable environment for younger children to be released to school. Secondly, there is a dynamic consequence that the conditions of the future sons and daughters of the current youth depend on the skills and awareness of the would-be parents. Therefore, an important means of securing basic education for the current children, the youth and the future children is providing non-formal education to the youth. Particularly, the female youth should be given special consideration as a result of greater social benefit from educating them.

2. Interventions such as through labor saving techniques, head's education, enhancing permanent type plants and reducing push factors for being with non-biological parents more effectively encourage schooling of female children. Furthermore, benefits to orphanage interventions in the area are more important for female children than for boys.
3. While there is no evidence for the effect of the value of household crop product, controlling for land size, the substantially significant and positive effect of crop diversification by the households indicates the potential gain from the latter. It almost equally encourages the schooling of male and female children.
4. The combined results of negative impact of land size, positive impact of transacting out land and adult-child substitution at work show two main areas of interventions: (a) Enhancement of local institutions that encourage land transactions through sharecropping and renting has to be targeted to encourage schooling of female children. (b) Furthermore, provided that the market for land cannot be expected to be ubiquitous, enhancing market for its complements, particularly adult labor market has to be enhanced.

5. Even at the absence of household demographic and economic interventions, there seems to be the possibility of raising the school attendance of male children. This needs a further sociological research in order to point out the factors that reduce the effectiveness of the choice between work and schooling for boys.
6. The result that the local micro finance utilization is associated with lower likelihood of schooling of female children calls for further investigation to point out the interaction mechanism.
7. The indication of work - schooling effective choice and hence high work intensities for female children mitigates against future attempts of full day school session. It might force substantial female children to forgo schooling, which could have conveniently been combined with work otherwise.

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APPENDIX 1

TableA1 Sample Kebeles and Households

Sample Kebeles	Male Headed	Female Headed	Total	Proportional size of households (out of 156)	Actual size of the observed households	School Participation Rate of children of 7 to 18 years (%)
Dembi Dima	410	220	630	29	44**	51.7
Dembi Gobu	1228	104	1332	62	40***	63.2
Gajo Kuyi	728	171	899	42	38	68.3
Oda Hora	440	48	488	23	34	45.7
Total	2806	543	3349	156*	156	42.5

*Planned total household number for the survey was 168, comprised of 42 households from each Kebele.

** Some of the none responses are substituted with households in Dembi Dima Kebele.

***One household is automatically dropped due to several missing data as well as extreme values.

Source: The woreda documents and survey data

Table A2. Description of variables (Dependent Variable: Child schooling- 1 if currently attending;0 otherwise):(a) for the variables which are not subject to econometric investigation

Independent variables	Abbreviated as	Description
Head's age	H_age	Complete years
Spouse literacy	Ed-sp	1 if ever attended formal school, 0 otherwise
Head's marital status	H_mar	1 if with spouse, 0 otherwise
Number of boys	Boys	Square root of number of boys aged 7 to 18 years
Number of girls out of school	G_outsc	Square root of number of girls aged 7 to 18 years who are out of school
Number of boys out of school	B_outsc	Square root of number of boys aged 7 to 18 years who are out of school
Family size	F_size	Total number of permanent household members
Individual level incidence of malaria	Chil_mal	1 if the child has ever suffered for the last 12 months, 0 otherwise
Traditional labor sharing	Trad_lab	1 if the household participated in traditional labor sharing in the past 12 months, 0 otherwise
Off- farm activity by the household	Off_farm	1 if any household member participates in income generating activity; 0 otherwise
Utilization of hire-in labor	Hire_in	1 if the household utilized hire-in labor for the last 12 months, 0 otherwise

Table A2. Description of variables (continued):for the variables which are not subject to econometric Investigation

Independent variables	Abbreviated as	Description
Shortage of hire-in labor	HLab_Short	1 if the household has faced shortage of hire-in labor in the last12 months, otherwise
Shortage of of household labor due to any illness	Ill_Lshort	1 if the household has faced shortage of household own labor that is lost to any illness, 0 otherwise
Cash crop production	Cash_crop	1 if the household has produced any cash crop such as red peppers, green peppers and sugar cane, 0 otherwise
Protestant religion	Prot	1 if protestant, 0 otherwise
Muslim religion	Musl	1 if Muslim, 0 otherwise
DembiDima Kebele	Dembi Dima	1 if from Dembi Dima, 0 otherwise
Dembi Gobu Kebele	Dembi Ggobu	1 if from Dembi Gobu, 0 otherwise
Gajo Kuyi Kebele	Gajo Kuyi	1 if from Gajo Kuyi, 0 otherwise

Table A2. Description of variables (continued): (b) for the variables which are subject to econometric investigation

Independent variables	Abbreviated as	Description
Sex dummy	Dum_sex	1 if the child is male, 0 otherwise
Age of the child	age	years of age completed
Age squared	age_sq	square of years of age completed
Relation of the child to the head	rel_head	1 if the child is son or daughter of the head, 0 otherwise
Presence of infants in the household	inf	1 if household members up to six years are present in the household, 0 otherwise
Number of girls	Girls	square root of the number of (other) girls in the household who are in the age group of 7 to 18 years
Number of adults	adults	square root of adults in the household who are in the age group of 19 to 60 years
Head's formal education	ed_head	1 if any formal education has been attended, 0 otherwise
Sex of the household	Hsex	1 if male, 0 otherwise
Household level incidence of malaria	malaria	square of the proportion of the household members who have ever suffered from malaria in the current academic year
Total own cultivable land	Land	square root of hectares of land
Sharecropping or/and renting in land	Dum_lin	1 if sharecropped or/ rented in land in the past two years, 0 otherwise
Sharecropping or/and renting out land	Dum_lout	1 if sharecropped or/ rented out land in the past two years, 0 otherwise
Irrigation access	irr	1 if the household have had irrigation in the past two years, 0 otherwise
Number of oxen	Oxen	square root of oxen
Livestock units	livest	Square root of livestock unit excluding oxen

Table A2. Description of variables (continued): for the variables which are subject to econometric investigation

Independent variables	Abbreviated as	Description
Membership in the local micro-finance	mic_fin	1 if have been client in the local micro-finance for the past two years, 0 otherwise
Paid work by the child	Wage	1 if the child has ever participated in any paid work out of the household during this academic year, 0 otherwise
Cereal crop diversification by the household	Dcrop	1 if the household has produced two or more cereal crops during the current years, 0 otherwise
Current value of current annual cereal crop product of the household	vcrop	Natural logarithm of current value of current annual cereal crop product of the household
Permanent plant (crop) ownership	pplant	1 if the household has ever sold product (s) of permanent type plants such as eucalyptus tree, mango, chat papaya, gesho and so on in the past three years, 0 otherwise
Religion dummy	orth	1 if the head is an orthodox, 0 otherwise
Native Language	Lang	1 if Oromiffa, 0 otherwise
School distance	sc_dist	one way travel minutes (in order of five)
Location cluster dummy	oharo	1 if belonging to Oda Haro Kebele, 0 otherwise

Table A3 Units of Livestock

Animals	Units
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

**For their distinct purpose, oxen are separately treated in the analysis*
Source: Storck, et al (1991) cited in Assefa (2002)

TableA4. ANOVA Results and Descriptive Statistics (a) for the variables which are not subject to econometric investigation

Variables	Mean of the variable for those currently in school	Mean of the variable for those currently out of school	Mean of the variable for all	F- Value of the ANOVA of Test	Significance level	Is the mean of the variable greater for the children currently in school regardless of its significance?
H_age	44.1367	44.9950	44.512	.649	.421	No
Ed-sp	.3477	.2300	.2961	7.549	.006	Yes
H_mar	.8320	.8500	.8399	.269	.605	No
Boys	1.3480	1.3162	1.3341	.396	.530	Yes
G_outsc	.6243	.5756	.6029	.724	.395	Yes
B_outsc	.4779	.4434	.4628	.452	.502	Yes
F_size	7.9687	7.4900	7.7588	3.439	.064	Yes
Chil_mal	.6356	.7026	.6652	2.149	.143	No
Trad_lab	.5547	.5900	.5702	.570	.451	No
Off_farm	.5078	.4600	.4868	1.025	.312	Yes
Hire_in	.2891	.3200	.3026	.508	.477	No
HLab_Short	.3008	.3200	.3092	.193	.660	No
Ill_Lshort	.6211	.6750	.6447	1.423	.234	No
Cash_crop	.1836	.1800	.1820	.010	.922	Yes
Prot	.1211	8.000E-02	.1031	2.051	.153	Yes
Musl	.1211	7.500E-02	.1009	2.634	.105	Yes
Dembi Dima	.2383	.2800	.2566	1.022	.313	No
Dembi Ggobu	.3008	.2300	.2697	2.861	.091	Yes
Gajo Kuyi	.2812	.2000	.2456	4.018	.046	Yes

TableA4. ANOVA Results and Descriptive Statistics (continued) (b) for the variables which are subject to further econometric investigation

Variables	Mean of the variable for those currently in school	Mean of the variable for those currently out of school	Mean of the variable for all	F-Value of the ANOVA Test	Significance level	Is the mean of the variable greater for the children currently in school regardless of its significance?
dum_sex	.5313	.4700	.5044	1.684	.195	Yes
age	12.8633	11.4700	12.2522	18.031	.000	Yes
rel_head	.8945	.8400	.8706	2.970	.085	Yes
inf	.5820	.5950	.5877	.078	.781	No
girls	1.1128	.9169	1.0269	10.758	.001	Yes
Adults	1.9397	1.8459	1.8986	5.023	.026	Yes
ed_head	.5273	.3950	.4693	8.000	.005	Yes
hsex	.8672	.8850	.8750	.325	.569	No
Malaria	.5485	.5992	.5707	1.556	.213	No
land	1.2763	1.2975	1.2856	.145	.703	No
Dum_lin	.1641	.1850	.1732	.342	.559	No
Dum_lout	.1445	.1050	.1272	1.579	.210	Yes
irr	.3203	.3250	.3224	.011	.916	No
oxen	1.0788	1.0611	1.0710	.091	.764	Yes
livest	1.2659	1.2715	1.2684	.004	.947	No
mic_fin	.2187	.3600	.2807	11.322	.001	No
wage	.1055	.1206	.1121	2.128	.062	No
Dcrop	.6484	.5400	.6009	5.548	.019	Yes
vcrop	6.8799	6.8676	6.8745	.011	.918	Yes
Pplant	.6875	.5300	.6184	12.064	.001	Yes
orth	.7578	.8450	.7961	5.295	.022	No
Lang	.945	.9296	.9385	.474	.491	Yes
sc_dist	7.820	8.04591886	7.9189	.434	.510	No
oharo	.1797	.2900	.2281	7.861	.005	No

TableA5. Certain Variables Correlated With Head's Age

Variables	Correlation Coefficient
Head's literacy	-.4117**
Spouse literacy	-.2722**
Infants	-.3095**
Family size	.1339**
Adults	.2254**
Land	.3281**
Oxen	.1421**
Livestock units	.1937**
Value of cereal crop	.1282**

** - Signif. LE .01 (2-tail)

TableA6. Certain Variables Correlated With Head's Marital Status (being with spouse)

Variables	Correlation Coefficient
Spouse literacy	-.2662**
Head's sex	.7028**
Infants	.1930**
Family size	.4150**
Adults	.3227**
Land	.2786**
Oxen	.2253**
Livestock units	.2526**
Value of cereal crop	.2911**

** - Signif. LE .01 (2-tail)

TableA7. Regression Results of Family Size on Certain Variables:
OLS regression

Source	SS	df	MS	Number of obs = 455		
Model	2346.14748	7	335.163925	F(7, 447)	=	139.14
Residual	1076.74044	447	2.40881529	Prob > F	=	0.0000
				R-squared	=	0.6854
				Adj R-squared	=	0.6805
				Root MSE	=	1.552
fsize	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
ed_head	-.4117958	.1796974	-2.29	0.022	-.7649524	-.0586393
ed_sp	.869531	.1772081	4.91	0.000	.5212664	1.217795
infants	2.075485	.1659007	12.51	0.000	1.749443	2.401527
adults	3.123518	.2338512	13.36	0.000	2.663934	3.583102
girls	1.907948	.119908	15.91	0.000	1.672294	2.143601
head's sex	.691532	.2580136	2.68	0.008	.1844618	1.198602
oda haro	.5621535	.1771776	3.17	0.002	.2139489	.910358
_cons	-1.129904	.3544221	-3.19	0.002	-1.826445	-.4333639

TableA8. The Saturated Econometric Model

Probit estimates

Number of obs = 455
 LR chi2(25) = 131.61
 Prob > chi2 = 0.0000
 Pseudo R2 = 0.2110

Log likelihood = -245.99641

ch_sch	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
dum_sex	.2419056	.1379684	1.75	0.080	-.0285075	.5123187
age	.9674614	.1543494	6.27	0.000	.6649421	1.269981
age_sq	-.0358213	.0061557	-5.82	0.000	-.0478863	-.0237563
rel_head	.5097291	.2080858	2.45	0.014	.1018884	.9175698
inf	-.274221	.1651066	-1.66	0.097	-.597824	.049382
girls	.3314165	.1172072	2.83	0.005	.1016945	.5611385
adults	.5458486	.2549264	2.14	0.032	.046202	1.045495
ed_head	.5403244	.1722718	3.14	0.002	.2026778	.877971
hsex	-.3629986	.2542951	-1.43	0.153	-.8614078	.1354107
malaria	-.0540838	.1763123	-0.31	0.759	-.3996496	.2914821
land	-.4014076	.1713954	-2.34	0.019	-.7373364	-.0654787
dumlin	-.1237176	.2463715	-0.50	0.616	-.6065969	.3591617
dumlout	.3273163	.2381142	1.37	0.169	-.1393789	.7940116
irr	-.1332298	.1605205	-0.83	0.407	-.4478441	.1813846
oxen	.0664864	.1470911	0.45	0.651	-.221807	.3547797
livestock	-.0578607	.1082999	-0.53	0.593	-.2701246	.1544032
mic_fin	-.338124	.1657483	-2.04	0.041	-.6629847	-.0132633
wage	-.5070478	.2267232	-2.24	0.025	-.951417	-.0626785
dcereal	.535839	.1692868	3.17	0.002	.204043	.8676351
vcrop	-.0579674	.0789733	-0.73	0.463	-.2127521	.0968173
perplant	.4952682	.1547458	3.20	0.001	.1919719	.7985644
rel_orth	-.1032658	.1977744	-0.52	0.602	-.4908964	.2843648
lang	.244528	.324681	0.75	0.451	-.3918352	.8808911
sc_dist	-.0012113	.0195764	-0.06	0.951	-.0395804	.0371578
oharo	-.4026119	.1873804	-2.15	0.032	-.7698707	-.0353531
_cons	-6.918898	1.1855	-5.84	0.000	-9.242436	-4.59536

TableA9. Means of the Major Variables that are Different between the two Groups of Children by Mother Tongue*

variables	Mean for the Oromiffa speakers	Mean for the others
Presence of Infants	.5995	.4286
Head's education	.4848	.2500
Land transaction-in	.1288	.8571
Land transaction-out	.1335	3.571E-02
Cereal diversification	.5831	.8929
Value of crop	6.8400	7.4193
Permanent Plant Ownership	.6300	.4286
Orthodox Religion	.7822	1.0000
School Distance (*5 minutes)	8.0023	6.4643

TableA10. Econometric Results by Sex Groups for the age 7 to 17 years

Variables	For the age group 7 to 17 years			
	Males		Females	
	Margin al Effect s	Z	Margin al Effect s	Z
Age	0.59	4.97***	0.29	2.13**
age_sq	-0.02	-4.57***	-0.01	-1.85*
rel_head	-0.07	-0.50	0.23	1.91*
infants	0.07	0.84	-0.19	-1.91*
Girls	0.18	2.59***	0.26	3.55***
Adults	0.15	1.40	0.17	1.23
ed_head	0.03	0.36	0.42	4.70***
Land	-0.04	-0.59	-0.52	-5.17***
Dum_lout	0.02	0.14	0.31	3.16***
mic_fin	-0.08	-0.84	-0.25	-2.70***
Wage	-0.26	-1.78*	-0.23	-1.56
dcereal	0.15	1.77*	0.13	1.44
Pplant	0.21	2.79***	0.39	4.02***
Oharo	-0.08	-0.83	-0.26	-2.69***
Statistics				
Observations	202		206	
L.Likelihood	-99.0417		-97.8877	
Wald chi2	59.61		63.20	
Prob >chi2	0.0000		0.0000	
Pseudo R2	0.274		0.3122	

TableA11. Demographic Structure of the Sample Households

Age Interval	Frequency	Percent	Cumulative Percent
0 to 4	104	10	10
5 to 9	190	18.3	28.3
10 to 14	187	18	46.3
15 to 19	174	17	63.3
20 to 24	63	6.1	69.4
25 to 29	52	5	74.4
30 to 34	46	4.4	78.8
35 to 39	59	5.7	84.5
40 to 44	37	3.6	88.1
45 to 49	39	3.8	91.9
50 to 54	28	2.7	94.6
55 to 59	17	1.6	96.2
60 to 64	19	1.8	98
64+	22	2.1	100.0
total	1037	100.0	

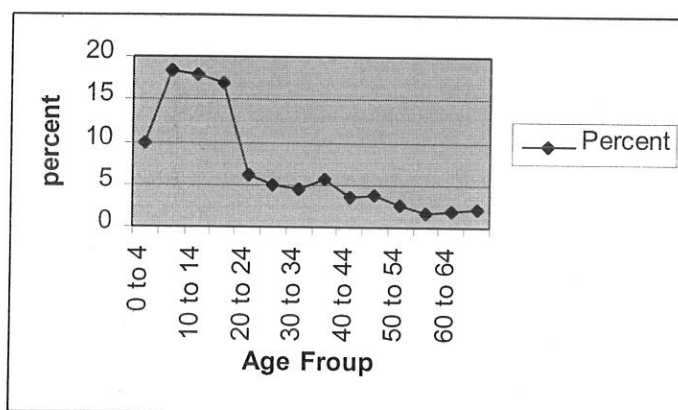


Figure A1. Population Pyramid of the Sample Households

APPENDIX 2

Farm Household Survey Questionnaire for the Study:

The Impacts of Demographic and Economic Variables on the Rural Household Schooling Decision: Evidence from Four Kebeles around Bako Town in West Shoa Zone

Identification Particulars

1. Kebele	2. Selection No. of HH
3. Name of the Household Head	4. Name of the Respondent

CODE 1.1. RELATION TO HOUSEHOLD HEAD

Head	01
Wife/Husband/Partner	02
Son/Daughter of head or both.....	03
Son/Daughter of spouse.....	04
Grandchild	05
Father/Mother.....	06
Sister/Brother	07
Niece/Nephew	08
Uncle/Aunt	09
Son/Daughter-in-law	10
Father/Mother- in-law.....	11
Brother/Sister- in-law	12
Grandparent	13
Other Relative of Head or Spouse.....	14
Servants (Farm Worker, Herder, Maid, Etc.)	15
Other Unrelated Person.....	16
Specify.....	

CODE 1.2. MARITAL STATUS

Married (Single Spouse)	01
Single	02
Divorced	03
Widowed	04
Not Together for any reason	05
Have more than one spouse	06

CODE 1.3. RELIGION

Orthodox.....	01
Protestant.....	02
Muslim.....	03
Other	04
Specify	

ID code	1. Full names of usual household members	2. What is the relationship of (Name) to the head? code(1.1)	3. Sex. Male.....1 Female..2	4. Age Completed years (0If it is less than one)	6. Marital status, code (1.2)	7. Religion, code (1.3)	8. Mother Tongue Language Oromiffa...1 Other.....2	9. Have (Name) ever suffered from Malaria in the last 12 months? Yes.....1 No.....2
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								

CODE 2.1 SCHOOLING COMPLETED

Never any schooling	01
Some church/Mosques school	02
Literacy Campaign.....	03
1 st grade (Primary school)	04
2 nd grade (Primary School)	05
3 rd grade (Primary School)	06
4 th grade (Primary School).....	07
5 th grade (Primary School)	08
6 th grade (Primary School completed)	09
7 th grade (first year junior school).....	10
8 th grade (second year junior school).....	11
9 th grade (High school).....	12
10 th grade (High school).....	13
11 th grade (10+1) (High school).....	14
12 th grade (10+2) (High school).....	15
Above high school.....	16
Specify.....	

CODE 2.2. WHY NOT CURRENTLY ATTENDING SCHOOL?

Too young	01
Was required for farm activities	02
Was required for other household activities	03
Was required to care for sick/elderly	04
Was required to work for wages	05
Too expensive to go to school	06
School too distant	07
Not appropriate for female children to go to school	08
Schooling believed not to increase income	09
Could learn everything useful at home	10
Too sickly to attend	11
No places Available in local school	12
No school of appropriate religion available	13
Other reason	14
// Specify	

CODE 2.3. MAIN ACTIVITY

Farmer or Family farm Worker	01
Domestic Work.....	02
Manual worker	03
Tailor	04
Weaver	05
Crafts worker/Potter	06
Blacksmith	07
Food Seller	08
Skilled Factory Worker	09
Teacher	10
Health Worker	11
Administer/Clerical.....	12
Soldier.....	13
Trader.....	14
Student.....	15
Looking for Work.....	16
Not in labor force.....	17
Herding.....	18
Other.....	19
Specify.....	

II. WORK ACTIVITIES AND EDUCATION BACKGROUND (FOR ALL MEMBERS UNLESS SPECIFIED)

ID code	Full names of usual household members	9. Formal Education			10. Major occupation /activities/ for the last 12 months for all members	11. If not working or not seeking any, why?		
		9.1. For All	9.2. For the age group 7 to 18 years					
		Highest Grade ever attended	9.1.1. Is (Name) attending school in this academic year?	9.1.2. For those currently out of school ('2' or '3' in 9.1.1) (Code 2.2)				
	Copy from (1)	(code 1.4)	Attend ing.....1 Attended before.....2 Not yet attended....3	Why (name) has never been to school or quitted?	Primary Code(2.3)	Secondary Code(2.3)	Code 2.4	
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								

CODE 2.4. REASONS FOR NOT WORKING

Child too young	01
Child disabled	02
Child is going to school	03
There was no need	04
Temporary sickness.....	05
Other.....	06
(specify).....	

OTHER SCHOOL RELATED QUESTIONS

1. Where (what) is the nearest school?

1. This village (Gobu Walda)

2. This village (Gajo Kuyi)

3. This village (Tibe)

4. This village (Hallo)

5. Other village (specify name of the school)-----

6. Bako

2. Where do (would) you educate your school age household members? (distance, one way travel time)

1. This village (Gobu Walda)_____ minutes

2. This village (Gajo Kuyi) _____ minutes

3. This village (Tibe) _____ minutes

4. This village (Hallo) _____ minutes

5. Other village (specify name of the school)----- minutes

6. Bako _____ minutes

7. No idea

3. If the answers for '1' and '2' are different, why?

1. Quality consideration

2. Limited capacity of the nearest school

3. Other

Specify.....

CODE 3.1. TYPE OF WAGE WORK

Farm worker (for pay).....	01
Professional.....	02
Skilled laborer.....	03
Soldier	04
Unskilled worker.....	05
Food for work.....	06
Other.....	07
Specify	

CODE 3.2. LOCATION OF EMPLOYMENT

This Kebele.....	01
Other Kebele in this Woreda.....	02
Nearby town.....	03
Another Woreda.....	04
Other.....	05
Specify	

CODE 3.3. EMPLOYMENT

Permanent.....	01
Temporary (Contract).....	02
Daily.....	03

CODE 3.4. EMPLOYER

Smaller farmers.....	01
Commercial farmers.....	02
NGO.....	03
Government organization.....	04
Urban Dwellers.....	05
Others.....	06
Specify	

CODE 3.5. PERIOD

End of harvest.....	01
Year round.....	02
Between weeding and harvest.....	03
Other.....	04
Specify	

CODE 3.6. REASONS FOR NOT SEEKING OTHER JOBS

No employment opportunities.....	01
Needed on farm.....	02
Jobs too far away.....	03
Wages too low for kind of work.....	04
Does not want to work for others.....	05
Other.....	06
Specify	

III. OFF FARM INCOME AND BUSINESS ACTIVITIES

1. Did you or any other members of the household work off the household's land either on some one else's land or in some other employment, against payment in cash or in kind in the last 12 months?
- Yes1 If Yes, Give Details
- No2 If no (go to question 6)

ID cod	2. specify the kind of work, code (3.1)	3.Location of employment code(3.2)	4. Nature of employment code (3.3)	5. Kind of employer code (3.4)

6. Have you or any other member of the household liked to work (more) for wages in the last

	6 Moths	12 Months
6a. Yes = 1 No = 2		
6b If Yes, who would like to work,? (member ID code, multiple responses with comma)		
6c If yes during which period? Code (3.5) (Multiple answers)		
6d If no, give reasons (put the most important one first) (code 3.6)		

7. Have you or other members of your household been involved in the following activities in the last 12 Months?

Activities	Household Member (s) responsible (ID code)
Weaving/Spinning	
Blacksmithing	
Pottery	
Making and selling of charcoal	
Collecting and selling firewood or dung cakes	
Collecting and selling grass and straw	
Trade in grain/general trade (incl. banana, Pepper, Honey, prod.	
Trade in Livestock/ Livestock Prod.	
Traditional healer/religious teacher	
Transport (by pack animal)	
Renting draft animal	
Other activities not already mentioned?	

8. If any member of the household participated in any off-farm activity, why? (Give us two reasons, according to importance). Code (3.8)

Reason # 1R		Reason # 2 R	
-------------	--	--------------	--

REMITTANCE INCOME

9. Has the household received any other income (Such as remittances from friends/relatives, gifts, food aid/other aid, other transfers in the last 12 months? Yes ... 1, No... 2

IV. LAND OWNERSHIP AND USE

	1a. Total own cultivable land (excluding grazing)	1b. Own land left fallow	2 Total Cultivated land				3 Land given to other family			4 Grazing Land		
			Own land	Rented in land	Sharecr opped in land	Gift	Rented out land	Share cropped- out land	Gift	Own	Rented in	Gift
Area (in Hectar)												

6. Did you (a) Sharecropped- or rented-in land last year? Yes.....1 No.....2
 (b) Sharecropped- or rented-out land last year? Yes.....1 No.....2

7. During the last two years, have you cultivated two or more types of cereals?
 Yes.....1
 No2

- 8a. During the last two years, have you been cultivating the same size of land
 The same size of land1
 Larger size of land2
 Smaller size of land3

- 8b. If not the same, indicate the main reason (multiple answers, according to importance)

- Land redistribution (Shigishig)1
 Land redistribution among family members2
 Rent or Sharecropping etc.3
 Fallow-crop land proportion change.....4
 Others.....5

(specify).....

9. Have you had access to irrigation:

- a. Last year? 1. Yes 2. No
 b. This year? 1. Yes 2. No

- 10..If yes, land size used (specify the unit)

A. your own	B. Rent in

6. If yes in (5), for what purpose do you use it? (Multiple answers: put in descending order of importance)

--	--

House construction -----1

Fuel -----2

Source of income -----3

Natural beauty -----4

Other -----5

(Specify) -----

VII. LIVESTOCK OWNERSHIP

ID Code	Type of Livestock	1 Number owned and present at your farm (Excluding Q2)	2 Number not owned but cared for	3 Number owned but away	4 How many did you own exactly one year ago (present or away)?	5. How are they attended during Day? Privately.....1 Pooled with others on community land.....2
	Calves					
	Bulls					
	Oxen					
	Heifer					
	Cows					
	Sheep					
	Goats					
	Horses					
	Donkeys					
	Mules					
	Chicken					
	Young Bulls					

9.1. CEREAL CROP CODE

Maize.....	01
Sorghum.....	02
Wheet.....	03
Barley.....	04
Teff.....	05
Pea.....	06
Bean.....	07
Other.....	08

Specify-----

9.2. UNIT CODES

Kilograms.....	01
Dawla.....	02
Medaberia.....	03
Qunna.....	04
Other.....	05

Specify

2. Do you frequently need credit? 1...Yes 2...No

If "yes", what is (are) the major source(s)? [Multiple answers possible in order of importance]

--	--	--

Rural micro finance.....	1
Money lender.....	2
Relatives.....	3
No source.....	4
Others.....	5

specify.....

3. Are you a client of the microfinance in this area?

Yes.....1

No.....2

4. If yes in (2),

- For how many years?
- Have you proposed for (or want to borrow) in this year?

Yes.....1

No.....2

5. Specify the purpose of the loan.

Purchase of oxen.....	1
Purchase of fertilizer or high yielding varieties.....	2
For land rent.....	3
For oxen rent.....	4
For animal husbandry.....	5
For trading capital.....	6
To repay other debts.....	7
Other.....	8

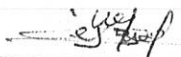
Specify.....

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all source of materials used for the thesis have been duly acknowledged.

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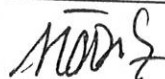
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