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Does Schooling Influence Productivity? The Case of Ethiopian Manufacturing Enterprises[1]

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Abstract

An empirical investigation was conducted to verify whether schooling influences productivity in the Ethiopian Public Manufacturing Industries. The results indicate that schooling influences the productivity of manufacturing enterprises significantly; viz, the higher the proportion of the labour force with a high level of schooling in an enterprise, the higher is productivity. This implies that increasing the proportion of social wealth expended on education is paying and that the education system in Ethiopia seems effective in translating skilled manpower into services. This, in turn, implies that not only broadening schooling in terms of quantity, but also deepening schooling by fostering quality could increase the productivity of manufacturing enterprises. Thus, government has to intervene in supplying skilled manpower since there is a serious risk of private under-investment in training at a firm level. However, for successful industrialisation to take place, any government move to supply these resources should involve the beneficiaries in order to balance demand and supply; give emphasis to tertiary education as strongly as basic education; and synchronise with other supportive schemes since human capital investment on its own cannot lead to the industrialisation of a country.

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1. Introduction

1.1 Background

Education is believed to create a productive citizen by inculcating important and useful knowledge into the minds of people, thereby speeding up economic development. Education "*transforms the raw human beings into production human capital by instilling the skills required by both the traditional sector and the modern sector of the economy, and makes the individuals more productive not only in the market place but also in the household*" [Tilak, 1992: 12].

Based on the above premise, a number of efforts have been made to quantify the impact of education in expediting economic development in different parts of the world since the 1950's. Some of the results of these efforts are summarised in Table 1.

These efforts have continued in other directions, as well in ways of seeking to quantify the importance of literacy in explaining differences in economic growth of countries; the correlation of enrolment ratios and GNP per capita; the cost-benefit ratio of investment in primary education vis-à-vis investment in infrastructure, etc.

Table 1: Role of Education on the Growth of Per Capita GNP or Income: Study Results

Researcher/Author	Year	Country	Contribution of Education
Denison	1909-29	USA	23%
	1929-57	USA	42%
	1948-73	USA	21%
Kendricks and Jorgenson	1945-76	USA	15-25%
Psacharopoulous	1950s and 1960s	Africa	17.2%
		Asia	11.2%
		Latin America	5.1%
		North America	20.0%
		Europe	6.5%

Source: Tilak, 1992:11-14

Regarding the relationship between literacy and economic growth, Bowman and Anderson [cited in Tilak, 1992:13-14] found out that:

- For a country to reach a GNP per capita level of US $200 (in 1950), a 40% adult literacy rate is necessary;
- GNP per capita crosses the US $500 only if literacy rate exceeds 80%; and
- Primary enrolment differences in the 1950s had substantial explanatory power for income level differences in 1980s.

Furthermore, Peasle's study (cited in Tilak, 1992:15]) on the 34 richest countries of the world since 1850 showed that no country has ever achieved significant economic growth without first attaining an enrolment ratio of 10% at primary level. The correlation coefficients between enrolment and economic growth were found to be strong: Curle found a 0.64 correlation coefficient between GNP per capita and post-primary enrolment and a coefficient of 0.53 between GNP per capita and proportion of GNP invested in education [Tilak, 1992:15]. Econometric methods produced similar results, namely the relationship between literacy and economic development is significant and strong.

For instance, according to Tilak (1992:16):

- Hicks found that a 20% increase in the literacy rate leads to a 0.5 percent increase in the growth rate;
- Wheeler found that an increase in literacy from 20 to 30 percent resulted in an increase in real GDP of 8 to 16 percent.
- Marris predicted that a one-percentage point difference in primary enrolment ratio was associated with 0.035 percent points in inter-country differences in per capita income growth rates.

Regarding the benefit-cost ratio of investment in education vis-à-vis investment in infrastructure, results favoured investment in the former. For instance, Marris's study (see Tilak, 1992:16) of 63 countries produced a benefit-cost ratio for primary schooling enrolment of not less that of 3.4 (for low income countries for the period 1981-87) while the equivalent ratio for infrastructure was found to be one or less than one.

All these empirical evidences strongly support the pivotal role played by education in economic development and suggest that a certain proportion of social wealth must be allotted for expanding education. A country that has failed to do so is liable to remain underdeveloped. In this regard, Lall stated that " *the operation of easy, low technology activities with which industrialisation generally starts requires literacy and schooling, a range of basic technical skills and some high level technological and*

managerial skills. To build upon a base of easy activities and enter more demanding activities calls for increasing level and technical specialisation in education" (Lall, 1992a: 117).

The low level of human capital invested in industry in Africa, including Ethiopia, suggests that this is one reason why the region presents a general picture of poor technological mastery and dynamism in industry. African countries with relatively high literacy rates and secondary schooling enrolment ratios like Kenya, Mauritius and Zimbabwe (Cornia et al, 1992:217) are also those with the best industrial record. Rodrik, in emphasising the importance of schooling and educational attainment as initial conditions for growth in East Asia, had said " *once initial levels of schooling is taken into account, there appears to be nothing miraculous about the high performing Asian Economies' growth experiences*" (Rodrik, 1994:8). All these are supportive of the contention that schooling is important in influencing productivity and growth.

But learning could be partly a matter of inherent intelligence, and partly of aptitudes and incentives. Education explosion and growth of enrolment may not necessarily bring about enhanced productivity and growth. How effectively those resources can be translated into services and how consistent the pattern of human resource development is with the pattern of economic growth is the central issues. In this respect, Easterlin says "I *think we can safely dismiss the view that the failure of modern technological knowledge to spread rapidly was due to significant differences among nations in the native intelligence of the populations. To my knowledge there are no studies that definitively establish differences, say, in basic IQ among the people of the world*" (Easterlin, 1981:5). Incentives for learning, education systems and quality of education matter more for productivity than any other variables.

A study carried out by Behrman and Birdsall in Brazil produced a much lower social rate of return to expanding primary years of schooling once quality is taken into account. They concluded that "*deepening schooling by increasing quality has a higher social rate of return than broadening schooling by increasing quantity*" (Berhman and Birdsall, 1983: 929).

There are other studies, which find weak or insignificant relationship between education and economic growth (Tilak, 1991:22). There are theories, as well, which consider education as a credential mechanism and screening apparatus. Schooling may not actually raise cognitive skills or productivity but may raise the private wage because it serves as a signal to employers of some positive characteristics like ambition or innate ability.

Study Objective

It is now generally accepted that a person with a high level of formal education is better prepared to adapt, understand, learn, use and create ideas. An enterprise staffed with personnel equipped with the proper skill and education has to appear at a higher production frontier to insure better resource utilisation and higher productivity. Ethiopia being cognisant of this fact has put every effort to hasten human resource development. This can be seen from the total public and education expenditure figures provided in Table 2.

As can be seen, total public expenditure on education increased continuously since 1990/91 at an annual average growth rate of 23.1 percent. Not only has the magnitude of public investment on education increased, but also its share in total public expenditure, the latter rising from 9.7% in 1990/91 to 13.8% in 1995/96.

Table 2: Public Education Expenditure in GDP 1990/91-2003/04

Year	Total Education Expenditure (000 Birr)	Share from Total Public Expenditure (%)	Share from GDP (%)
1990/91	489,654.8	9.7	2.4
1991/92	528,467.6	12.4	2.6
1992/93	694,400.0	11.3	2.6
1993/94	1,033,600.0	12.9	3.8
1994/95	1,145,200.0	13.3	3.6
1995/96	1,336,969.2	13.8	3.5
2000/01	2,178,400.0	13.7	4.0
2001/02	2,507,100.0	14.2	4.8
2002/03	3,293,100.0	16.1	5.8
2003/04	4,146,000.0	20.4	5.9

Source: PHRD. Education Sector Review: Synthesis and summary. Addis Ababa, Nov. 1996.
MoE. Education Statistics Annual Abstract 1996 E.C (2003/04). January 2005

However, the author could not come across empirical studies undertaken on Ethiopia to establish quantitatively whether schooling, in the Ethiopian context, has served as a screening and credential mechanism or as a condition of growth. Thus, this paper has yet to verify whether investment in schooling influences the productivity of the economy or whether it is unnecessary over-investment. Given this gap in knowledge,

the objective of this paper was to examine how significantly schooling has influenced productivity in Ethiopian manufacturing enterprises and generate some evidence on where schooling stands in the Ethiopian context.

During the writings of this paper, however, there were efforts towards the same end by Netsanet, Assefa and Abay (see Senait and Alemayehu, 1998). Netsanet measured the contribution of education to Ethiopia's economic growth using a growth equation (time series error correction model). He arrived at a result that education enters positively and significantly in explaining growth in aggregate real output (Netsanet, 1998). Assefa and Abay (1998) examined the impact of education on the technical and allocative efficiency of smallholder farmers in Ethiopia using the frontier profit function approach and arrived at a result that educated farmers are relatively and absolutely more efficient than illiterate farmers. These efforts nonetheless did not consider the impact of the level of schooling (primary, secondary and tertiary) on productivity, which is the focus of this paper.

There were efforts by Tesfayi and Krishnan (1998), Wolday (1998) Mengistu (1998) and others in estimating "returns to schooling" using earning function; but not reviewed since the focus here is analysing the impact of the different level of schooling on productivity.

2. Model

Two models are employed here to determine the importance of education in Ethiopian manufacturing enterprises. The first model is a version of Cobb-Douglas production function and the second is total factor productivity. The version of Cobb-Douglas production function is of the following form:

$$Q = AK^{\beta}L^{\alpha} \qquad (1)$$

Where Y =output; K =Capital; L = Labour; A = Efficiency parameter; β=Capital elasticity of output and α= Labour elasticity of output.

Labour is assumed to be heterogeneous so that the efficiency of the labour force differs by educational category. Four educational categories are considered, namely:

L_o = Number of workers with no formal schooling;

L_1= Primary schooling;
L_2= Secondary schooling and
L_3 = Tertiary schooling.

It is further assumed that the difference in efficiency between L_i and the base category L_o is ε_i. That is:

$$L_i = (1+\varepsilon_i)L_o \tag{2}$$

If ε_i is negative, schooling has a negative impact since the productivity of the L_i category is less than that of category L_o and the vice versa if $\varepsilon_i > 0$.

Under this scenario, labour in its efficiency unit becomes different from its mere number; that is, the labour input (Le) will be (see appendix):

$$L_e = L_o + \sum_{i=1}^{3}(\varepsilon_i + 1)L_i = L + \sum_{i=1}^{3}\varepsilon_i L_i \tag{3}$$

Here L is homogenous labour, with identical productive content as L_o.

If $\varepsilon_i>0$, labour in its efficiency unit is greater than its mere volume. In this case, schooling influences productivity positively. If $\varepsilon_i<0$, schooling is a cost.

Under this scenario, equation (1) will take the form of:

$$Y = AK^{\beta}[L_o + \Sigma(\varepsilon_i + 1)L_i]^{\alpha} \tag{4}$$

This can be transformed to another form by expanding equation (4):

$$Y = AK^{\beta}[L + \Sigma\varepsilon_i L_i]^{\alpha} \tag{5}$$

Since L= L_o+L_1+L_2+L_3, dividing the right hand side by L/L will turn the equation to:

$$Y = AK^{\beta}\left(L(1+\frac{\Sigma\varepsilon_i L_i}{L})\right)^{\alpha} \tag{6}$$

Assuming $\lambda_i = L_i/L$, equation (6) will take the form:

$$Y = AK^{\beta}[L(1+\Sigma\varepsilon_i\lambda_i)]^{\alpha} \tag{7}$$

If L is factored out, equation (7) will be:

$$Y = AK^{\beta}L^{\alpha}(1+\Sigma\varepsilon_i\lambda_i)]^{\alpha} \tag{8}$$

In this equation, the variable λ_i represents the proportion of each educational category and $\Sigma\lambda_i=1$. The coefficient of each λ_i represents the productivity differential between educational category i and the base category λ_o. By definition, if ε_i is greater than zero, then category λ_i is more productive than the base category λ_o. In this instance, schooling is paying.

Since it minimises the problem of multicollinearity and heteroscedasticity, it is better to divide both sides of equation (8) by L to give:

$$\frac{Y}{L} = \frac{AK^{\beta}L^{\alpha}(1+\Sigma\varepsilon_i\lambda_i)]^{\alpha}}{L} \tag{9}$$

Given that $L = L^{\beta} L^{1-\beta}$, equation (9) will be:

$$\frac{Y}{L} = A\left(\frac{K}{L}\right)^{\beta} L^{\alpha-(1-\beta)}\{1+\Sigma\varepsilon_i\lambda_i\}^{\alpha} \tag{10}$$

Taking its logarithms, equation (10) can be written as

$$Ln\left(\frac{Y}{L}\right) = LnA + \beta Ln\left(\frac{K}{L}\right) + \theta LnL + \alpha Ln(1+\Sigma\varepsilon_i\lambda_i) \tag{11}$$

where $\theta=\alpha+\beta-1$. θ indicates the extents of returns to scale. If $\theta<0$, there are decreasing returns to scale, if $\theta=0$ constant returns to scale are indicated, and if $\theta>0$ there are increasing returns to scale.

If we make use of the first-order Taylor series approximation that $Ln(1+x)\approx x$, then it is possible to rewrite equation (11) as:

$$Ln\left(\frac{Y}{L}\right) = LnA + \beta Ln\left(\frac{K}{L}\right) + \theta LnL + \alpha \sum \varepsilon_i \lambda_i \qquad (12)$$

The problem here is to identify singly ε_i from the coefficient of λ_i. $\theta=\alpha+\beta-1$ implies that $\alpha=1-\beta+\theta$. Since $\varepsilon_i=\alpha\varepsilon_i/\alpha$, we get $\varepsilon_i=\alpha\varepsilon_i/(1-\beta+\theta)$. Thus, εi can be determined from the coefficients of Ln(K/L), LnL and λ_i.

Another alternative to detect the importance of schooling in determining productivity is outlined below. First, the total factor productivity (A) of each firm is calculated using the expression:

$$A = \frac{Y}{aL + bK} \qquad (13)$$

Where a and b are Labour and Capital shares from value-added and Y, L and K are as specified in equation 1. The next step is to observe whether there are differences in total factor productivity (TFP) across firms and determine if these TFP differences exhibit a systematic pattern in relation to educational composition of the labour force in each firm using the following functional form:

$$A= f (K/L, W, \lambda_0, \lambda_1,\lambda_2,\lambda_3) \qquad (14)$$

Where:

K/L= Capital-labour ratio;
W =average wage rate;
λ_o = proportion of workers with no formal schooling;
λ_1 = proportion of primary schooling;
λ_2 = proportion of secondary schooling and
λ_3 = proportion of tertiary schooling.

If the coefficient for λ_i is positive, then i-category of schooling is important in determining productivity.

A panel data set, following a sample of individuals over time, is used in this paper, providing multiple observations on each individual included the sample (Hasiao, 1986:1). Panel data have advantages over conventional cross-sectional or time

series data in that they increase the degrees of freedom and reduce possible collinearity problems, thereby improving the efficiency of econometric estimates. Secondly, sequential observations for a number of individuals help to make inferences about the dynamics of change and help to construct and test more complicated behavioural models. Moreover, panel data help to reduce the effects of omitted variables over time or across individuals (Hsiao, 1986:1-4).

Nevertheless, panel data have their own limitations. Heterogeneity across units and over time leads to a variety of models, each based on assumptions made about the intercept, slope and characteristics of the disturbance term. The possible model specifications are presented in Table 3 where i and t represents enterprises and time.

Table 3: Taxonomy of Panel Data Models

	Assumptions about:		
Models	**Intercept**	**Slope**	**Disturbance Term**
1(a)	Common for all i,t	Common for all i,t	$E(UU') = \delta^2$
1(b)	Common for all i, t	Common for all i,t	E(UU')=V
2(a)	Varying over i or t	Common for all i, t	Fixed effect model
2(b)	Varying over i or t	Common for all i,t	Random effect model
3(a)	Varying over i, t	Common for all i,t	Fixed effect model
3(b)	Varying over i, t	Common for all i, t	Random effect model
4	Varying over i,t	Varying over i,t	Random Coefficient Model

Source: Johnston [6:397].

Model 1(a) assumes an identically, independently and normally distributed disturbance term. Model 1(b) assumes a heteroscedastic or serially correlated disturbance term, which requires a generalised least square (GLS) technique. Model 2 relaxes the assumption of a common intercept but retains the assumption of common slope coefficients for all decision units. Model 2(a) assumes an enterprise specific effect that reflects heterogeneous technologies and managerial skills or a time effect that reflects heterogeneous changes in capacity utilisation, technical progress (learning) or the general environment over time. Model 2(b), on the other hand, assumes a single intercept and the differential intercepts are merged with the disturbance term (which gives a random effect or error component model). Model 3 assumes the intercept to vary across individuals and over time simultaneously leading to a two fixed effects model (enterprise effect and time effect) or a three component error term- each component standing for enterprise effect, time effect and

the usual white noise. The specifications to be employed depend on the objectives of the study, the sampling technique, and the ease of the estimation techniques.

In this paper, model 2(a) is selected due to the strong conviction that the intercept for the current study might be different across enterprises. This is because of technological and managerial differences (which need to be captured so as not to confuse the impact with differences in schooling) but not over time, since the time is short and the years are nearly normal and identical. All possibilities will, however, be explored to arrive at reasonable inferences and implications.

3. Data and Limitations

As is obvious from the above, information required for the models relate to output (Y), capital (K) and labour (L), the latter by educational category.

Gross value-added at factor cost at current prices can represent output. Value-added is chosen in this analysis simply because it makes aggregation across enterprises possible and avoids double counting (inclusion of brought-in materials from other enterprises) and properly accounts for work done by each enterprise. The only problem in considering value-added as a measure of output in production is that it ignores the possibility of substitution between primary and intermediate inputs.

Capital input in production can be represented by net fixed assets of the enterprise in spite of the fact that:

- Net fixed assets constitute a stock (not a flow) concept, which is irrelevant to a production function.
- There is a direct relationship between changes in technology and gross fixed assets since innovations are embodied in capital goods, which replace existing equipment.
- Net fixed assets suffer from arbitrariness involved in the concept of depreciation.

In this paper, labour input in production is represented by permanent man-years excluding temporary and contract man-years. This has limitations in terms of not giving due consideration to the following questions:

- Which labour inputs are appropriate factors of production?
- What stock is available for use in production (man-years)?

- In what time periods are stocks available for production (man-hour)?
- Whether there is compensation for the flow of services (wages)?
- Does the productivity content of an hour of heterogeneous labour be identical thereby labour can be additive?
- Do relative earnings really match with relative marginal productivity and hence wage can serve as weighting mechanism?

As mentioned earlier, labour is classified by educational category. Initially, it was attempted to classify labour employed in the enterprises into four categories; namely, no formal schooling, primary schooling, secondary schooling and tertiary education levels. However, data constraints imposed restrictions and permanent man-years had to be partitioned into four: Labour with an educational background of less than grade 8 (L_1), of between grade 9 and 12 (L_2), of semi-professionals (L_3) meaning those with diploma, and of professionals (L_4) i.e. those with first degrees and above. Thus, the coefficients ε_i represent the difference in efficiency of labour between educational category i and the base educational category of below grade 8.

The sources of data used consist of audited financial reports and plan documents of each manufacturing enterprise included in the study. From plan documents permanent man-years broken down by educational category were obtained. All other information was obtained from the audit report of the enterprises. Information was gathered on 53 manufacturing enterprises for three consecutive years. These enterprises covered all ten sectors of the manufacturing (industrial) sector of the country. But, their selection can be said to be random since some sectors are represented disproportionately and some enterprises, which lacked data on one or more relevant variable, were excluded from the study. All the enterprises included in the study are public. Because the working environment, management and practical application of skills acquired through formal education are different in private and public enterprises, the results of the study might not be representative of realities in the private sector.

The years selected for the analyses are 1986/87, 1987/88 and 1988/89, which were relatively normal years, with no major upheavals like drought, war or political changes (including changes in the planning process). But, these years coincide with the period when there was a command economy, which stifled professionals' inspiration to apply their knowledge. Hence, the results obtained may not reflect the current situation where there has been a switch to more liberal practices.

4. Estimation Results

4.1 Summary Statistics

The schooling background of the labour force and the sample distribution of schooling of the selected manufacturing enterprises are summarised in Table 4. The average proportion of professionals in the total labour force of Ethiopian manufacturing enterprises was only 2.04 percent. The bulk of the labour force (almost 91.35 percent) consisted of non-professionals mostly grade 12 and below (of which 71% were grade 8 and below). Professional and semi-professional categories of labour force accounted for only 8.65 percent of the total labour force in the Ethiopian manufacturing enterprises under consideration.

But there were variations across enterprises with respect to the proportion of the labour force of professional and semi-professionals. While there were enterprises with no professional or semi-professional labour force, there are others with maximums of 8.45 and 31.11 percent professionals and semi-professionals respectively. The variance (or standard deviation) clearly shows this variation, although the variation of the proportion of professionals across enterprises was minimal compared to that of grade 8 and below category. Whether the variation in the proportion of professionals across enterprises showed a pattern in terms of relationship with productivity differences across enterprises is the main concern to be checked.

Table 4: Summary Statistics of Educational Background

	Educational Status			
Summary Statistics	**Professional**	**Semi Professional**	**Grades 9 - 12**	**Grades 8 and below**
Mean	0.0204	0.0661	0.2638	0.6497
Standard deviation	0.0147	0.0529	0.1188	0.1275
Median	0.0188	0.0505	0.2319	0.6656
Interquartile range	0.0182	0.0549	0.1329	0.1532
Minimum	0	0	0.0816	0.253
Maximum	0.0845	0.3111	0.7108	0.9031
IQR/1.35	0.0135	0.0407	0.0984	0.1135
Kurtosis	2.7566	5.4052	2.5319	0.5075

Skewness	1.2991	1.9806	1.3949	-0.7683

***Source**: Own Computation based on data from selected manufacturing enterprises.*

Regarding the sample distribution, all categories of educational status proved to be skewed. Given mean and median statistics, it can be shown that while the distribution of Grade 8 and below (L_1) category labour is negatively skewed, that of other categories are positively skewed. A skewed distribution is evidently not normal. In approximately normal distributions, the relationship between S.D and IQR is that S.D $\approx$ IQR/1.35 (Hamilton, 1992:8). In all cases in Table 4, however, the S.D is greater than IQR/1.35, confirming the non-normality of the sample distributions, with implications for the regression results.

4.2 Correlation between Productivity and Schooling

It has already been observed that there were variations in educational status of the labour force and in labour productivity across the enterprises. Whether the variation in the educational composition of the labour force corresponds to the variation in labour productivity has to be verified. The simplest mechanism to do this is to measure the strength of the linear association between these two variations through correlation coefficients. To this end, both Spearman and Pearson correlation coefficient between labour productivity (in its logarithmic form) and educational categories are computed and summarised in Table 5.

Since all the coefficients are statistically significant, they clearly indicate the association between educational category and labour productivity. The correlation between labour productivity and professional labour is 0.4188 - positive and significant - implying that enterprises with a higher number of professionals usually have higher labour productivity. The strength of the association, however, declines as educational level declines. While the correlation coefficient between LnY (the logarithm of labour productivity) and L_4 (proportion of professional man-years to total permanent man-years) is 0.4188, it is only 0.3891 for L_3 (proportion of semi-professionals), and 0.2485 for L_2 (proportion of labour force between Grades 9 and 12). The surprising outcome is the negative association between L_1 (proportion of labour force in grade 8 and below) and LnY implying that the higher the proportion of L_1, the lower is labour productivity.

Since the significance test for Pearson correlation coefficient depends on the assumption of bivariate normality which has already been proved to be wrong (distributions of L_4, L_3, L_2 and L_1 are non-normal), rank correlation coefficients are

estimated. These yield, however, similar results and only differ from the Pearson coefficient in terms of strength and importance. The rank correlation coefficients are lower in all cases except L_2 than the Pearson coefficients. Regarding relative importance of coefficients, the L_2 category replaces the L_4 category.

Table 5: Correlation between Productivity and Educational Category

Summary Statistics	Correlation Between productivity (LnY) and			
	L_4	L_3	L_2	L_1
Pearson				
● Coefficient	0.4188	0.3891	0.2485	-0.4384
● Significance*	0.0000	0.0000	0.0020	0.0000
Spearman (Rank)				
● Coefficient	0.3274	0.264	0.3341	-0.3968
● Significance	0.000	0.000	0.000	0.000

* Stands for p-value

Productivity is better revealed by total factor productivity than by simple average partial productivity (like average labour productivity). The association of the educational composition of the labour force and the productivity (or efficiency) of an enterprise may be clearly revealed if total factor productivity (TFP) is employed in stead of labour productivity. Thus, TFP is computed using equation 13. Labour is expressed in terms of permanent man-years; and factor shares are current wage to value added at factor cost ratios. The computed correlation coefficient between TFP and educational categories are reported in Table 6.

Table 6: Correlation between TFP and Educational Category

	Correlation Between TFP and			
	L_4	L_3	L_2	L_1
Pearson				
● Coefficient	-0.2146	-0.2789	0.0294	0.1120
● Significance	0.007	0.000	0.716	0.164
Spearman (Rank)				
● Coefficient	-0.2808	-0.2371	-0.0305	0.1236
● Significance	0.000	0.003	0.716	0.124

The results presented in Table 6 are unexpected. Either the correlation coefficients (both Pearson and Spearman) between educational category and TFP are statistically insignificant (for example L_2 and L_1) or of opposite signs where the actual coefficients are statistically significant (for example L_3 and L_4). These results show however partial effects and the combined effect of variables might change the picture.

Thus, the linear form of equation 14 is regressed and this completely changes the picture as revealed in Table 7.

Table 7: OLS Regression results of expression 14

Variables	Coefficients	P-Value	F-ratio	R^2
W	0.33394	0.002	49.17	0.608
LnK	-1.4831	0.000		
L_4	14.167	0.098		
L_3	6.2208	0.004		
L_2	5.2629	0.000		
L_1	3.3830	0.000		

Note: Standard errors are white heteroscedastic adjusted.

From Table 7, all the coefficients of L_i are positive and statistically significant at the 1-percent level except L_4, which even is significant at the 10 percent significance level. Furthermore, the signs of the coefficients for all L_i are positive and increase as the level of schooling increases. This fact reveals the importance of schooling in influencing the productivity (efficiency) of enterprises.

4.3. Econometric Results

The basic model estimated is

$$\text{Log}\,{}^{Y}\!/_{L} = \text{LnA} + \text{BLn}\,{}^{K}\!/_{L} + \theta\text{LnL} + \alpha\,\varepsilon_2\lambda_2 + \alpha\,\varepsilon_3\lambda_3 + \alpha\,\varepsilon_4\lambda_4 + \text{U} \qquad (15)$$

Where:

Y/L = Labour (Average) productivity
K/L = Capital- Labour ratio
L = Permanent man year
K = Net fixed asset
Y = Gross value added at factor cost, at market price
λ_2 = Proportion of labour force between grades 8 and 12 education
λ_3= Proportion of semi-professional permanent man-years from total
λ_4 = Proportion of Professional man-years from the total; and
U= Disturbance term.

What will be assumed about the intercept, disturbance term and returns to scale will vary the model specification. Based on these assumptions, there will be different cases, which could be grouped into two categories. The first category assumes non-varying intercept and the second category assumes varying intercept across enterprises and/or over time.

Category I

Case 1: The disturbance term is assumed to be independently, identically and normally distributed, i.e., $U_{i,t} \sim iid\ (0, \delta^2)$.

Case 2: Given case 1, outliers (both mild and extreme) are excluded and not adjusted for heteroscedasticity.

Case 3: Given case 2, regression is carried out without a constant.

Case 4: Given case 2, the production function is assumed to exhibit constant returns to scale and heteroscedasticity is adjusted using White's method.

Case 5: Outliers are excluded because of the heteroscedasticity problem and the OLS estimation is adjusted based on White's heteroscedasticity-consistent standard errors.

Category II

Case 6: Intercepts are supposed to vary across enterprises to reflect differences in managerial skills, experience and technology. Both fixed and random effect models are employed.

Case 7: Intercepts are supposed to vary over time to reflect the changing situation of demand and supply especially due to shortage of foreign exchange. Both fixed and random effect models are employed.

Case 8: Intercepts are supposed to vary across enterprises and over time simultaneously. Fixed and random effect model specification is applied.

Given these cases, regressions are estimated using different computer Econometric programmes, each specialised for specific purposes. "Microstat" is used to test for autocorrelation and heteroscedasticity problems; "SPSS" is used to identify outliers and symmetry of the disturbance terms; and “LIMDEP” is used to estimate fixed and

random effect model specifications. The results of this exercise are summarised in Table 8(a) for scenario cases 1 to 5 and in Table 8(b) for category II cases.

The setback here is how to choose a case explaining the actual situation of enterprises most aptly. Case 1 cannot be a candidate for selection since it contains extreme outliers (three cases) and exhibits problems of autocorrelation and heteroscedasticity. Case 2, also exhibits heteroscedasticity problems, which are adjusted in Case 5. Case 5 produces a statistically insignificant coefficient for L_4 implying that professionals do not influence productivity in any better way than other educational categories; i.e., regardless of the number of professionals employed, labour productivity will remain indifferent, contradicting the results of the correlation carried out in the previous section. Case 4 produces similar results as Case 5. On the contrary, Case 3 (regression without a constant and adjusted for heteroscedasticity using White's method) produces theoretically justifiable and statistically significant coefficients. The only problem with Case 3 is that it assumes a non-varying intercept implying differences in technology, management skills, production experience, external environment (shortage of raw materials, and foreign exchange), affecting labour productivity indifferently across enterprises and/or over time. This assumption is relaxed by including enterprise and time effects in Category II cases.

Table 8(a). Summary of Regression Results for Category I

Items	Case 1	Case 2	Case 3	Case 4	Case 5
Ln K/L	0.344*	0.209*	0.213*	0.209*	0.209*
LnL	-0.087	-0.009	0.161**	-	-0.009
λ_4	6.241	5.942***	8.625*	6.058	5.942
λ_3	0.704	1.824**	2.476**	1.844**	1.824
λ_2	0.199	0.989*	1.941*	1.025*	0.989*
Constant	1.902*	1.366*	-	1.301**	1.366*
D.W	1.583	1.820	1.810	1.821	1.820
R^2	34.4	37.7	32.2	38.1	37.7
F-Ratio	23.86	19.79	-	24.88	19.79

*Notes: *, ** and *** represent coefficients which are statistically significant at 1%, 5% and 10% levels respectively.*

Category II regressions are estimated with two steps or iterative GLS, allowing for group wise heteroscedasticity and cross group correlation (in built in LIMDEP). The setback is that it does not consider the problem of autocorrelation, but this problem

has already been dealt with through the exclusion of outliers from the data set. The Durbin-Watson statistic proves this, as is evidenced by the fact that D.W is 1.8.

For all of the category II cases, enterprise effect, time effect and the combined effect of both are estimated. But, the enterprise effect produces theoretically unjustifiable and statistically insignificant coefficients. The specification, which considers both time and enterprise effects simultaneously does not produce significant results, either. The time effect specification, however, produces theoretically meaningful and statistically significant coefficients. The Hausman test (large values in this test favour the fixed effect over the random effect model) suggests that the fixed effect specification is the appropriate one (the Hausman statistics is 34.9). The choice of the fixed effect specification can further be supported by the Lagrange multiplier (LM) test, which favours the fixed effect model over OLS without time effect (the LM statistics is 34.2 - large LM values favour the fixed effect model over OLS without group specific effects).

Table 8(b). Summary of Regression Results for Category II

Variables	Enterprise Effect		Time Effect		Both	
	Fixed	Random	Fixed	Random	Fixed	Random
Ln K/L	-.0.097	0.205*	0.199*	0.201*	-0.096	0.182*
LnL	-0.960*	-0.085	-0.008	-0.006	-0.658***	-0.040
λ_4	-9.782**	-1.359	7.508**	7.294**	-8.766**	1.291
λ_3	-0.708	0.896	1.848**	1.845**	-0.602	1.362
λ_2	0.646	0.459	1.115*	1.098*	0.703	1.026**
Con	-	2.100**	-	1.239*	6.250	1.709**

*Notes: *, ** and *** represent coefficients which are statistically significant at 1, 5 and 10% levels respectively.*

Once the fixed effect specification is chosen, what would remain is to obtain estimates of ε_i. The fact that the coefficient of LnL in the fixed time effects model is not significantly different from zero suggests constant returns to scale. Accordingly ε_i can be identified via $\varepsilon i=\alpha\varepsilon i/(1-\beta)$. In contrast, for case three (category I) the coefficient of lnL is significant at 5 percent. Thus, we used $\varepsilon i=\alpha\varepsilon i/(1-\beta+\theta)$. The results of ε_i for the fixed time effect model (category II) and case 3 (category I) are presented in Table 9.

Table 9: Values of ε_i

Coefficients	Fixed Time Effect	Case 3
ε_2	1.395	2.466

ε_3	2.309	3.146
ε_4	9.129	10.95

As is evident, all ε_i`s are positive, and their sizes increase as educational background improves or as tiers of schooling getting higher up.

5. Conclusion

As has been shown in this paper, the correlation between labour productivity and educational background is significant and positive. The regressions also yielded statistically significant relationship between total factor productivity and other variables including educational variables (excluding a constant term due to the problem of singularity of matrices) suggesting a positive impact of schooling on productivity. The basic econometric model used especially the time fixed effect specification produced similar results. Differences in labour productivity increase as the educational level increases. For instance, ε_2 is 1.395 while ε_3 is 2.309, 1.65 fold greater than ε_2 and ε_4 is 9.129 which respectively is 6.5 and 4 fold greater than ε_3 and ε_2. It shall be noted that ε_i represent the productivity differential between educational category λ_i and the base category λ_0.

Based on the above results, three conclusions can be drawn. First, schooling influences the productivity of manufacturing enterprises considered significantly. Second, the level of schooling is strongly associated with the level of productivity, i.e., the higher the proportion of the labour force with higher level of schooling in an enterprise, the higher the enterprise's productivity. Third, allotting an increasing proportion of social wealth to education is paying.

Thus, the results of the analysis provide empirical evidence that schooling in Ethiopia can serve as a condition for growth for it affects productivity significantly and positively. It is possible to infer from this that the education system in Ethiopia has, by and large, effectively translated skilled manpower training into productive services at least in the manufacturing sector. From the standpoint of the manufacturing enterprises, the education explosion and growth in college and university enrolment could have meant moving to a higher level of the productivity frontier. The results are telling and suggesting that in addition to broadening schooling and increasing

quantity, improving quality is also required to increase the productivity of manufacturing enterprises in Ethiopia.

The implications of this analysis to Ethiopian industrialisation are clear. Industrialisation is nothing but a sustained increment in productivity, a constant improvement in the efficient use of resources and an evolutionary process of acquiring technological capabilities. Successful industrialisation is associated with improvements in local technological know-how i.e. in the process of imitating, assimilating, transferring and adapting production techniques. These technological improvements are, in turn, person-to-person processes, the paces of which are influenced by the availability of skilled man power - the level of schooling.

Level of schooling has been proved to influence productivity in Ethiopian manufacturing enterprises substantially, implying that the technical competence of an industrial work force is improved through education imparted by the formal education system. Post employment and vocational training should improve this technical competence of the industrial work force even further, thereby increasing productivity and hastening industrialisation. In line with this, enterprises should undertake employee-training programs and institute in-firm training mechanisms. In Korea, companies spend at least 5-6% of their total budget on education and training programs (Lall, 1992:177) and this is one of the secrets of South Korea's rapid entry into new and demanding industries.

In the Ethiopian context, the problem is that there is a serious risk of private under-investment in training at the firm level because enterprises cannot appropriate all the returns on their investment to education. Enterprises will invest in their own training programs confidently, only if the extent of labour mobility is low and investment on employee-training yields appropriate benefits. But, in a free market governed system, labour is highly mobile and in-house trained workers leave. Nation-wide, mobility must not be restrained for it facilitates diffusion of knowledge. On the other hand, government has to adequately supply ever-increasing demands for skilled manpower. The modalities for supplying trained manpower will therefore need to be worked out according to prevailing conditions on the ground.

However, three areas where the government should take action are evident. First, government should involve the private sector and public enterprises (the prime beneficiaries) in its human capital development efforts for specific demand to match supply in both quantity and quality. Second, government should not only dwell on basic education but also consider tertiary education. The coefficients for semi-

professional and professionals proved that tertiary education influences overall productivity more strongly than basic education. Third, human capital expansion alone does not lead to the industrialisation of a country. For successful industrial development to take place, human capital should be combined with physical investment, infrastructure, technology, facilitative institutions and appropriate incentives. A proper balance is thus required; however, the nature of this balance depends on endowments, level of development, inherited structure and institutions. Efforts that stress only human capital run the risk of misunderstanding industrial development and misguiding industrial strategies.

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Appendix

One can easily arrive at equation 3 from equation 2 in the following way:

$$
\begin{aligned}
L_i &= L_o(1+\varepsilon_i) \\
&= (1+\varepsilon_i)\, L_0\left(\frac{L_i}{L_i}\right) \\
&= (1+\varepsilon_i)\left(\frac{L_0}{L_i}\right) L_i
\end{aligned}
$$

$$\Rightarrow \left(\frac{L_i}{L_0}\right) L_i = (1+\varepsilon_i)\, L_i$$

$$L_i^e = (1+\varepsilon_i)\, L_i$$

That is, L_i in efficiency units (relative to L_0).

$$
\begin{aligned}
L_T^e &= \sum_{i=0}^{3} L_i^e = \sum_{i=0}^{3} (1+\varepsilon_i)\, L_i \\
&= L_0 + \sum_{i=1}^{3} (1+\varepsilon_i)\, L_i, \sin ce\ \varepsilon_0 = 0 \\
&= L_0 + \sum_{i=1}^{3} L_i + \sum_{i=1}^{3} \varepsilon_i\, L_i \\
&= L_0 + L_1 + L_2 + L_3 + \sum_{i=1}^{3} \varepsilon_i\, L_i \\
&= L + \sum_{i=1}^{3} \varepsilon_i\, L_i
\end{aligned}
$$

This is total labour in efficiency units.

The Implications of Asset Ownership on Child Work in Rural Ethiopia[1]

Assefa Admassie[2]

Abstract

Children have always been working in industries and enterprises, in shops and stores, on farms and plantations, in domestic homes and habitats, on roads and streets, and in restaurants and hotels. There is by now a virtually unanimous view that poverty is the main, although not the only, cause of child labour. Even altruistic parents who care about the welfare of their children can thus be forced to see their children working because of poverty. If work participation exceeds an acceptable threshold level, the normal development of children could be seriously affected. The main aim of this paper is to provide empirical evidence on the link between asset ownership and child work in the context of a subsistence rural economy. The results show that most children in rural Ethiopia perform some form of work either in the house or on the farm. Although access to physical asset is expected to raise household income and create an incentive for school attendance, it might reduce school attendance and increase the probability of work unless accompanied by technological development. Policies that encourage school participation and help to improve the income generating potential of households and the provision of productive assets to create a more stable economic base are needed to reduce the engagement of children in work activities.

1. Introduction

[1] The final version of this article was submitted in June 2006.

Child work is a widespread problem particularly in developing countries despite legislations prohibiting the participation of children in harmful work practices. Children continue to participate in work activities, putting at stake their education, their health, their normal development to adult hood, and even their lives. Millions of them work under hazardous conditions, which present dangers to their health, safety, and welfare. They toil in mines and quarries, are exposed to agrochemicals in agriculture, squat in crippling positions to weave rugs and carpets and scavenge in rubbish collection centers. Many more are enslaved in bonded labour, isolated in domestic service, and traumatized and abused in the commercial sex trade.

According to the ILO (1999) estimate, up to 250 million children under the age of 15 years work worldwide. The vast majority of these children do not have access to education. For more than 120 million of these children, work is a primary full time activity while the reminders combine work with schooling or other non-economic activities. More than 95 percent of the global child labour is now largely a developing country phenomenon. In absolute terms Asia, being the most densely populated region of the world, has the largest number of child workers with 61 percent of the global child workers. In relative terms however, Africa comes first in the proportion of children participating in economic activities with an estimated 41 percent of the total number of children aged between five and 14 compared to 22 percent in Asia and 17 percent in Latin America (ILO 1997). The incidence of child labour in Africa is, therefore, about twice the level in Asia. Child labour in Africa has increased mainly due to factors such as rapid population growth, reduced standards of living as a result of economic crisis, limited public spending on social services like education, wars and civil strife, breakdown of family structures, etc. (Hemmer, *et al,* 1996). While the trend in child labour globally shows rapid decline, the number of working children in Africa is projected to increase to 100 million by the year 2010.

Within the African continent, some countries are more prone to child labour problem than others. Eastern Africa has the highest child participation rate within the African continent followed by Western Africa (ILO, 1996). Children's work participation rate in Eastern Africa is estimated to be about 33 percent while West Africa and Middle Africa account for 24 and 22 percent of the child labour, respectively (Kebebew, 1998). It is evident that the less developed a country is, the greater the proportion of the child population who work. One study has reported that the activity rates of children between the age of 10 and 14 are more than 40 percent in Ethiopia, Kenya,

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Uganda and Tanzania while it is less than 6 percent in Mauritius and South Africa (ILO, 1997). However, these official statistics have considered only those children between the age of 10 and 14 years. If children below the age of 10 years have been included, the figure would have been much bigger than is reported by the official statistics.

According to some estimates it looks that more boys than girls work, the average ratio being three boys to two girls. Africa also has the highest participation rate of girls among the developing countries. However, surveys do not take into account domestic work in one's own household or caring for sick or disabled family members, which are usually performed by girls than boys. If such work were taken into account, there would be little or no variation between the sexes and the total number of working children, and the number of girls might even exceed that of boys.

It is also clear that the more elementary the type of the economic activity or the kind of occupation that does not need specific skills, the larger the relative size of the working children in that particular industry or occupation. These factors influence the distribution of the total number of working children by branch of economic activity or by occupation in any specific country. As a result, the relative level of the child workforce in any industry or occupation could vary from one country to another. Economic activities related to the agricultural sector are predominant in the proportion of child workers. More than seventy percent of the child labourers in developing countries are engaged in agricultural and related activities. In some countries it can even be as high as 90 to 95 percent. Agriculture absorbs most of the child labourers because agricultural production in developing countries is often labour intensive characterized with primitive and backward technology. Parents also want their children to acquire the basic agricultural skill so that they become good and able farmers when they grew up.

Although some the statistics exist that show the level or the incidence of child labour force participation rate in Ethiopia (Basu, 1999), lack of data has affected the amount of research done on the determinants of child time use decisions. A significant portion of the children working in domestic services and on family farms is usually ignored from the statistics. Even the few empirical works on the topic have disproportionally focused on the more visible forms of child labour. Above all, most empirical studies have focused on the labour intensive manufacturing sectors in South Asia and Latin America. In addition, existing studies do not often consider work in the house, on the farm, on family enterprises etc., as child labour and discriminate between market based and non-market based work. So, the issue of child labour has not received adequate attention in Ethiopia for these and many other reasons.

2. Statement of the Problem

Child labour should be a concern to any developing country because of the long-term negative repercussions that starting working life too young has on the personal development of the child as well as on the economic and social development of the country. According to Anker (2000) there may be several reasons why we should be concerned with the problem of child labour. First the humanitarian concern emphasizes the protection of children from any form of exploitation and hazardous work. According to this view, children are fragile and need special protection. The second concern relates to the educational concern. Excessive work can be harmful for children since they will not have time to go to school or even if they go they have little time to study. The last concern relates to the macro and micro economic effects of child labour. On the one hand children do make significant contribution to family income in many developing countries. In fact, without the support of their children many parents would not have survived. Children contribute to household income in cash or in kind either by working in the labour market or by directly contributing to the labour demand of households. On the other hand, employment of children in work activities may displace unskilled labour from the labour market. This will create unemployment problems, which will, in turn, results in economic and social problems.

The problem of child labour is closely associated with poverty and technological backwardness. It is both a cause and a symptom of poverty. As argued well by Basu and Van (1998) it is not because parents are irrational and unsympathetic to their children that they send them to work but primarily to increase household income or as part of a survival strategy to minimize the risk of interruption of the income stream. It is often, a mitigation mechanism against a decline in income. Household poverty, which is manifested in terms of low or declining income and asset ownership, has often been singled out as the most important reason why under aged children are pushed into the labour market. Family income is a determining factor in parents' decisions whether a child has to work or not. A steady income that meets the basic necessities of daily life and allows for some savings for occasional big expenses will make it easier to forgo a child's earnings. The children of the poorest families are less likely to have access to primary education. Children from families living on poverty incomes often start work at the age when their better-off counterparts are attending school.

Poverty is a complex, deep seated and pervasive reality of the modern times. Poverty leads to a vicious circle of poor health, reduced working capacity, low productivity and

shortened life expectancy. Poverty expresses itself in the form of material deprivation, low human capital formation such as education and health, vulnerability to risk and lack of power (World Bank, 2000). It is a trap leading to inadequate schooling, low skills, insecure income, early parenthood, ill health, and an early death. Low level of education and health can lead to low income and hence to material deprivation. Vulnerability to risk can lead to inappropriate resource allocation decisions. It hinders growth, fuels instability, and keeps poor countries from advancing on the path to sustainable development. Nearly half of the population of the world lives on a less than US$ 2 a day; about 1.2 billion people struggle on a US$ 1 or less a day and a further 1.6 billion people live on US$ 1 to US$2 a day and are thus also poor, insecure and at risk of falling to the level of bare subsistence (World Bank, 2003).

Child labour leads to the perpetuation of household poverty across generations and slows economic growth and social development. As long as poverty pushes some families to send their children to work, the next generation is condemned to the same fate. While not all child labour is harmful, many children pay a high price for being engaged in work activities in terms of poor or lost education opportunities and poor health. This in turn translates into high social and economic costs for the countries concerned. In its worst form it robs children of their health and education and even their lives. Families on the margins of survival have to weigh their investment on their children's education against the value to the household of the work that a child might do. The bulk of child labour is in the informal sector, on farms and in micro and small enterprises. In family businesses and farms, children may not be paid at all and most of their work serves to release time for adult members of the family to increase household earnings. Even in the context of the family, child labour can be hazardous and constitute a barrier to school attendance and performance.

Although there is very little information on child labour, there is no doubt that it is an enormous problem in Ethiopia. It is hypothesized that many under-age children in Ethiopia are engaged in wage and non-wage works, which could be considered as child labour since many of these activities are both exploitative and deprive children their education and other ingredients necessary for their proper growth (Assefa, 2000; 2002; CSA, 2001). According to recent ILO estimates and projections, the participation rate of children in the world between the age of 10 and 14 has been estimated to be around 13 percent in 1995. But the corresponding figure for Ethiopia was more than 42 percent (Basu, 1999). Moreover, while the participation rate of children in economic activities of the same age group globally will be less than 10 percent by the year 2010, it will be about 40 percent in Ethiopia (ILO, 1997) .Experience elsewhere shows that children below the age of 10 are also economically

active (Assefa 2000 and Assefa 2002). Therefore, the incidence of child labour in Ethiopia could be even higher if the working children below the age of 10 are included in the above figures. Everyday observation also suggests that the incidence of child labour even among those 10 to 14 years of age might be much higher both in the urban and rural areas than suggested by the reports.

The level of poverty in Ethiopia is extremely high in terms of all major indicators of poverty as compared to other countries. The level of deprivation, life expectancy, under-one and infant mortality rates are probably the worst in the world and are all below the sub-Saharan African average. The rural literacy rates in Ethiopia are also one of the poorest in the world. Another indicator is the level of child malnutrition. The figures are again very high as compared to other countries. The proportion of people in Ethiopia who are absolutely poor i.e. those whose total consumption expenditure was less than the total poverty line in 1999/00 was estimated to be around 44 percent (MoFED, 2002). The proportion of absolutely poor people in urban areas was 37 percent while it was 45 percent in rural areas suggesting that the incidence of poverty is much higher in rural areas than in urban areas. Children in rural areas are only given limited opportunities to attend school. The net primary school enrollment rates are very low although gross enrolment rates may be higher. Children are often left out of school to help their parents at home. So, there is a need to break the cycle of poverty and give the Ethiopian children some hope.

Although poverty is usually manifested in terms of low income, finding an appropriate and direct measure of household income is often difficult with respect to rural economies where households rely less on the market. In the case of rural subsistence economies the link between poverty and asset ownership is particularly very strong since greater asset ownership means more wealth. The livelihood of the poor is fundamentally determined by the asset base it owns. It is often argued that the main cause of poverty in developing countries is lack of access to productive assets and hence increased access to productive assets by poor households is the best means of reducing poverty. Physical assets empower poor households by increasing their incomes; serve as reserves against shocks; and provide choices to escape from harsh or exploitative conditions. Thus, it is better to use household physical assets as proxy measures for income and welfare of rural households. With respect to child labour, ownership of productive assets should decrease children's probability of working and increase their probability of school attendance. If households lack productive assets, they would survive a sudden drop in income by borrowing on the human capital market, meaning let children work instead of attending school.

The main means of livelihood in rural Ethiopia is agriculture, land ownership being an important determinant of welfare. Land ownership and poverty are closely related in Ethiopia. A study showed that the poorest 20 percent of the households owned about 0.28 hectares of land per adult equivalent, compared to 0.59 hectare per adult for the richest 20 percent (Dercon, 1999; Getachew, 1995). Because of increased population, marginal land has been brought under cultivation in many parts of the highland. Due to the absence of market for buying and selling land and the end of repeated land distribution, newly formed households cannot access more land. Many young adults end up being dependent on their families and their largely inadequate resources and as a consequence farm plots are subdivided into ever-smaller parcels.

Another important input in agricultural production is the availability of livestock both as a store of value and for traction power. In all farming systems livestock are the single most important store of wealth. Oxen are crucial in the ox plough farming system, which is most common in the Ethiopian highlands. In other farming systems where oxen are less important for traction, livestock provides a very important source of additional income, via milk and meat, dung, etc. Many studies have confirmed the correlation between poverty and livestock ownership (World Bank, 1998; Webb, et al, 1992; Getachew, 1995; Dercon, 1999). In most communities in Ethiopia owning no or very little livestock is a clear characteristic of the poor. Poor households do not have the oxen for traction power and are thus forced to give out part of their land to another household in the form of a sharecropping agreement.

The poor also typically have limited other durable household assets such as TV and radio sets. A study showed that of the poorest 20 percent only 3 percent have a radio (MEDaC, 1995). Even the distribution of these assets is skewed in favor of urban areas. Access to social and economic infrastructure by the poor is also limited. The poor are typically further away from all services such as road, telephone or post offices. Many rural households depend on rivers and lakes for their water supply. Household labour is often one of the few means of earning income the poor can rely upon. If illness strikes and working days are lost income will be strongly affected. Illness or death of a household member causes serious labour shortage and high expense for rural households. There are very few health facilities in rural Ethiopia as compared to any other country. So, interventions to reduce rural and urban poverty would have broader implications on child work.

In general, while the incidence of child labour may vary greatly from country to country and even possibly within countries, it is, however, clear that the number of

working children in Ethiopia is so high that it deserves to be a matter of priority concern in Ethiopia. Excessive participation of children in work activities jeopardizes children's possibilities of becoming productive adults in the future. Having a child to labour will have immense impact on the child's physical and intellectual development. It is an extremely expensive phenomenon both for the child and for the society in general. Although it is generally agreed that the complete abolition of child labour will take a long time, there is a need to ensure that a start is made towards the abolition of this problem and diagnosis of the problem is the first step in this direction. Any intervention policy on child labour should be based on a careful analysis and research rather than just emotion and impulse. This study, thus, attempts to examine the implications of asset ownership on the allocation of children's time in rural Ethiopia, with the aim of suggesting possible areas of interventions. The study will, therefore, have serious implications on child welfare and education policies.

3. The Objectives of the Study

In light of the forgone discussion, the main aim of this study is to provide empirical evidences on the link between poverty, measured in terms of asset ownership and child work in the context of a subsistence rural economy. More specifically the study aims to examine the impact of asset ownership on child time use decisions.

4. The Theoretical Framework

The theoretical framework for analyzing households' decisions about the allocation of children's time is best is captured by the household production function approach formulated by Becker (1965).[3] The household economic theory of labor deployment states that intra-household decisions regarding task allocation are made on the basis of utility maximization. This framework has been widely used in empirical works to study the joint allocation of time of household members. The model assumes that the household makes joint decisions on how many children to have and how to allocate the time of household members to market and household work and to schooling (Rosenzweig and Evenson, 1977). Household members are allocated those tasks that will bring the greatest returns to the household. For instance, Becker (1981)

argues that the sexual division of labor is a logical response to women's reproductive role. As women bear children, they are most suited to their care and are consequently tied to tasks within the home. Men are not as well deployed for childcare and are, therefore, best deployed for generating an income for the family.

Similarly, a child's non-leisure time can be spent on schooling, on home-based production, on economic activity in the market or on a combination of these. Thus, the three rival claims on the non-leisure time of the child will be school attendance, work and the combination of school attendance with work. A household allocates the time of children between these competing activities, taking into account the private returns to each activity, and the household allocates the time of its children to wherever the perceived private return is highest until the marginal return is equalized across all of the child's time.[4] Thus, child labor becomes a consequence of a rational family strategy if the marginal benefits of child labor (i.e., earnings and saved costs of schooling) are higher than the marginal cost of child labor in terms of the forgone return to human capital investment.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

observable child, household, and environmental attributes, which are exogenous, and (e) the stochastic element that captures the unobservable:

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

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

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

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

Households then maximize household utility subject to the combined time and income constraints with respect to the composite commodities.[5]

5. Methodology of the Study

5.1 The Analytical Model Used

The study has adopted a general utility-maximizing framework to model the choices regarding child-time-allocation activities as a function of child-specific, parental, household, environmental, technological and cultural characteristics. It is assumed that the time allocation decisions for the children are made either through a complete

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

agreement among family members regarding the choices or by an altruistic adult, who often is considered to be the household head. Households' decisions about allocating their children's unit-time endowment can be econometrically modeled in different ways depending on the number of options and on the view one holds about the decision-making process. The decision can be modeled on the basis of simultaneous consideration of all the options or on the basis of an ordered decision. If the decision can be modeled in terms of a dichotomous choice model and the decision to work and to go to school are assumed to be independent, then a univariate probit model can be used. But if the two decisions are assumed to be made jointly, a bivariate probit model will be the appropriate approach. Under circumstances with more than two possible states in which a child could be at any one time, the bivariate or univariate probit approach will not be suitable. Hence, when a simultaneous decision-making process is assumed for three or more alternative choices, a multinomial choice model is appropriate.[6]

Although, there may be several activities that children may undertake simultaneously, the study assumes that a child's unit-time endowment can be used for four mutually exclusive activities. At a particular time, a child could be only attending school, only working, attending school and working at the same time or being idle, i.e., neither working nor attending school (leisure). This gives rise to the polychotomous choice framework.[7] Hence, the probability of a child having activity j is given by the following multinomial logit model.

$$prob(Y_i = j) = \frac{e^{\alpha_j + \beta_j X_j}}{\sum_k e^{\alpha_k + \beta_k X_k}} ;..j,k....0,1,2,3 \qquad (8)$$

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

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

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

that the sum of the probabilities of the four alternatives must be unity, it can be shown that:

$$
\begin{aligned}
prob\ (school\ ) &= \frac{e^{x\beta_A}}{1+e^{x\beta_A}+e^{x\beta_B}+e^{x\beta_C}} \\
prob\ (work\ ) &= \frac{e^{x\beta_B}}{1+e^{x\beta_A}+e^{x\beta_B}+e^{x\beta_C}} \\
prob\ (school\ +\ work\ ) &= \frac{e^{x\beta_C}}{1+e^{x\beta_A}+e^{x\beta_B}+e^{x\beta_C}} \\
prob\ (inactive\ ) &= \frac{1}{1+e^{x\beta_A}+e^{x\beta_B}+e^{x\beta_C}}
\end{aligned}
\tag{9}
$$

Given the above specification, the likelihood function becomes:

$$
L = \prod_s \frac{e^{x_s\beta_A}}{1+e^{x_s\beta_A}+e^{x_s\beta_B}+e^{x_s\beta_C}} \prod_h \frac{e^{x_h\beta_B}}{1+e^{x_h\beta_A}+e^{x_h\beta_B}+e^{x_h\beta_C}} \ldots \prod_m \frac{1}{1+e^{x_m\beta_A}+e^{x_m\beta_B}+e^{x_m\beta_C}}
\tag{10}
$$

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

$$
y_{ij} = \begin{cases} \mathbf{1} & \textit{if the } i^{th} \textit{ child falls in the } j^{th} \textit{ category} \\ \mathbf{0} & \textit{otherwise} \end{cases}
\tag{11}
$$

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

$$
L = \prod_{i=1}^{n} p_{i0}^{\,y_{i0}}\, p_{i1}^{\,y_{i1}}\, p_{i2}^{\,y_{i2}}\, p_{i3}^{\,y_{i3}}
\tag{12}
$$

as:

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

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

By differentiating the log likelihood function given in (13) with respect to the parameters ($ß_i$), the maximum likelihood estimators can be generated through an appropriate mathematical iterative procedure. It should be noted that the signs of the ß coefficients are not necessarily equal to those of the marginal effects.

Unlike the standard regression analysis, the parameter value (ß) is not directly interpretable as the effect of a change in the explanatory variable on the mean or expected value of the dependent variable.[8] The coefficients need to be adjusted to be marginal effects in the case of the logit model. In other words, the marginal effect, which gives the partial derivatives indicating the change in the probability of the dependent variable relative to a unit change in one of the independent variables, needs to be computed. As the relationship between the regressors and the absolute probabilities is nonlinear, marginal effects vary according to the choice of vector X and, consequently, they will vary among individuals according to the point of evaluation. By differentiating the multinomial logit model, we find the marginal effects of the explanatory variables on the probabilities as:

$$\delta_j = \frac{\partial P_j}{\partial X_i} = P_j \left[ß_j - \sum_{k=0}^{J} P_k ß_k \right] = P_j \left[ß_j - \overline{ß} \right] \tag{14}$$

Therefore, the signs of the marginal effects could be different from the signs of the coefficients. For continuous variables the marginal effect is the probability change in response to an increase in the value of the independent variable by one evaluated at the mean value. For dummy variables the marginal effect is computed as the difference in probabilities of the dependent variable between the group with

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

designated value 1 and the reference group. The probabilities are constrained to sum to zero for each variable across the choices in the multinomial logit model.

5.2 The Data Used

The data for this study came primarily from an LSMS-type survey on rural households in Ethiopia. The Department of Economics at the Addis Ababa University undertook five rounds of rural household surveys in collaboration with different organizations, such as the Center for the Study of African Economies (CSAE - Oxford University), IFPRI and USAID. The fifth round survey, which is the latest one covering 18 villages and undertaken during the 1999/2000 crop season, was the main source of data for this study. Additional information from previous rounds of surveys was also used to complement the present data-set. The fifth round survey involved 1,681 households with an average household size of 5.88 members, giving a total of 9,884 individuals. The data included information on the primary and secondary occupations of every member of the household, including children above the age of 4 years. Children between the ages of 4 and 14 years have been the main focus of this study. The upper age limit was chosen because it defines the age at which some pupils begin their secondary education and because that is the minimum age for employment according to the Ethiopian Labor Law (TGE, 1993). There were a total of 3,611 children between the ages of 4 and 14 years, who were either in school and not participating in other activities, specializing in work, combining school attendance with work or were neither in school nor in the labor force. However, the total number of children used in this study has been only 3003 because of missing values. In addition, gender-disaggregated models were also specified and estimated.

6. The Results and Discussions

6.1 Some Descriptive Analysis

The early participation of children in work activities, which is very common in Ethiopia, is a cause for concern. The younger the child is, the more vulnerable he or she will be to physical, chemical and other kinds of hazards at the workplace. According to the data some 12 percent of the sampled children have started to participate in work activities by the age of four years (see Table 1). By the age of ten almost all children have started to participate in work activities. Similarly, some

children also start going to school at an earlier age[9]. Moreover, because of lack of secondary schools or limited number of places in schools, it is expected that after this age schooling might even be less of a choice.

Table1: Work-starting ages for children in rural Ethiopia

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

Source: Fifth round rural household survey, 1999/2000

It is not uncommon to find children participating in more than one form of activity in rural Ethiopia. A child was assumed to be in one of four different states at any one particular time period: attending school, working, combining school attendance with work or doing none of these activities at any particular time. Close to forty percent of the sampled children are engaged in work activities only while more than a quarter of them combine school attendance with work activities (see Table 2). One should, however, need to be careful not to conclude that work participation may not affect children's education. Excessive work participation may affect significantly children's scholastic achievements.

[9] The school starting age in Ethiopia is set officially at seven years. But since there is no compulsory education policy many children do not start school attendance at that age. Early school enrolment in urban areas and late school enrolment in rural areas are very common.

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

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

* work includes all work activities including farm work, domestic work, herding, crafts-work, trading, manual work, food selling, or any other type of work.
** others include non-respondents and disabled children
Source: Fifth round rural survey, 1999/2000.

The empirical evidence also shows that children participate in different types of work activities such as farm work, domestic work, herding, and child care as well as several informal activities (see Table 3). Farm work and domestic chores are the main types of work activities involving children in rural Ethiopia. However, there is a gender difference in terms of the types of work performed by male and female children. Boys have generally greater participation in farm work while girls participate more in domestic work. These activities could be harmful to the children's normal development since they may directly conflict with their education and health.

Table 3: Type of work activities performed by children by age and sex (%)

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

* Domestic work includes activities like cooking, cleaning, child care, fetching water and wood, etc.
** Others include informal activities like food selling, trading, manual work, pottery, crafts work, etc.
Source: Fifth round rural survey 1999/2000

Participation of children in work for too many hours or work beyond their physical strength could have serious implications on children's physical and mental development. Excessive work participation may have several harmful effects including possible damage to the health and psychological development and most importantly their educational development. The result of this study shows that children could be subjected to excessive long hours of work (see Table 4). Many children are forced to work more than 12 hours a day. Such excessive work hours defiantly would affect children's normal physical development and reduce their learning abilities even if they are able to attend school. Boys spend more time in livestock herding and farm work, while girls spend more time on herding and child care activities. Child care could be harmful since it is incompatible with school attendance.

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

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

Domestic work includes all housework except childcare.
Source: Fifth round rural survey, 1999/2000.

6.2. Results of the Econometric Analysis

The link between household income and the allocation of children's time is one of the most important issues related to child labor that has received much attention in the literature (see, for instance, Psacharopolous 1997; Patrinos and Psacharopolous, 1997; Kassouf 1998; Canagarajah and Coulombe, 1998; Grootaert, 1998; Blunch and Verner, 2000). According to the insufficient income hypothesis, households are compelled to send their children to the labor market because their income is low. Several empirical studies have documented that the contributions of children to family income in developing countries can be substantial, ranging between 10 and 40 percent of the household income (see, for instance, Sharma and Mittar, 1990; Swaminathan, 1998; Cain, 1977; Patrinos and Psacharopolous, 1997; Myers, 1989;

Kassouf, 1998). Hence, household poverty, which is manifested in terms of low or declining income, has often been singled out as the most important reason that under-aged children are pushed into the labor market.

Nonetheless, the relationship between household income and child work remains still controversial and inconclusive[10]. Historical evidence does not provide adequate explanations for whether the rise in household incomes has been the instrumental factor in eliminating child labor from the present-day industrialized countries or whether the introduction of relevant legislation was the driving force[11]. Nevertheless, there is now a general consensus that the poorer the household is, the more likely that children are to work. According to Basu and Van's (1998) luxury hypothesis, a family only sends its children to the labor market if its income from non-child labor sources drops very low. When household wealth rises, children will be progressively withdrawn from labor activities in favor of alternative activities such as schooling (Grootaert and Kanbur, 1995; World Bank, 1998). A casual observation of the geographic distribution of child labor today also suggests a negative association between child labor and aggregate income (Basu, 1999).

Empirical evidence about the link between family income and child work within the context of subsistence and non-monetized rural economies is hard to find, primarily due to lack of an appropriate and direct measure of household income. This problem is especially difficult when analyzing rural economies, where households do not rely heavily on the market for consumption and production decisions[12]. Thus, it is better to use proxy measures to examine the effect of household income on decisions about the allocation of children's time. An appropriate proxy for rural household income or wealth is to use the physical and financial assets of households. It is now increasingly being accepted that one of the main causes of poverty in developing countries is the lack of access to productive assets. Thus, increased access to productive assets by

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

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

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

poor households is the best means of reducing poverty.[13] For these households, the amount of land they own is too small to ensure the nutritional well-being of the family and is also of poor quality. Lack of draft power and fragmented plots are additional factors characterizing poor households. In addition, access to credit can be an important factor, since imperfect capital market arrangements often are considered to be serious obstacles to agricultural productivity on the one hand and to children's school attendance on the other. Some empirical studies have argued that child labor can be observed, despite parental altruism, because there are no markets for loans against the future earnings of children.[14] The availability of credit would encourage parents to incur the direct costs of schooling.

Theoretically, ownership of productive assets should decrease children's probability of working and increase the probability of school attendance. However, some have called for a careful approach to asset-based poverty reduction measures, since asset accumulation may actually lead to an increased incidence of child labor, thereby creating a conflict between asset ownership and human capital formation.[15] Nevertheless, it can be argued that if households lack productive assets, they would survive a sudden drop in income by borrowing on the human capital market, meaning sending children to work instead of school.

The evidence in the pervious section has demonstrated that children undertake a variety of work related activities, which may directly affect their educational progress although some of them were able to combine school attendance with work participation. The real question now is to what extent does poverty as proxied by the asset level owned by households influence children's work participation. The implication of asset ownership on child work is examined next using an econometric analysis. On the basis of the theoretical and empirical model developed earlier, a multinomial logit is used to assess the impact of asset ownership on child work. The

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

[14] Lahiri and Jaffrey (1999), Ranjan (1999), Grote et al (1998) and Ranjan (2001) have all presented a variety of theoretical models in which child labour arises as a result of imperfect credit markets.

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

descriptive statistics of the different variables used in the analysis are presented in Table 5.

Table 5: Descriptive statistics of the variables used

Variable	Description	Mean	Std. dev.	Min	Max.
Activity	Dependent - (0) if child is inactive, (1) if child is only attending schooling, (2) if child is doing only work, and (3) if the child combines work with schooling	1.59	1.04	0	3
Household assets					
Roof	1 if roof is made of galvanized iron; 0 otherwise	0.33	0.47	0	1
Wall type	1 if wall is made of stone, concert, brick or cement; 0 otherwise	0.19	0.39	0	1
Farm_Ass	Expenditure on farm equipment over the last two years in Birr	6.27	19.29	0	312.00
Land	Size of own cultivable land in hectares	1.30	1.08	0	8.63
Number_p	Number of farm plots owned in 1999	3.37	2.26	0	15
Share_cr	1 if household practices share cropping; 0 otherwise	0.29	0.45	0	1
Fertility	Average land fertility index; 1 if land was lem (good), 2 if lem-teuf (mediocre) and 3 if teuf (poor)	1.59	0.64	0.5	3.0
Slope	Average steepness of land; 1 if land was medda (flat), 2 if land was dagath-ama (moderately sloped), or 3 if geddel (steep incline).	1.28	0.46	0.5	3
Lu_cattl	Number of cattle owned by household in livestock units	3.20	3.06	0	23.50
Lu_smliv	Number of small ruminants owned by the household in livestock units	0.36	0.67	0	6.50
Lu_equin	Number of equines owned in terms of livestock units	0.62	1.05	0	8.75
Off_farm	1 if household participated in off-farm activities; 0 otherwise	0.24	0.43	0	1
Incom_ac	1 if the household participated in income generating activities; 0 Otherwise	0.44	0.50	0	1
Remitt	1 if the household has received any remittances; 0 otherwise	0.30	0.46	0	1
Labour	1 if the household participated in any traditional labour sharing arrangement; 0 otherwise	0.62	0.49	0	1

With the objective of highlighting the relationship between the allocation of the child-time endowment and household asset ownership, several productive assets were considered in this study[16]. The most important assets included in the model were the size of the land owned together with a measure of its quality, the mode of operation (sharecropping), the number of plots cultivated, the number of large and small livestock owned, the construction material used for walls and roofs and the total expenditure on farm assets, such as hoes, plows and sickles. All of these are important measures of wealth in rural Ethiopia. Land and livestock are the two most important productive resources rural households in Ethiopia own. In a non-monetized rural economy, the construction material used for dwellings is also an important indicator of wealth. While poor households use mostly grass and wood for roof construction, wealthy households often use galvanized iron. Similarly, wealthy households use concrete material or brick for wall construction, while poor households usually use mud or wood. In addition, participation of household members in non-farm[17] and income-generating activities,[18] acquisition of remittances, participation in reciprocal labor-sharing arrangements to ease any labor shortages and households' access to credit also have been included in the analysis. The results of the analysis are presented in Tables 6, 7 and 8.

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

[16] The results of the impact of household assets have been generated after controlling other factors such as child and household characteristics, cultural factors such as religion and ethnicity, technology as well as location specific factors.

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

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

one of the main activities of children in rural Ethiopia. Herding animals is probably one of the main reasons for the prevalence of child bondage in some parts of the country.[19] In order to examine the effect of livestock ownership on child work and school attendance, three types of livestock were included in the analysis.[20]

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

Land is the other most important physical resource for rural households in Ethiopia. The amount of land owned reflects the permanent income potential of households and can be used as collateral, thereby indicating the borrowing ability of the household. Since children working on the family farm are not paid an explicit wage, their marginal product is demonstrated by the size of the land operated. The size of the land owned may increase the likelihood of a child working if land-intensive farming activities are undertaken, which require more labor, including child labor. Thus, land size may have a negative effect on school attendance. The effect of land size was significant on both the schooling and work participation equations, with the strongest effect on the school attendance equation. In general, land size has a negative effect on school attendance and a positive impact on work participation. The result shows that increased farm size reduces children's school attendance likelihood by nearly 4 percent and increases their likelihood of work attendance by about 2

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

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

percent. Land size does not contribute greatly to explaining the decision to combine work with school attendance. The negative and strong effect of land size on school attendance suggests that as land size increases, households need more labor, including child labor, to transform it into a productive resource. On the other hand, since poor households own less of this productive resource, work opportunities for household members are limited. A negative effect of land ownership on school attendance was also reported in other empirical studies (Jensen and Nielsen, 1997; Cockburn, 2000; Bhalotra and Heady, 2000).

The result implies that increased land size might lead to more work, since it requires more labor, including child labor, thereby reducing children's likelihood of attending schools. Land is an important indicator of wealth in rural Ethiopia. It is also one of the most important productive resources that children could inherit from their parents. Therefore, larger farm size might lower the need for an alternative source of income and livelihood through investment in education for the children. Consequently, parents may not see the value of education and invest in it if they have sufficient productive resources that they can pass over to their children.

Investment in children's education might also be seriously affected by the productivity of the available resources. Land and livestock could be more or less productive, depending on the environmental circumstances prevailing in the system. One household's land may be more productive and fertile, while another household may have more livestock units to resort to during times of crisis. The productivity of the land owned by a household is reflected in, among other things, the fertility status of the farm plots and the degree of steepness (slope). Good land quality could reduce child labor, since a fertile and flat plot is conducive to farming and requires less labor but generates higher income. On the one hand, more fertile and flat land will require less labor, including child labor, thereby releasing children from work and creating better opportunities for school attendance. But, less fertile land could reduce household income and increase the risk of income fluctuations, thus demanding intensive agricultural practices and more labor input. Therefore, land size alone may not be an adequate indicator of wealth, unless there are means to transform it into a productive asset.

Two indices were included in the model to account for differences in land quality-fertility and steepness indices. The land-fertility index and the land-steepness index had significant effects only on the work and combined school-work equations. As the land-fertility index declines by one unit, specialization in work activities increases significantly. More specifically, the likelihood of specializing in work activities

increases by nearly 4 percent when land fertility declines by one unit, and the likelihood of combining school and work is reduced by about 2 percent. Cockburn (2000) also reported that land quality reduces child labor. The steepness of the land does not seem to have any significant effect on decisions about the use of children's time.

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

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

participation in non-farm employment also seems to encourage the probability of school attendance and of combining work with schooling, but reduces the probability of specializing in work.

The link between poverty and child work can also be analyzed by examining the impact of other wealth indicators, such as the construction material used for walls and roofs and the value of farm equipment owned. These indicators could also indicate the relative wealth position of rural households. Wealthy households generally use cement, bricks or stone for wall construction and galvanized iron for roof construction, while the poor ones use mostly grass or other non-durable materials. The productivity of the land owned by a household also depends on the availability of farm equipment. The results of the analysis show that households using galvanized iron for roof construction are 4 percent more likely to send their children to school than households using other construction materials. Similarly, households using brick, stone or cement for wall construction are nearly 5 percent more likely to encourage the combination of work with school attendance. Families owning more farm equipment are more likely to encourage the combination of work with school attendance. All these results imply that wealthier households encourage at least combining work with schooling, if not schooling alone, suggesting a strong link between poverty and child labor.

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

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

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

Finally, the special constraints faced by the poorest segments of households were represented by the inclusion of households' access to credit. A negative relation between child labor and credit availability and, correspondingly, a positive relation between school attendance and credit availability was expected, since child labor may be interpreted as borrowing across generations. The result of the study shows that access to credit seems to enhance school attendance and reduce the likelihood of specializing in work activities in general.

7. Conclusions and Policy Implications

The results of this study show that most children in rural Ethiopia perform some form of work either in the house or on the farm. Labour force participation is common even among those below the legal working age or those supposed to be in school. Excessive work, be it on the farm or in the house or in the labour market will have serious implications on the development of children. If work participation exceed an acceptable threshold level the educational development of these children could be seriously affected. The results underscore that the determinants of child labour are complex and many out of which household asset is but only one. A single intervention on the problem, which ignores its complexity, may not produce much success. Hence, the problem can only be addressed through a multifaceted approach that includes social, cultural, economic, and regional factors. The results of this study lead to a strong support for the hypothesis that household asset plays important roles in the allocation of children's time endowment.

Although access to physical asset is expected to raise household income and create an incentive for school attendance, our study shows that asset ownership might reduce school attendance and increase the probability of work unless accompanied by technological development. The results also suggest some gender differences in

which boys are less likely to specialize in work and are more likely to attend school or at least to combine work with school attendance while girls are more likely to take up home care tasks and are less likely to attend school.

Untangling the social, economic and cultural dynamics affecting families' decision whether a child should work or go to school is an important step towards effective action to combat child labour and cycles of poverty. The study clearly underscores the importance of educational investment and the need to broaden access to education to ensure that the future generations would be less impoverished than the present ones. So, policies are needed to encourage school participation improving the income generating potential of the household through the creation of income generating activities and the provision of productive assets to create a more stable economic base. Monitoring the working conditions of children who combine school with work may be an important policy agenda. Although legislation alone will not resolve working children's problems, an appropriate legislative framework can support other programs. Existing laws protecting working children must be better publicized and their implementation monitored.

Adults in all communities must be made aware of their responsibilities towards all children in their Community and community structures, such as religious groups can be used to uncover and monitor hidden forms of child labour and to support children. Working children also need support services, e.g. counselling services, education, skills training and health services. Accumulation of vital statistics is also an important measure to reduce child labour. Finally, additional research is needed to examine the impact of work participation on children's scholastic achievement since many children combine work with school attendance.

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Table 6: Marginal effect on the probability of SCHOOL attendance (All children)

Variable	Marginal effects	Std. error	P [|Z| >Z]
CONSTANT	-0.5669	0.1160	0.00
CONCRETE/BRICK/STONE WALLS	-0.0345	0.0253	0.16
IRON ROOF	0.0344	0.0159	0.03
FARM EQUIPMENT	-0.0003	0.0004	0.41
CATTLE	-0.0096	0.0038	0.01
SMALL RUMINANTS	0.0163	0.0144	0.25
EQUINE	0.0197	0.0091	0.02
LAND OWNED	-0.0367	0.0102	0.00
NUMBER OF PLOTS	0.0102	0.0041	0.01
PRACTICING SHARCROPPING	-0.0486	0.0193	0.01
FERTILITY OF LAND	-0.0074	0.0136	0.58
SLOPE OF LAND	-0.0178	0.0192	0.35
PARTICIPATION IN OFF FARM WORK	0.0246	0.0193	0.20
INCOME GENRATING ACTIVITY	0.0229	0.0153	0.13
REMITTANCE	0.0439	0.0197	0.02
LABOUR SHARING	-0.0378	0.0179	0.03

MODEL SUMMARY STATISTICS	
NUMBER OF OBSERVATIONS	3003
NUMBER OF ITERATIONS	8
LOG LOKILIHOOD FUNCTION	-2721.479
RESTRICTED LOG LIKELIHOOD	-3907.795
CHI –SQUARED	2372.63
SINGINFICANCE LEVEL	0.0000
PERCENT CORRECTLY CLASSIFIED	60.51

Table 7: Marginal effect on the probability of specializing in WORK (All children)

Variable	Marginal effects	Std. error	P [|Z| >Z]
CONSTANT	1.1289	0.1781	0.00
CONCRETE/BRICK/STONE WALLS	0.0138	0.0332	0.67
IRON ROOF	-0.0105	0.0217	0.62
FARM EQUIPMENT	0.0005	0.0006	0.38
CATTLE	0.0002	0.0047	0.97
SMALL RUMINANTS	-0.0159	0.0179	0.37
EQUINE	-0.0067	0.0125	0.59
LAND OWNED	0.0215	0.0126	0.08
NUMBER OF PLOTS	-0.0096	0.0059	0.10
PRACTICING SHARCROPPING	0.0245	0.0243	0.31
FERTILITY OF LAND	0.0353	0.0179	0.04
SLOPE OF LAND	0.0020	0.0262	0.94
PARTICIPATION IN OFF FARM WORK	-0.0288	0.0259	0.26
INCOME GENRATING ACTIVITY	-0.0045	0.0205	0.82
REMITTANCE	-0.0988	0.0260	0.00
LABOUR SHARING	0.0532	0.0238	0.02

MODEL SUMMARY STATISTICS	
NUMBER OF OBSERVATIONS	3003
NUMBER OF ITERATIONS	8
LOG LOKILIHOOD FUNCTION	-2721.479
RESTRICTED LOG LIKELIHOOD	-3907.795
CHI –SQUARED	2372.63
SINGINFICANCE LEVEL	0.0000
PERCENT CORRECTLY CLASSIFIED	60.51

Table 8: Marginal effect on the probability of combining WORK with SCHOOL attendance (All children)

Variable	Marginal effects	Std. error	P [|Z| >Z]
CONSTANT	-1.4096	0.0867	0.00
CONCRETE/BRICK/STONE WALLS	0.0489	0.0193	0.01
IRON ROOF	-0.0145	0.0129	0.25
FARM EQUIPMENT	0.0005	0.0003	0.07
CATTLE	0.0111	0.0025	0.00
SMALL RUMINANTS	-0.0054	0.0102	0.59
EQUINE	-0.0080	0.0074	0.27
LAND OWNED	0.0008	0.0072	0.91
NUMBER OF PLOTS	0.0041	0.0033	0.21
PRACTICING SHARCROPPING	0.0388	0.0138	0.00
FERTILITY OF LAND	-0.0187	0.0111	0.09
SLOPE OF LAND	-0.0054	0.0164	0.74
PARTICIPATION IN OFF FARM WORK	0.0102	0.0158	0.51
INCOME GENRATING ACTIVITY	-0.0181	0.0122	0.13
REMITTANCE	0.0639	0.0153	0.00
LABOUR SHARING	0.0102	0.0139	0.46

MODEL SUMMARY STATISTICS

NUMBER OF OBSERVATIONS	3003
NUMBER OF ITERATIONS	8
LOG LOKILIHOOD FUNCTION	-2721.479
RESTRICTED LOG LIKELIHOOD	-3907.795
CHI –SQUARED	2372.63
SINGINFICANCE LEVEL	0.0000
PERCENT CORRECTLY CLASSIFIED	60.51

Influence of Micro-Finance Services on Farm Households Income: *The Case of Oromia Credit and Saving Share Company–Kuyu Branch, Ethiopia*[1]

Kebede Duga[2], Bezabih Emana[3] and Gezahegn Ayale[4]

Abstract

The paper analyzes the influence of microfinance services in improving economic performance of farm households using data collected from 100 randomly selected households. Descriptive analysis of the changes in income level between the baseline and survey year was made whereas binary logit model was used to analyze the determinant of incremental income.

The results revealed the existence of improvement in the household income of the clienteles. Microfinance service related variables such as proper utilization of the disbursed loan, average loan size, appropriateness of loan disbursement schedule, and access to required amount of loan were found to be significant factors influencing the incremental income of the clientele. Other determining factors include land holding, shortage of draught animals, and distance to market.

The policy implications of the results tend to emphasize on the importance of supervision of loan service, improved loan schedules, proper identification of feasible business plan, income diversification of the clientele, and strengthening market access.

Keywords: Determinants, micro-finance, clientele, credit, logit model, Ethiopia

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1. Introduction

Similar to the other sub-Saharan African countries, the socio-economic situation of Ethiopia is characterized by low growth of income, inadequate social services, high population growth, economic inefficiency, and high unemployment rate, etc. resulting in severe poverty. As a result, diseases, malnutrition, and illiteracy are wide spread affecting more seriously women and children (Tsehay and Mengistu, 2002). Poverty also severely affects investment, which further leads to vicious poverty cycle due to lack of investment capital.

As poverty is a multidimensional problem, its solutions are multifaceted. In the Agricultural Development Led Industrialization (*ADLI*) strategy of Ethiopia, rural finance has been considered as an important tool for agricultural development and food security. Moreover, the Ethiopian Sustainable Poverty Reduction Strategy (SPRSP, 2002) underlines the importance of micro-finance institutions in poverty reduction and sustainable development. From the assessment of the Grameen Bank and even the experiences of some Micro-finance Institutions (*MFIs*) of Ethiopia, one can identify a number of best bet practices as well as challenges in the sector (Belay, 2001). Even though it cannot be a panacea – universal-remedy for poverty and related development challenges, micro finance is an important tool in the poverty eradication program. It can play an important role in facilitating the realization of rural development, and empowering the poor through provision of financial means to increase income and access to social services thereby creating confidence and self-esteem (Wolday, 2002). Micro-finance institutions provide suitable financial and other services using innovative methodologies and systems at low cost to meet the needs of low income sections of the population and act as intermediaries in a genuine sense (Wolday, 2000).

Oromia Credit and Saving Share Company (OCSSC), which was established in 1997, is one of the 21 licensed MFIs in the country with 70 branches and 50,815 clienteles and loan outstanding of about 43.4 million (OCSSCOAR, 2002). The company operates in 190 districts in Oromia and About 99% of the clientele of the company are from rural areas.

2. Statements of the Problem

The major objective of the OCSSC is improving the living conditions of rural households through mobilization of saving and provision of credit. Hence, it is expected that the income of clientele households would increase. Some anecdotal observations[5] on the ground, however, show that there are mixed influences of credit provisions on the incremental income of the clienteles. USAID (1995) revealed that financial schemes of institutions that do not follow sound, sustainable financial principles and facilitate real economic growth might cause more harm than good. A similar study by Pischke et al. (1966) recommended that NGOs offering credit and other financial services should be subjected to national standards and adoption of appropriate standards.

Limited access by rural farm households to financial services is widely recognized in Ethiopia. According to the Microsoft Project Document of UNDP (1999), the economically active but poor in Ethiopia who can potentially access financial services are about 6 million out of which about 8.3% have gained access to the licensed microfinance institutions. Scaling up of the financial services provided by microfinance institutions requires identification of supportive features that are acceptable to the clienteles. Accordingly, it is imperative to analyze the influences of microfinance parameters and other factors affecting the household income in order to provide empirical evidences on the extent of influence of microfinance services. The major question to be answered is whether variables associated with microfinance service significantly contribute to incremental household income or not.

This study was, therefore, designed with the objectives of analyzing the influence of micro-finance services on the incremental income of the target households and identify instruments of microfinance services such as loan size, loan scheduling, utilization, etc. that would affect the performance of microfinance services.

3. Microfinance Services in Ethiopia

Provision of financial services could be made through saving and credit functions. Both functions could be provided from informal and formal financial markets. Micro-

[5] *The major author worked for the company and had informal discussions with the clienteles regarding the benefits of the loan disbursed.*

finance institutions are among the formal financial institutions targeting the poor both in urban and rural areas. Micro finance institutions started operations in the country following the issuance of Proclamation No. 40/96, which regulates the businesses of micro finance in the country. The National Bank of Ethiopia, that is the licensing authority, has since then been issuing a number of guidelines that underpin the operation of micro finance institutions in the country. The major target groups of most of the MFIs operating in urban areas are women while the lion's share of the target groups are men in rural areas. These institutions have been trying to enlarge their client and area outreach for the last almost five years (Tsehay and Mengistu, 2002).

Even though few MFIs are being involved in managing the pension fund of Social Security Authority and money transfer, the provision of credit and saving products are the two most important financial products/services delivered by all MFIs in Ethiopia (Wolday, 2002). Loan products of MFIs in the country can be divided into two general categories: viz. agricultural loans and micro-business loans. The agricultural loans are loans for agricultural inputs, livestock production, bee-keeping, etc. The loans are usually term loans; the principal and interest are paid at the end of the loan term, which varies from one week to one year for all MFIs in the country.

Micro-business loans are loans for petty trade, handicraft, and other services, which are repaid weekly, bi-weekly, or monthly on a regular basis. The micro-business loans do have lower risks to MFIs portfolio management and loan loss as compared to agricultural loans, and they diversify household income. Saving is a precondition for investment and consumption smoothing and as a result, it can be an effective instrument to overcome economic shocks. The saving products include center savings, compulsory group savings, individual voluntary savings, and institutional voluntary savings.

Owing to small loan sizes and short loan period, which are major features of informal credit in both rural and urban areas of Ethiopia, the demand for products of MFI has been growing. According to Wolday (2000), delivery of microfinance services has been considered as one of the policy instruments to enable rural and urban poor increase output and productivity, induce technology adoption, improve input supply, increase incomes, reduce poverty and attain food security.

Microfinance institutions have a surmountable outcome and impacted individual households thereby raising their income level elsewhere and in Ethiopia. The Grameen bank in Asia is a case in point. In Ethiopia, few studies have established a relationship between microfinance institutions and household income. Samson

(2002) has indicated that Busa Gonfa Share Company of MFI operating around Modjo areas could increase household income through its lending scheme. However, only 30% of the households in the study area were able to access the service one of the reasons being resource constraint.

Grameen bank based lending methodology, which includes "center", group and individual structures, has been employed. "Center" savings are fixed amount of savings (at least one Birr) by each member per month at center level while group saving is a certain portion of the required loan (10% for OCSSCO) that is deducted and saved with the institution. Individual saving (which can be of compulsory and voluntary) is the amount (minimum of Birr two per member per month), saved by the clientele with the company. Other organizations, associations, and any body having legal entity with company make institutional saving.

The Oromia Credit and Saving Share Company (OCSSCO) was established in 1997, evolving from Oromia Rural Credit and Saving Scheme Development Project. The project had almost the same mandate as that of OCSSCO today, and commenced its operation in four districts/branches in four Oromia zones in February 1996. The branches were Kuyu of North Showa zone, Sinana-Dinsho of Bale zone, Hetosa of Arsi zone, and Shashamene of East Showa zone. This study was conducted in Kuyu branch of the company to assess the influence of the micro-finance services of the company on household economic situation between the year of establishment (1996) and the survey year (2002).

4. Conceptual Framework

Rural incomes fluctuate from season to season in response to weather shocks and related agricultural activities. Due to the risks affecting income levels and consumption, poor rural households in developing countries demand access to financial services to help stabilize income and consumption, and alleviate food insecurity (Zeller, et al., 1997).

Since farm households earn income from different sources, it is important to aggregate the income from different sources and include the different factors responsible for income generation in the incremental income model described in section 5.2, with major focus on the features of microfinance services. The major source of income is crop and livestock production the level of which is affected by

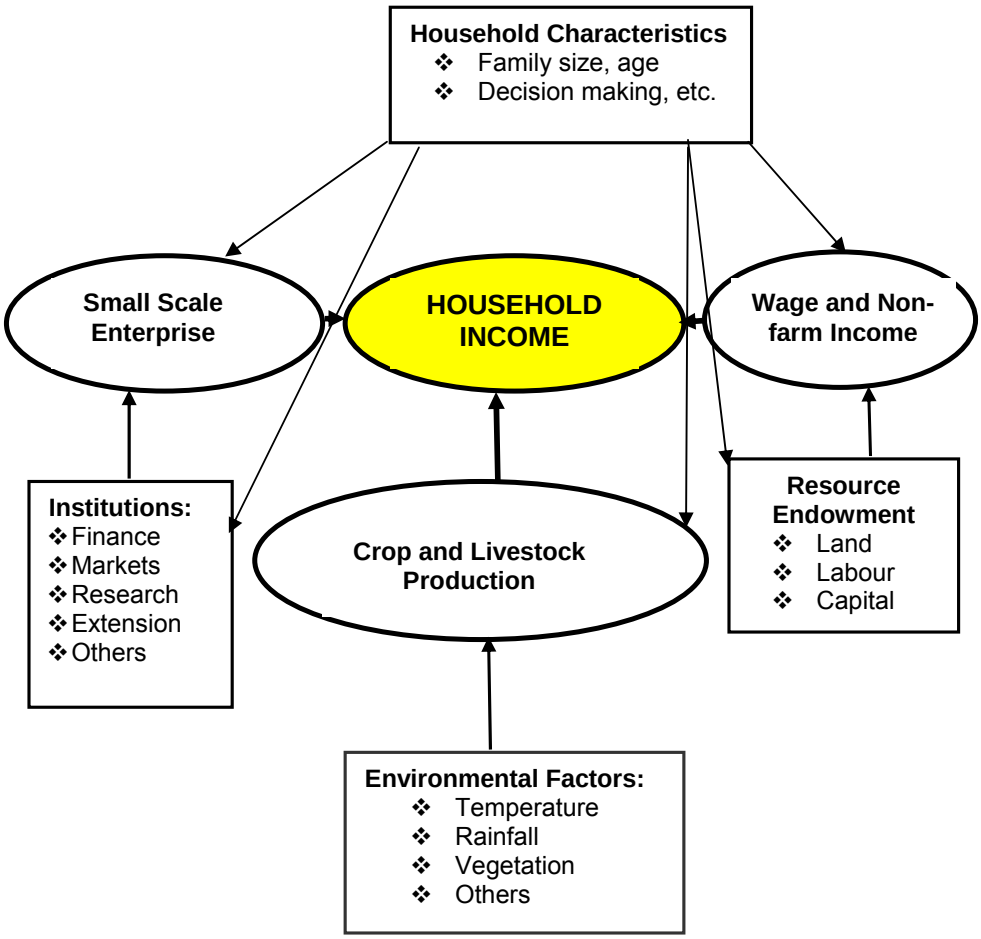
environmental factors such as soil, rainfall and temperature. The amount of production is also a function of the different factors of input such as land, labour and capital. Moreover, the decision-making and management skill of the household affects the factor combination and enterprise selection, thereby affecting the level of agricultural production and income. The level of output and the price of inputs and cost of production, which are determined through institutional factors and market forces, determine the income from agricultural production.

Another source of income is wage income which is affected by institutional factors such as labour market, labour mobility, wage policy, etc. Institutional factors play key roles in terms of finance, markets and research and extension services, which affect innovation and use of technologies, both in production and business sectors with ultimate impact on the utilization of credit received from microfinance institutions.

Another key factor determining the household income is micro-business or small scale enterprises which provide alternative or complementary job opportunities for both women and men in the rural and urban areas. The role of micro-finance institutions is considerable in creating access to financial services to enable income generation activities by engaging in small scale enterprises and use of production technologies to increase household income.

The extent to which microfinance services affect the income changes and improvements in the livelihoods of the clienteles is determined by the company policies such as loan size, loan purposes, repayment schedules and other parameters. In this study, key variables illustrated in Figure 1 were included in the econometric model of incremental household income to determine the extent to which the microfinance services and associated policies contribute to the increase in household income.

Figure 1: Schematic Representation of Factors Affecting Household Income



Source: Own sketch

5. Methodology

5.1 Data

The data used in this paper were collected from farm households who have been clienteles of the OCSSCO for five subsequent years. In order to analyze the changes in the income of the clienteles, two types of data were collected and analyzed. Firstly, primary data were collected from 100 randomly selected from 2197 clienteles of the OCSSCO-Kuyu branch during the year 2002. Structured questionnaire consisting of variables relevant for attaining the objectives of the study were used for data collection.

Moreover, the baseline data that was collected by OCSSCO-Kuyu branch at the very beginning of client-ship of the two parties in the year 1996 were collected from the files of the sample households at the branch office of the company. The major data included in baseline survey were annual income, family size, total land holding, total livestock holding, land use pattern, housing condition, health, access to financial services, farm household characteristics such as sex of the head, age and education level, etc. The data sets are consistent with the data requirement of the study.

5.2 Analytical Model

In this study, both descriptive and econometric analyses were conducted. The descriptive statistics was used to evaluate the significances of changes in some key parameters between the year of first intervention and the study period. Accordingly, frequency distribution, mean, minimum, and maximum values of some important variables were computed to compare the changes in relevant parameters over the five years.

Contribution of MFIs services to poverty alleviation is determined by institutional factors such as loan purposes, loan term, loan size, land size, intensity of off-farm economic activities, marketing services, etc. Variation in the contribution of MFIs services to incremental incomes of the target groups may be due to any or all of these factors, which also vary spatially and temporally. In order to analyze the influences of these factors and identify the relative importance of these variables, a binary model was used. Accordingly, a logit distribution model was defined following Liao (1994), Gujarati (1988) and Aldrich and Nelson (1984):

$$Pi = \frac{1}{(1+e^{-Zi})} = \frac{e^{Zi}}{(1+e^{Zi})} \quad (1)$$

Where P_i: is a probability that the income of ith farmer is improved.

e^{Zi}: stands for the irrational number *e* to the power of Zi

Z_i : is a function of N-explanatory variables which is also expressed as:

$$Z_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_n X_{ni} \quad (2)$$

Where X_1, X_2, …, X_n = Explanatory variables

βo - is the intercept

β_1, β_2, ---, β_n are the logit parameters (slopes) of the equation in the model.

The slopes tell how the Log-odds in favor of improved income changes as independent variables change. The unobservable stimulus index Z_i assumes any values and is actually a linear function of factors influencing improvement in income. The Z_i ranges form -∞ to +∞, P_i ranges between *0* and *1* and that P_i is non-linearly related to the explanatory variables. P_i is non-linear in X_j, and in the β's as well.

It can be shown that $\frac{P_i}{1-P_i}$ is simply the odds ratio in favor of improvement in income level. It is the ratio of the probability that the farmer would have increased income to the probability that he/she would not have improved income. Finally, taking the natural log of odds ratio can be written as:

$$Li = Ln(\frac{Pi}{1-Pi}) = Ln(e^{\beta_0 + \sum_{j=1}^{n} \beta_j X_{ji}}) = Zi = \beta_0 + \sum_{j=1}^{n} \beta j X_{ji} \quad (3)$$

Where L_i is log of the odds ratio in favor of increased income, which is not only linear in X_j, but also linear in the parameters. This model can be estimated using the iterative maximum likelihood estimation procedure.

5.2.1 Definition of Variables and Hypothesis

Dependent variable

The incremental income of the clientele of the company was defined as binary dependent variable, where a dichotomous variable takes *1* for those with increased income and *0* otherwise. The incremental income was defined taking two points in time, i.e. the survey year and the baseline year. The base year is the year in which the clientele joined the company, i.e. year 1996, whereas the survey year is the year of data collection, i.e. year 2002.

Explanatory variables

In this paper, the explanatory variables included in the econometric model could be categorized into socioeconomic and institutional factors, which are hypothesized to have influences on the household income of the clientele. Based on the review of literature and actual conditions of the study area, the following explanatory variables were expected to explain the probability of having increased income situation (Belay and Belay, 1998, Asfaw, et al., 1997; Zeller, et al., 2001).

1. Appropriateness of loan disbursement time (discrete variable). In the world of banking in general, and micro finance services in particular, loan by its nature is both time and purpose sensitive. The clientele of the company would be more benefited if loan processing is made in accordance with these conventional views. Therefore, appropriate loan disbursement schedule is expected to have direct influence on the financial performance of clientele. The variable is discrete assuming a value of *1* if the clientele indicates appropriateness of loan disbursement and *0* otherwise.

2. Appropriateness of loan term (discrete variable). Loan term is a schedule, which fixes duration of the loan and specific date of loan repayment, which is governed by the lending institution with agreement of the borrower. In most cases loan term is a function of loan size and loan purpose. Accordingly, the lending institution and the borrowers attempt to convince one another to set terms of the loan. Missing this concept will lead to setting repayment schedule for a given purpose quite before or after its maturity, which in turn leads to loan default. Therefore, appropriate loan terms can have positive effect on the success of loan purposes, improving the economic condition of the clienteles. In this paper, this variable is discrete assuming a value of *1* if the clientele indicates appropriate loan term and *0* otherwise.

3. Average loan size of the client (continuous variable). Loan size depends on the purpose of the loan. In the study area, where capital is scarce as compared to labour and land, larger loan size is needed to acquire productive factors of production and engage in micro-business activities. Hence, the magnitude of loan the clientele received over the last five years is expected to have direct relationship with the improvement in income of the household.

4. Acquiring required amount of the loan (discrete variable). In principle, borrowers are expected to propose loan size along with loan purpose(s). However, there are cases in which local community representatives or committees together with branch staff(s) determine the loan size, based on production capacity, repayment capacity, social characteristics, etc. of the borrower and his loan purpose(s). Failure to provide the required loan size is expected to have negative repercussion on the loan performance. It is, therefore, hypothesized that provision of the required loan size would have high probability of increasing the income of the clienteles. In this study, the variable assumed a value of *1* if the client received the amount he/she requested and *0* otherwise.

5. Utilization of the loan for the intended purpose (discrete variable). Upon loan processing, all clienteles specify their respective loan purpose(s), for which they use the loan, and they are not allowed to divert the loan to other purposes. But some times, clienteles are found to divert the loan to other purpose(s), may be due to incompatibility of loan size, unexpected circumstances, social problems, etc. This will have an impact on the loan performance. Basically, in addition to their indigenous knowledge, the clienteles are given training on all aspects of micro finance services, feasible loan purposes(s), utilization of the loan, etc. before loan processing by the company. Therefore, utilization of the loan received, for the intended purpose(s) has direct relationship with the improvement in income level. The variable assumes a value of *1* if the loan is used for the intended purpose and *0* otherwise.

6. Shortage of draught animals (discrete variable). Draught animals are one of the components of capital as a factor of production. The availability of this capital enhances the income generating capacity of farmers through increased crop production as well as oxen rental incomes. If the loan disbursed is used for productive purposes, availability of draught power would complement the loan to increase productivity. That means, despite loan acquisition, shortage of draught animals has negative effect on income generating capacity of the farmers. The shortage can be traced from the baseline information of households since the resources at hand are assumed to be available to complement the credit received to

generate income. In the econometric model, the oxen variable assumed a value of *1* if the client had problem of draught oxen at the beginning of the loan period and *0* otherwise.

7. Extension service (discrete variable). Extension services provide technical skill to enable improved crop and livestock management and increase productivity. Coexistence of extension services along with micro finance services has direct influence on the improvement of income of the target groups. The variable is assigned a value of *1* if the client gets extension service and *0* otherwise.

8. Off-farm income (continuous variable). Off-farm activities are economic activities other than agricultural production. These include petty trade, handicrafts and other activities, directly reflecting the small-scale enterprises shown in Figure 1. These economic activities create employment opportunities by absorbing the disguised employment in rural areas through enhancement of diversification of economic activities and reduction of risks. Therefore, engagement in off-farm economic activities is expected to have a direct relationship with improved income of the clienteles.

9. Distance to market center (continuous variable). Access to market is crucial for business undertaking. This has critical importance for loan performance. Usually markets are situated at towns, even though there are small markets at village level. Farmers residing closer to markets have more access to information about the lending institutions and requirements for acquiring loan and business information, as compared to those away from the towns. On the other hand, experiences show that those residing near or in towns divert loan from the intended purposes or consume the loan they have received. Moreover, mostly, farmers residing away from market centers /towns are believed to be more genuine and less extravagant. Therefore, the nature of relationship between distance to market and loan performance could depend on the prevailing situation.

10. Family size (continuous variable). Income from agricultural production is a function of labour. Family size, adjusted for dependency, is supposed to have direct relationship with the level of income. Children of less than 14 years and elders of more than 60 years were considered as dependent and do not as such contribute to income generation. Besides family size, gender differential is important in microfinance analysis. Unfortunately, the female households coverage of the microfinance services at the survey period was so limited to consider gender difference in the model.

11. Land holding (continuous variable). Land is also one of the major factors of production. Crop production is entirely dependent on land. Land is also crucial input for mixed farming through supply of grazing land, forages, and other feeds. Therefore, land holdings and improvement in income level are expected to have direct relationship.

5.2.2 Sensitivity Analysis

Significant explanatory variables discussed above would influence the change in income level. But the extent of the influence would not be the same for all the significant variables. The relative effect of a given quantitative explanatory variable on the changes in income level is measured by examining the elasticities, defined as the percentage change in probabilities that would result from a percentage change in the value of these variables. To calculate the elasticity, one needs to select a variable of interest, compute the associated P_i for 'Typical Clientele'. Then vary the X_j of interest by some small amount and re-compute the P_i, then measure the rate of change as $\partial P_i/\partial X_j$. Where ∂X_j and ∂P_i stand for percentage changes in the continuous explanatory variable (X_j) and in the associated probability (P_i), respectively: when dX_j is very small, this rate of change is simply the derivative of Pi with respect to X_j and is expressed as follows (Aldrich and Nelson, 1984; Maddala, 1992):

$$\frac{dP_i}{dX_j} = \frac{e^{zi}}{(1+e^{zi})^2}\hat{\beta}_j \qquad (4)$$

$$= P_i(1-P_i)\hat{\beta}_j \qquad (5)$$

The impact of each significant qualitative explanatory variable on the probability of improvement in income is calculated by keeping the continuous variables at their mean values and the dummy variables at their most frequent values (*0* or *1*).

6. Results and Discussions

6.1 Socioeconomic Changes between Baseline and Survey Years

Descriptive statistics of some key indicators, which might be influenced by improvement in income due to micro-finance service, was analyzed. Apparently MFIs improve household income that can be used to stimulate savings and investment in livestock and oxen holdings, housing, and renting land resources. More savings imply the capacity of the farmer to avail more inputs, which enable him/her to produce more and generate more income. As discussed earlier, oxen provide draught power for cultivation and increased oxen holding contributes to improved wealth and household income.

Better housing condition results in healthy and productive life. Land rented-in contributes to incremental income due to its complementary use with other yield increasing inputs which would not have been used when land is scarce.

In addition to the above quantitative variables that measure impacts of micro finance services on the 'beneficiaries', there might also be other qualitative variables, such as children schooling, nutrition, clothing, etc. Employment generation and human capital formation can also be indicators of impacts of micro-finance services.

Assessment of the impacts of micro-finance services were made by asking the clienteles their perceptions of the impacts on variables listed in Table 1. The results indicate that living condition of 86% of the sample clienteles improved while that of 14% showed no improvement of which 3% of the clienteles had no changes in their living condition and that of 11% deteriorated. Disaggregated analysis shows that the impact of the micro-finance service is highly associated with income generation (70%), asset creation (65%), improved nutrition for the family members (63%) and increased livestock holding (57%) (Table 1).

Table 1: Proportions of Clienteles with Improved Living Conditions

Indicator	Clienteles with Improved Conditions (%)
Children schooling	55.81
Better clothing	13.97
Improved nutrition	62.78
Improved housing condition	22.10
Increased livestock number	57.00
Increased asset	65.11
Improved income level	70.00

Source: Own Computation

In this paper, annual income of the clientele was considered as the most appropriate variable for the assessment of the influence of the micro-finance services. Hence, the improvement in income level was used to categorize the clientele in to those with

improved income and those without improvement (Vasthoff, 1968; Tesfaye, 2001). Household incomes during the base year and survey year were compared. Those with increased household income were defined as *"Improved"* while those with no improvement, i.e. same level of income or worsened income level, were defined as *"Not Improved".*

Table 2 compares the mean level of the continuous economic variables of the clienteles with improved conditions and clienteles the economic conditions of whom were not improved. The comparisons were made at the base year and the survey year, i.e. five years after the commencement of the loan scheme. The economic improvement between the two reference years was statistically significant at 1% level. Income from agricultural production and off-farm income and the asset accumulation were significantly higher after the commencement of the micro-finance services. The difference between the clienteles with "Improved" and "Not Improved" groups in terms of the economic variables listed in Table 2 was insignificant at the initial stage and became significant after the loan scheme was commenced. The factors underlining these differences are further analyzed under section 6.3.

Table 2: Mean Comparison of Some Economic Variables during the Base and Survey Years

	Base year			Survey year			Total		
	Improved	*Not Improved*	*t-values*	*Improved*	*Not Improved*	*t-values*	*Base year*	*Survey year*	*t-values*
Agricultural income (Birr)	1800	2119	-1.091	4270	2191	6.714***	1895	3647	-8.916***
Off-farm income (Birr)	114	42	1.656	728	299	2.850***	92	597	5.481***
Oxen owned	2.01	1.89	0.834	2.63	2.33	1.639	1.97	2.51	5.103***
al livestock holding (TLU)	6.48	5.74	1.003	8.38	6.29	2.348**	6.26	7.75	4.285***

* Significant at 10% level, **Significant at 5% level, ***Significant at 1% level.

6.2 Results of Multicollinearity Test

Existence of income differentials among the clienteles calls for identification of factors responsible for the variation in the household's incremental income. Accordingly, econometric analysis of factors affecting the probability of income improvement was made. Before estimating the model, it was necessary to check for the functional relationships between the explanatory variables. If multicollinearity is less than perfect, the regression coefficients, although determinate, possess large standard errors (in relation to the coefficients themselves), which means that the coefficients cannot be estimated with great precision or accuracy (Gujarati, 1995). In this paper, existence of serious multicollinearity was tested using Variance Inflation Factor (VIF) for continuous explanatory variables and contingency coefficient for discrete explanatory variables. Table 3 and 4 display the VIF and the contingency coefficients respectively.

Table 3: Tests for Existence of Multicollinearity among Continuous Variables

The Continuous Variables	Collinearity Statistics		
	Tolerance	VIF	R_i^2
Average loan size (Birr)	0.912	1.096	0.088
Total family size of the household (No.)	0.929	1.077	0.071
Total land holding (ha)	0.948	1.055	0.052
Distance to market (Kms)	0.872	1.147	0128
›ff-farm income during the base year (Birr)	0.976	1.024	0.023

Source: Own computation

R_i^2 is the coefficient of multiple determinations when the variable X_j is regressed on the other explanatory variables. A rise in the value of R_j that is an increase in the degree of multicollinearity, does indeed lead to an increase in the variances and the standard errors of the OLS estimators. The R_i^2 and the value of VIF are directly related while the value of VIF is inversely related to tolerance level. A VIF value greater than 10 is used as a signal for the strong multicollinearity between the two considered continuous variables (Gujarati, 1995). The result of the test, therefore, indicates lack of serious multicollinearity problem among the continuous variables.

The values of contingency coefficient, which basically range between 0 and 1 are significantly small (Table 4). Low value of contingency coefficient indicates absence of serious multicollinearity problem between the considered discrete variables.

Table 4: Tests for Existence of Multicollinearity among Discrete Variables

	Loan disbursement time	Loan term	Problem of draught power	Extension service	Loan requested	Utilization of loan
Loan disbursement time	1.000					
Loan term	0.220	1.000				
Problem of draught power	0.1361	0.088	1.000			
Extension service	0.007	0.050	0.066	1.000		
Amount of loan requested	0.054	0.059	0.567	0.105	1.000	
Utilization of loan	0.238	0.247	0.043	0.120	0.059	1.000

Source: Own computation

6.3 Econometric Results

Using the explanatory variables defined above, a logit model was estimated using Maximum Likelihood Estimation procedure, of the SPSS computer software. Equation (3) was used to estimate the logit model. Table 5 shows the parameter estimates and statistical significance of the coefficients.

The econometric result shows that the probability of improved income level due to micro-finance intervention is positive and significant. The model predicts 78% of the cases correctly, which is considered as statistically significant. Among the microfinance service variables, appropriateness of time of loan disbursement, utilization of loan for the intended purposes, and loan size affected the probability of incremental income positively and significantly.

Moreover, the availability of land needed for crop production and distances to market center have positive influences on the probability of increased income, which implies positive loan performance in terms of impacting on the well being of the clienteles. These factors are essential for utilization of credit both for production and business undertaking since they serve as complementary factors.

Table 5: Maximum Likelihood Estimates of Logit Function

Variables	Coefficients	Odds ratio	Wald statistics	Sig. level
	2.553	12.85	3.778	0.052*
Appropriateness of loan time	0.902	2.465	1.846	0.174
Appropriateness of loan term	0.004	1.004	5.051	0.025**
Average loan size	-0.466	0.627	0.603	0.437
Shortage of draught power, base year	0.064	1.067	0.013	0.911
Extension service	0.001	1.001	0.926	0.336
Off-farm income	0.279	1.321	0.736	0.391
Provision of loan demanded	0.116	1.123	2.721	0.099*
Distance to market	0.024	1.025	0.036	0.849
Family size	0.638	1.893	5.373	0.020**
Land holding	2.979	19.661	7.906	0.005***
Utilization of loan	-11.174	0	11.767	0.001
Constant				

-2 Log likelihood Ratio = 91.026
Likelihood Ratio Index (McFadden R^2) = 0.7450
Chi-square (χ^2) = 31.147
Correctly predicted (Count R^2) = 78.00%
*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

6.4 Marginal Effect Analysis / Sensitivity Analysis

As discussed above, the improvement in income of the sample clienteles was attributed to different factors, the statistically significant ones being loan disbursement time, loan size, loan utilization for the intended purposes, proximity to markets and land availability. The contributions or relevance of these significant factors may not be equally important. Ranking of these variables in terms of their relative importance requires defining a 'typical clientele' in terms of the most frequent values of the explanatory variables, discrete variables and mean values of the continuous variables, included in the model (Gujarati,1995), .

After estimating the parameters β_i in Equation (3) and identifying significant variables, it is possible to know the effect of change in any of the significant explanatory variables on the probabilities of observations belonging to either of the two groups i.e. those with improved income and those without. The marginal contributions of the variables for the logit model are given by Equation (5). The relative importance of quantitative variables can be measured by examining elasticity of the variables that would result from a change in the value of the variables. Thus, elasticities were computed for a typical farmer using the significant quantitative explanatory variables.

Then by taking the mean values of continuous variables, and the most frequent values of discrete variables, values of Z_i and P_i, from equation 1, would be 3.893 and 0.98 respectively. Then the elasticities of P_i with respect to x_{ij} (Equation 5) can easily be computed to determine the relative importance of these variables.

For instance, if the average land holding of the farmers increased by 10%, which is equal to 0.268 ha, the probability of income improvement for a "typical clientele" will be about 0.32%. With a further 20% increase in land holding, which is equal to 0.536 ha, the probability of income improvement for a "typical clientele" will be about 0.58%. The procedure holds true for other significant continuous variables in the model. Therefore, a "typical clientele" of the MFI services would have higher probability of increased income provided that these explanatory variables are set in appropriate combinations. Table 6 summarizes changes in probability levels of the significant continuous variables, with their mean values increased by 10%.

Table 6: Relative Importance of Continuous Significant Variables

Variables	P_{i1}	P_{i2}	ΔP_i (%)	Relative Importance
Average loan size	0.980	0.9883	0.85	1st
Land holding	0.980	0.9831	0.32	2nd
Distance to markets	0.980	0.9826	0.27	3rd

Source: Own computation

In assessing the relative importance of proper utilization of the loan as per the agreement made between the two parties, we use the "with" and "without" approach. Considering the existence of all variables in the model, dummy variables will be given the most frequent value of a discrete variable i.e. 1, and the continuous significant variables will assume their mean values. Accordingly, the value of *Zi* will be 3.893 and that of P_i is 0.980. The importance of loan utilization for the intended purpose would be observed by assigning a 0 value for this variable while keeping other

variables constant. The result shows that at a 0 value of loan utilization, the new P_i will be 0.714 where Zi equals 0.914.

A considerable change in probability of improved income is observed due to change in the variable from 0 to 1. Changing the loan utilization variable from 1 to 0 would reduce the probability from 98 % to 71%. This shows that the relative importance of this variable is considerably high. Similarly, it would be possible to identify the relative importance of the remaining significant discrete variables. Table 7 summarizes changes in probability levels of the significant discrete variables using the "with" and "without" approach.

Table 7: Relative Importance of Discrete Significant Variables

Variables	P_{i1}	P_{i2}	ΔP_i (%)	Relative Importance
Utilization of the loan	0.980	0.7138	27.16	1st
Appropriateness of loan disbursement time	0.980	0.7925	19.13	2nd

Source: Own computation

7. Conclusions and Policy Implications

The study confirms the relevance of micro-finance service to improve the economic conditions of the poor by enabling access to rural finance. Among the 100 sample clients of the OCSSCO, Kuyu branch, 86 perceives improvement in their socioeconomic conditions during the five-year client-ship with the MFI. Actual comparison of income during the survey year with the baseline data indicates that improved income level is visible for 70% of the cases. The impact of the micro-finance service is highly observed in terms of increased asset creation, improved nutrition for the family members and household income.

Comparative analysis of the economic variables shows that the income from agriculture and off-farm activities increased over the loan period indicating the opportunities created to increase agricultural productivity and income diversification. The econometrics results indicate that the probability of improved income was affected by the appropriateness of loan disbursement time, loan size, utilization of loan for the intended purposes, proximity to markets and land availability. The policy implications of the results could be the following:

1. Due to seasonality of agricultural production, for which timely procurement of inputs and crop management are crucial, timely provision of rural credit is of paramount importance. Moreover, financial resources needed for small scale enterprises, particularly if needed for purchases of agricultural goods for trading would be affected by time of loan disbursement.
2. Level of capital used determines the economic scale of business transactions. Micro-finance institutions, however, provide small loan size. The econometric result revealed the importance of loan size on economic performance of the clienteles. Hence, considering the nature of the loan and other parameters, it would be of paramount importance to increase loan size and work out business plan.
3. The fact that utilization of loan for intended purposes implies improving business skill and innovativeness of the clienteles, identifying feasible income generation activities and proper business plan for clients would be essential.
4. Land availability is also one factor that contributed to increased income of the households. In case of use of improved agricultural technologies such as crop farming and dairy production, land plays complementary role to the loan disbursed. Assessment of such alternative complementary factors of production would encourage the farmers to seek credit and improve their socio-economic conditions. Provision of loan for agricultural production to farmers facing land shortage should consider possibilities of land transaction.

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Intensification and Crop Commercialization in Northeastern Ethiopia[1]

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Abstract

Due to low farm production and productivity the majority of subsistence farmers in Ethiopia are not self-sufficient in food, and deliver meager amounts of farm output to consumers and agro-processing industries. Agricultural growth, an important pathway to food security, is realized through increases in per capita farm endowments (physical and financial assets and resources) and adoption of appropriate and proven technology and requires a transformation out of the semi-subsistence, low-input and low-productivity agriculture into a high productivity commercial agriculture.

This article investigates farm commercialization from two perspectives - output-oriented and input-oriented farm commercialization. Logistic model was applied to examine factors of commercial participation and use of chemical fertilizer, while Cob Douglass production function was employed for the analysis of production determinants. The data used for the analysis was collected from farm households sampled from communities in Northeastern Ethiopia.

The regression analysis of commercialization asserts that lack of market access (measured by distance) and engagement in livestock and off-farm employment significantly and negatively impact food crop commercialization. Total food crop production has been found to impress a strong and significant effect on commercialization. The production analysis indicated that farm size operated and technology (chemical fertilizer) are the most important production factors under the context of the study areas. Results of estimation of fertilizer use show the important and positive role of access to oxen and credit, and size of operated farm.

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The findings of the study generally imply the need for rationalization of policies and institutions in order to create incentives and rules that promote land transaction and markets for credit, product and input.

1. Introduction

Ethiopia's economy is primarily based on agriculture, accounting for 50 % of GDP employing 85 % of its labour and 90 % of total foreign exchange earnings. According to CSA (2002) 10,738,000 small farm households cultivated 9,133,510 ha. in 1999/2000 comprised of 93 % annuals, the rest permanent crops, at average area of 0.79 ha./household. About 95 % of cultivated land is under smallholder agriculture, the rest under state and commercial farms. Ethiopia's food security and agricultural development are thus highly dependent on the performance and development of smallholder farming systems. Cereals occupy more than 70 % of cultivated land and are the main staple foods in Ethiopia.

At the level of developing countries, about 440 million farmers still practice mainly subsistence agriculture, and subsistence crops cover more than 50 percent of cultivated land in the majority of low-income countries (von Braun and Kennedy, 1994). Ethiopian small farm holders who produce more than 90 % of agricultural production of the country are by and large subsistence producers. It is estimated that only 20 % of smallholder production goes to markets, mostly by a small percentage of farmers with access and means. Smallholders in the highlands of central and northern Ethiopia in particular produce mainly food crops, and for the most part are not involved in conventional cash crops (coffee, cotton, sugar cane, groundnuts, and vegetables)[4].

Due to low farm production and productivity, majority of subsistence farmers are not even self-sufficient in food, and deliver meager amounts of farm output to consumers and agro-processing industries (markets).

Intensification, an important mechanism for transforming subsistence smallholder farms into economically viable and commercially oriented farming units (Hinderink and Sterkenburg, 1987; von Braun and Kennedy, 1994; Pender, Place and Ehui, 1999), is at low level in Ethiopia. For example, on average, cereals yield 12 qt[5]. per hectare and pulses about 9 qt per hectare, both very low by world standards[6].

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[4] Farmers in southern, western and eastern low lands and mid-altitudes of the country are engaged considerably in the production of cash crops, particularly coffee, and in livestock and livestock products.

[5] 10 qt. = one metric ton

[6] For instance, the 2000 average per hectare yields of teff (*Teff eragrostis*), sorghum, maize, wheat and barley, the five major crops in the country in terms of area allocated to their production, are 7.96 qt, 11.54 qt., 18.25 qt., 13.79 qt. and 10.82 qt., respectively (CSA, 2002). The world average per hectare yields of

The basic research question of this paper are thus what constrains small farm households from pursuing an outward-looking market orientation, producing surplus over and above their consumption requirements, or from devoting land and labor to cash crop cultivation.

This paper attempts to show: (i) determinants of food crop commercialization, and (ii) farm input intensification; and (iii) combined with the former, the contribution of resource access and technology to agricultural output, hence marketed surplus.

2. Farm Commercialization Perspectives

Food security is a key policy objective in Ethiopia's social and economic development strategy (FDRE, 2001). Agricultural growth, an important pathway to food security[7], is realized through increases in per capita farm endowments (physical and financial assets and resources) and adoption of appropriate and proven technology (Hayami, 2001) and requires a transformation out of the semi-subsistence, low-input and low-productivity agriculture into a high productivity commercial agriculture. Given population growth and limits of area expansion, yield growth and market oriented patterns of crop production (commercialization) are prerequisites to agricultural economic growth (Strasberg et. al.1999). Commercialization, along with specialization, intensification and development of markets and trade, are fundamental building blocks for achieving economic growth. (von Braun and Kennedy, 1994).

However, the sale of incidental surpluses does not transform farming units automatically into commercial farms (Hinderink and Sterkenburg, 1987). Commercial farming involves also profit and loss accounting in financial terms, and a wage earning labor system (Carpenter 1971 as cited in Hinderink and Sterkenburg, 1987). Practical achievement of marketed surplus and commercialization thus include indicators of effective market participation: gross value of sales; importance of purchased inputs; share of hired labor as a percentage of total labor; time spent on growing cash crops versus crops for self consumption; and, acreage planted with

wheat, maize, barley and sorghum in 2000 are 27.189qt, 42.880 qt., 24.419qt and 13.679qt.respectively, while the average yields of the same crops for Africa are 17.805 qt, 17.246qt., 5.096qt and 8.791qt. in that order (http://faostat.fao.org).

[7] Food importation at the national level through expanded growth in international trade, or food purchase at the household level through expanded income, are other important pathways.

crops for sale as a percentage of total cultivated area (Hinderink and Sterkenburg, 1987).

Hinderink and Sterkenburg (1987) distinguished between three perspectives of farm commercialization:

(i) Economic-technocratic perspective: emphasizes economic and technical measures of increasing productivity and production for the market, where commercialization is tightly associated with modernization, and technology and market development are key determinants of agricultural transformation. Development is seen as a uni-linear process in which agricultural development in developing countries must follow the path of developed economies. The role of green revolution technologies is emphasized and combined with integrated rural development to remove institutional and infrastructural bottlenecks for market penetration.

(ii) Psychological-cultural perspective: attitudes, motivation and other farmer behavior are emphasized. According to Rogers (1970, cited in Hinderink and Sterkenburg, 1987), subsistence farmers: are inclined toward mistrust which negatively affects cooperation and organization beyond the family circle; lack interest in innovations; are fatalistic, village centered, and not very individualistic; have low level of aspiration; limited attention for the future; and have little inclination to save and invest. Less commercialized communities are isolated vis a vis the outside world which negatively affects specialization of production, trade, technological innovation and social change. The hierarchical authority structure and the subordination of individuals to community interests prevail over personal contractual relationships and economic decisions. Social controls limit the already limited choice of subsistence farmers in land use, cropping patterns and production technology (Abercrombie 1961 cited in Hinderink and Sterkenburg, 1987).

(iii) *Political-economic perspective*: political context and the nature of power relations at various geographical scales motivates the choice of economic system and the degree of integration into the global economic system. Agricultural commercialization contributes to development, but only when accompanied or preceded by structural change at various geographical scales. The political-economic and institutional context is proposed as a major sphere explaining longitudinal and spatial differences in socioeconomic development. Spatial differentiation is related to the intensity of market integration, interpreted as a process of structural change from subsistence to market economy. Four aspects of market integration are identified: increasing importance of wage labor, growing crops for sale, markets developed for consumer

goods and production inputs, and purchase of consumer goods and services (Dietz and Van Haastrecht, 1982 in Hinderink and Sterkenburg, 1987)

Each perspective plays a partial role in explaining agricultural commercialization in Ethiopia. Agricultural commercialization cannot be understood without taking into account the socio-cultural, political-institutional and economic-technical contexts that condition the nature of capital formation, the organization of production, technological changes and crops grown. For purposes of this study, the definition of Hinderink and Sterkenburg (1987:19) is used: agricultural commercialization involves "deliberate action on the part of agricultural producers - of their own free will or by means of coercion - to use the land, labor, implements and annual inputs (owned, purchased, hired, borrowed, obtained on credit or through customary arrangements - reciprocal or not) in such a way that a greater or smaller part of crops produced and /or animals raised is for exchange or sale".

Von Braun and Kennedy (1994) argue that one of the main reasons for the choice of subsistence production over commercial production in Sub-Saharan Africa is that own-production of food is a response to high transaction costs and risks related to production, markets, and employment. Subsistence production can largely be viewed as an insurance policy of farm households in response to risky income and market environment. Because subsistence farmers devote their time and land resources largely to own farm production, mechanisms that increase farm output impact food security in two ways: (i) directly increasing food availability and (ii) promoting production for market that increases cash income to enable food purchase. This second path is made possible by enhancing cash crop production and marketable food crops and livestock products. In addition, off-farm income, if accessible, augments household income and purchasing power. The commercialization pathway is dependent off course on local comparative advantages in agricultural potential, population density (demand) and market access (Pender et al., 1999).

However poor, risk-averse farmers with little land and resources are usually reluctant to gamble on new and highly risky crops, regardless of their potential profitability, unless their food security is first assured (von Braun et. al., 1991). Holden and Hailu (2002) in their empirical study in southern Ethiopia conclude that poverty and subsistence constraints undermine the ability to intensify production through the purchase of farm inputs or the planting of perennial cash trees. Adewumi and Omereshi (2002), based on their study of 291 sample farm households in Kwara state of Nigeria, conclude that meeting food requirement is the primary objective of farming households even prior to maximizing gross margin. Farming households

there view agricultural activities as a personal non-monetary need first and an income need only second (ibid). Notwithstanding the importance of self-sufficiency in the psychic of poor farmers, Dembele et al (2003) in assessing the commercialization of cereals in Mali after the 1980 market reform observed that cereal commercialization was enhanced by use of productivity increasing inputs and technologies, and that commercialization varied by farm size, crop type and type of farming.

Recent studies (Von Braun and Kennedy, 1994; Strasberg et. al., 1999) show that the conclusion sometimes made in the literature that commercialization has a negative effect on food crop production and nutrition is flawed. Von Braun and Kennedy (1994) observe that improved technology helps subsistence farmers to commercialize in low-risk ways; commercialization of agriculture entails a substantial expansion of demand for hired labor; and, commercialization contributes to food security via increased income and food availability. Although commercialization of agriculture is generally a matter of stimulated private-sector activity, they also argue that public action in Sub-Saharan Africa is crucial to facilitate the power of its driving forces - macro economic and trade policy, market reform, rural infrastructure improvement, and the development of legal and contractual rules under which farmers, traders and processors operate.

3. Data and Empirical Model

Data for this study were collected from 420 randomly selected farm households in Bati, Jamma, Dessie-Zuria, and Legambo woredas (districts) in Ethiopia by BASIS-CRSP project in 2000 and 2001.

Regarding the analytical models, let production (Y) be determined by the relation Y = f{A, L, K, T} where A is land, L is labor, K is capital, and T is technology. Consumption (C) is determined by household size in adult-equivalent consuming units (CU) and investment (I) made on non-consumption expenditures, i.e. C= f (CU, I). Fertilizer and improved seeds, depicted by technology, T, represent an input-oriented measure of farm commercialization. Marketed surplus (MS), defined as MS = Y-C, is an output-oriented measure of farm commercialization measured in this study via two constructs: percentage of farm households who participate in food crop marketing (Commercialization Participation, CP), and the ratio of total quantity of food (cereals, pulses and oil seeds crops) sold relative to total output produced (Commercialization index, CI).

As indicated in Table 1, except for Jamma farmers whose participation in marketing declined, the participation of farmers (CP) in other *woredas* increased in 2001/02 compared to 2000/01 (36.2 % to 51.1 %), due to better rainfall distribution. The commercialization index (CI), however, remained relatively static, and is generally low for all woredas. Jamma farmers who sold the highest proportion (CI-0.13) of food produced in 2000/01 sold a lower proportion (CI=0.07) in 2001/02 due to frost in the area, while CI in Dessie-Zuria and Legambo showed a slight increase. CP however showed considerable variability across woredas, hence was chosen as the output-oriented indicator of commercialization in the multivariate analysis that follows.

Table 1: Farmer Participation in Food Grain Marketing and Commercialization Index

Year	Item	Bati	Jamma	Dessie-zuria	Legambo	All *woredas*
2000/01	Commercial Participation (CP), %	34.9	60.4	24.7	20.5	36.2
	Commercialization Index (CI)	0.06 (0.14)	0.13 (0.16)	0.07 (0.17)	0.07 (0.17)	0.08 (0.16)
	N	106	106	97	83	392
20001/02	Commercial Participation (CP), %	35.8	48.5	58.8	62.1	51.1
	Commercialization index (CI)	0.05 (0.10)	0.05 (0.10)	0.10 (0.13)	0.10 (0.13)	0.08 (0.11)
	N	106	103	97	103	409

Source: BASIS-Ethiopia survey data. N= Number of respondents. Figures in parentheses are standard deviations.

Agricultural technology (T) - chemical fertilizer and improved seeds - plays an important role in commercialization, via their purchase from markets or government sales depots. Their adoption is generally influenced by size of farm holding, credit access, educational level of household members and agro-ecology. For the multivariate analysis of participation in input-oriented commercialization and adoption of agricultural technology, a logit model was employed based on the functional form in equation (1) (Maddala, 1992):

$$\log [p_{i} / (1-p)] \approx \beta_{o} + \sum_{j=1}^{k} \beta_{j} x_{ij} \quad (1)$$

Where, log $[p_{i/(1-P)}]$ is log of odds ratio, β_o is constant term, β_j are coefficients, and x is independent variables. The dependent variable (log-odd ratio) is the natural logarithm of the ratio of the probability that the i-th farmer participates in food crop commercialization (or adopts technology) to the probability that the i-th farmer does not (1-p).

Neo-classic economic theory informs us that land, labor and capital are the basic factors of production. Recent theory (Ray, 1998) explains that in addition to these conventional factors, technology and human capital play crucial roles in transforming agricultural production by helping to accelerate partial and total factor productivity. The relationship of these factors to determination of agricultural output in the Ethiopian highlands is examined in this analysis by employing the Cobb-Douglas function in equation (2):

$$Q = aX_1^b X_2^c X_3^d --- X_n^m \quad (2)$$

where, Q is food production, X_n refers to n-th factor of production, and b, c, d …… m are factor elasticities associated with the possible influencing variables. See Table 2 for variable names and definitions, and Appendix 1 for descriptive statistics. A priori expectation of the influence of explanatory variables on farm output follows.

*Market distance i*s used as a proxy for market access, as remote villages are exposed to poor road and telecommunication infrastructure and high transportation costs. Farmers nearer to market towns are expected to have higher participation in food crop marketing and technology adoption because transport and information costs increase with distance.

Agro-ecology affects commercialization of food crops and input procurements through locational factors, but also indirectly affects technology choice and application (chemical fertilizer and improved seeds) through biophysical interactions. Jamma woreda is agro-ecologically suited for crop farming because it is endowed with relatively better rainfall, soil, temperature, and topography (flat) that enable superior yield responsiveness of modern inputs compared with other study sites.

Food crop production, the total production of cereals, pulses and oilseeds, is taken as a measure of aggregate food output (Q). All else constant, an increase in food crop

production either decreases the food gap between own-production and consumption within the household, or increases food grain surplus for sale to outside markets.

Table 2: Names, Definitions and Measures of Explanatory Variables

Variable name	Definition	Measure
Head's gender [SEX3]	Gender of household head	1=male, 0= female
Consuming units [AE_CU_4]	Household size in adult-equivalent consuming units	Number of consuming units
Labor units [AE_LU_4]	Household labor in adult-equivalent labor units	Number of labor units
Agro-ecology [jamadumy]	Agro-ecological zone of the village in which the household resides and farms	1=Jamma woreda, 0= other woredas
Livestock-TLU [LIV_TLU4]	Livestock size (excluding oxen)	Tropical livestock units (TLU)
Land operated [LA_OP45]	Total farm size operated during 2001/02 cropping year (*belg+meher* seasons)	Hectares
Oxen [OXENOWE3]	Number of oxen owned	Count
Head's education [EDULEVE2]	Educational status of household head	0=non-literate, 1=read and write, 2= primary school, 3=post-secondary school
Head's literacy [LITRAT2]	Literacy status of household head	1=literate 0=non-literate
Market distance [DISMARK]	Distance to main market place	Minutes to walk
Credit [CREDIT_2]	Value of credit received	Birr
Food crop output [C_OUTPU2]	Total food crop output	Kg.
Non-farm income [NFI_YR2A]	Non-farm income (business and wage employment income)	Birr
Head's age [AGE_RND3]	Age of household head	Years

Note: Numbers in variable names indicate year or survey round.

Oxen: as the major source of traction power and an important capital asset, is expected to influence farm production positively by enabling farmers to accomplish seedbed preparation and seed covering on time and thoroughly, thus facilitating the

use of other complementary technological inputs such as fertilizer and improved seeds.

Non-oxen livestock holding, measured in Tropical Livestock Units (TLU)[8] is taken to measures livestock wealth, the principal asset in the Ethiopia's highlands. Livestock activities compete with crop production for labor and other resources in ways that negatively affect food crop commercialization. Animal manure is also a substitute for fertilizer if widely and substantially applied on farmers' fields. But, income generated by livestock activities could also be used for the purchase of inputs that benefit crop-oriented and input-oriented commercialization positively.

Operated farm size[9]*:* is hypothesized to affect food production and technology adoption positively. As landholding size in the Ethiopian smallholder sector is very small, even a slight increase in farm size operated can be expected to substantially increase household food production and hence marketed surplus.

Household consumption, approximated by household family size in terms of standard adult-equivalent consuming units[10], is expected to negatively affect crop commercialization through three mechanisms: a) household labor time for crop production is decreased because of demands for household maintenance and reproduction; b) increased food demand derived from more mouths to feed; and c) decreased labor productivity in the event that low consumption for poor households erodes human nutrition.

Household labor refers to the number of adult-equivalent labor units[11] within the household. For a high land*/*labor ratio, a positive effect on total food production would be expected, but the effect would tend to converge toward a small, minimum

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[8] Tropical livestock unit is calculated as 1.00 for a cow, 0.60 for heifer or young bull, 0.10 for calf, 1.43 for a camel, 0.80 for a horse, 0.70 for a mule, 0.50 for a donkey, 0.10 for a goat or sheep, and 0.01 for a chicken.

[9] Operated farm is land cultivated that includes own farmland held and land obtained in cash renting (rented-in) or in share cropping (shared-in) from other farm landholders. Leased-out farmland includes farm parcels rented-out on cash or shared-out in sharecropping arrangement to other farmers.

[10] Male (female) less than 1 year of age are assigned a weight of 0.3 (0.3), ages 1-6 a weight of 0.5 (0.5), ages 7-13 a weight of 0.7 (0.7), ages 14-19 a weight of 0.9 (0.9), ages 20—59 a weight of 1 (0.9), and ages greater than 59 a weight of 0.9 (0.7), respectively (source?)

[11] Coefficient for converting household labor into adult-equivalent standard labor units were as follows: for a male (female) less than 8 years of age 0.00 (0.00), 0.50 (0.50) for ages 8-14, 1.00 (0.70) for ages 15-65, 0.50 (0.35) for ages 66-75), and 0.00 (0.00) for ages above 75.

subsistence wage (reflecting a flattening of marginal labor productivity) as the land/labor ratio grows tight under conditions of high land use pressure.

Age of household head is used as proxy for management experience. It is expected to influence production and technology adoption positively during the most productive working years, then decline as labor productivity falls toward retirement.

Literacy of household head measured by educational level is assumed to positively influence commercialization as literate or educated farmers tend to have better access to extension service and advice of local development agents, and make better use of internalizing that information.

Chemical fertilizer, the amount of chemical fertilizer (Di-Ammonium Phosphate (DAP) plus Urea) applied by a farm household for food crops is expected to increase food production, given certain preconditions (timely application, sufficient soil moisture, favorable climate).

Off-farm income, including business and wage employment, theoretically could affect commercialization and adoption of technology either positively by easing cash liquidity constraints that impede the purchase of modern inputs, or negatively by competing with crop production for a limited supply of labor within the household.[12]

Credit. Cash credit augments the household budget constraint enabling farmers to purchase (or expand their purchase of) farm inputs, in particular fertilizer and seeds that would enhance farm productivity.

4. Regression Results

4.1 Food Crop Commercialization

The regression results in Table 3 seek to identify the main determinants of food crop-oriented commercialization. Results show that distance to main market is negatively and significantly related with participation in food crop commercialization as expected. An increase in market distance by 1 minute is predicted to decrease market participation by about 0.06 % (1- 0.994). Non-farm income is also negatively

[12] The robustness of labor rental markets in rural areas is a critical conditioning factor, as hired labor if available could help augment a binding household labor constraint.

related to food crop commercialization. As non-farm income increases by 1 Birr, odds of market participation decline by 0.001 %, as non-farm income activities compete with crop farming for labor and other resources. It is also common observation that farmers who are not well endowed with farm resources and production capacity, resort to low-paying non-farm activities, in particular petty trading and selling of firewood.

Table 3: Logit Regression Estimates for Farmers' Participation in Food Crop Marketing in South Wollo, Ethiopia, 2001/02 Cropping Year

Variable	B	S.E.	Wald	Exp(B)
Market distance	-0.006	0.002	7.966***	.994
Head's gender	0.254	0.268	0.895	1.289
Head's age	0.007	0.008	0.930	1.007
Consuming units	-0.032	0.080	0.155	.969
Non-oxen-livestock	-0.168	0.057	8.712***	.845
Non-farm income	-0.001	0.000	10.634***	.999
Food crop output	0.001	0.000	13.506***	1.001
Head's literacy	0.409	0.250	2.679*	1.505
Constant	-0.108	0.683	0.025	.897

Dependent variable: Participation in food crop marketing (commercialization), 1=participant, and 0 = non-participant

Note: Exp(B) shows the predicted change in odds for a unit increase in the predictor.

Omnibus tests of model coefficients: Chi-square= 51.083; df. = 8; sig. level = 1 %

Cox and Snell R^2 = 11.9 %; Nagelekerke R^2 = 15.9; percentage of correct prediction: 66.2 %; N included: 402 (95.7 %); *** = sig. at 1%; * = sig. at 10 %

Livestock holding (excluding oxen) is also negatively related with crop-oriented commercialization. An increase in one TLU results in a decline in the odds of market participation by 15.5 %, due to competition between livestock activities and crop farming for labor and other resources. Crop output, however has a significant and positive impact on food crop commercialization. As crop output increases by one unit, the odds of market participation increases by 100 %.

The regression analysis also shows the positive and significant (at about 10 % level) relation of literacy and participation in commercialization of food crops. Farm households with better education level seem to be keen to participate in food crop marketing. The education effect could be direct (market-orientation) or indirect via better production skill

and knowledge. Household size measured in adult-equivalent consuming units, which reflects household subsistence needs, is negatively related with participation in food crop commercialization. The negative sign suggests that households with large family size are forced to consume much or all of their production, supplying an insignificant amount or none for market, but the finding is not statistically significant. Neither gender nor age shows any significant impact on market participation.

In short, the regression analysis confirms that lack of market access (measured by distance) and engagement in livestock and off-farm employment significantly and negatively impact food crop commercialization. Literacy and total food crop production play a positive role, but only the latter has a strong significant effect. The logical question is therefore what determines food crop production in ways that stimulate marketed surplus, the focus of the next section.

4.2 Determinants Food Crop Production

Results of the Cobb-Douglass production function estimation are shown in Table 4. The empirical model (F-value=3.865, sig. level=1 %) estimated coefficients of farm size operated, household labor, age of household head (proxy for knowledge, skill and experience), oxen owned, fertilizer used, and cash credit received. Beta coefficients in the model are elasticities reflecting the percentage change in output resulting from a percentage change in input use.

As Table 4 shows, land size operated is highly significant with an elasticity of 0.518. A doubling of the present size of land operated (mean size=1.46 ha.) would result in an increase of food production by 51.8 %, other factors remaining the same. The coefficient for chemical fertilizer[13] is also significant and implies that doubling of the current level of fertilizer application would result in an increase in food production by 35.5 %. As the average amount of fertilizer used in the study areas is small (20.87 kg. per household, as shown in appendix 1), there are sizable output gains to be made from expanded fertilizer application. The result for oxen however is not statistically significant, suggesting the social capital is enabling oxen-less households to borrow or rent oxen in ways that prevent yield-deterioration.

Age of household head is negatively related to food production. This could be due to the better educational level of younger farmers; a bivariate statistical association test has shown that more of younger household heads are literate, while most of older

[13] In the production function improved seeds and fertilizer were tested and found to show a high level of co-linearity problem, and thus excluded.

farmers are non-literate. The credit coefficient in the regression is insignificant and negative, which is consistent with Damite and Negatu (2004) findings that the small cash credit obtained by farmers is used for smoothing consumption of food-short households. Household labor is negative but highly insignificant. This negative relation, though statistically insignificant, could be probably due to larger size of family labor in relation to other factors of production.

Table 4: Cobb-Douglass Estimation of Food Crop Production in South Wollo

Variable	B	Std. Error	Beta	t-value
(Constant)	8.504	1.259		6.757
log of household labor	-0.0558	0.228	-0.038	0.245
log of oxen owned	0.233	0.219	0.149	1.062
log of land operated	0.518	0.215	0.377	2.406**
log of credit received	-0.124	0.098	-0.199	1.262
log of head's age	-0.755	0.276	-0.378	2.738**
log of fertilizer (DAP+Urea)	0.355	0.148	0.387	2.391**

Dependent Variable: log of food crop production; ** = sig. at 5 % level

In sum, farm size operated and technology (chemical fertilizer) are found to be the most important factors of production under the context of the South Wollo in the 2001/02 cropping year. Policies and institutions that facilitate access to farmland (in particular via land rentals and sharecropping) require attention, particularly in situation where land underutilization is evident. Similarly, one has to focus on policy and institutions that promote technological change in smallholder agriculture. The next section deals with the adoption patterns and constraints of agricultural technology, particularly chemical fertilizer in the study area.

4.3 Farm Input Intensification

Smallholder farming households in the study *woredas* use limited chemical fertilizer, improved seeds, herbicides, insecticides, and farm implements. Chemical fertilizers are applied mainly to cereals, but its application to pulses and other crops is not common (Demeke et al., 1997). Improved seeds and chemical fertilizer are the dominant improved technologies used by farmers in the study areas (see Appendix 2 for the percentage of users of improved seeds and fertilizers). Maize and wheat are the main crops for which improved seeds are extensively promoted, the rest benefiting less from improved seed technology. Both a greater proportion of farmers and the average amount of seeds and chemical fertilizer applied in Jamma woreda

are greater than in the other study woredas in 2000/01 and 2001/02. Bati farmers use the least improved seeds and chemical fertilizer both in terms of average amount of inputs used and percentage of users. However, a higher proportion of Bati farmers apply manure, and rates of manure application are the highest in Bati, compared with other study woredas.

The results of the regression estimation of fertilizer use are shown in Table 5. Regression estimation was also carried out for Jamma, a study woreda in which the highest proportion of farmers use chemical fertilizer (Appendix Table 1), for more insights.

The regression results show that operated farm size has a positive and statistically significant impact on fertilizer use in both South Wollo and Jamma woreda. A unit change in size of farm operated entails more than two and half times and eight times higher chance to use chemical fertilizer in South Wollo and Jamma, respectively. This could be due to economies of scale, for fertilizer transaction cost per unit of operated land is lower for larger farms. Also larger farms often have greater influence (social capital) on personnel involved in fertilizer distribution.

Table 5: Logit Regression Estimation of Use of Chemical Fertilizer in South Wollo

Variable	South Wollo (All Study woreda)				Jamma woreda			
	B	S.E.	Wald	Exp(B)	B	S.E.	Wald	Exp(B)
Market distance	.007	.007	.944	1.007	-.016	.011	2.026	.985
Head's age	.003	.015	.037	1.003	-.008	.020	.149	.992
Labor units	.071	.222	.103	1.074	.124	.369	.112	1.131
Farm size operated	.974	.351	7.686***	2.648	2.147	.750	8.202***	8.557
Soil quality	.860	.502	2.934*	2.363	1.499	.746	4.033**	4.477
Oxen	1.482	.448	10.942***	4.400	1.649	.677	5.931**	5.203
Non-oxen livestock, TLU	-.344	.140	6.070**	.709	-.512	.220	5.432**	.599
Non-farm income	-.001	.001	1.333	.999	-.002	.002	.852	.998
Credit	.003	.001	9.668***	1.003	.003	.002	2.375	1.003
Head's literacy	.877	.542	2.615	2.403	1.221	.745	2.684	3.390
Jamma-dummy	5.995	.981	37.361***	401.426	-	-	-	-
Constant	-10.665	2.072	26.492	.000	-3.355	2.344	2.050	.035

Dependent variable: use of chemical fertilizer (DAP and/or urea), 1=user, 0 = non-user
Note: Exp(B) shows the predicted change in odds for a unit increase in the predictor.
Omnibus tests of model coefficients for all woreda (South Wollo): Chi-square= 229.679; df. = 11; sig. level= 1 %

Cox and Snell R^2 = 43.6 %; Nagelkerke R^2 =74.6 %; Percentage of correct prediction: 95.5 %; N included: 401 (95.5%).
Omnibus tests of model coefficients for all Jamma woreda: Chi-square= 70.465; df. = 10; sig. level= 1 %
Cox and Snell R^2 = 51.3 %; Nagelkerke R^2 =69.0 %; Percentage of correct prediction: 86.7 %; N included: 98 (94.2 %).
*** =sig. at 1 % level; ** = sig. at 5% level; * = sig. at 10 %

Fertility status of soil, traditionally measured as low fertility (*tuff*), medium fertility (*lem-tuff*) and high fertility (*lem*), also has a role in the decision of whether and how much fertilizer to use. Findings of the regression analysis show that farm households with better soil quality tend to use chemical fertilizer. Soil quality is positively induced by the application of organic manure, rotation and residual fertilizer carry-over. Landscape may also affect soil fertility via its effect on erosion. A change in soil quality towards better level in South Wollo and Jamma woreda results in the increase of odds of applying fertilizer by 2 times and four and half times respectively, other factors remaining constant. These results are consistent with the findings for agro-ecology, as proxied by the Jamma dummy variable, which also shows a positive and significant effect on fertilizer use. This could be probably better quality soils respond to chemical fertilizer better than poor quality soils, for good quality soils have better organic matter that enhances the productivity impact of chemical fertilizer.

Increasing oxen holdings by one unit increases the odds of using fertilizer in South Wollo and Jamma by more than four times and five times, respectively, other factors remaining unchanged. Oxen power is a critical production factor for small farm holders (Negatu, 2004). The relationship between livestock holding (excluding oxen) and fertilizer use is found to be negative and significant in both South Wollo and Jamma. An increase in one TLU in South Wollo and Jamma, other factors remaining constant, reduces the odds of applying chemical fertilizer by 29.1 % and 40.1 %, respectively, reflecting both competition for household labor, and substitution effects between manure and fertilizer need.

An increase in the credit received in one unit would increase the chance of applying fertilizer in South Wollo by 100 %. In Jamma, credit coefficient is positive but not significant at 10 %. The results indicate in general the importance of credit in improving farmers' access to chemical fertilizer.

The fertilizer adoption estimation results in general imply the need and importance of policies and institutions that promote farmers' access to oxen, that increase size of operated farm, and access to credit. The results imply also the need of agricultural diversification through promoting food crops production in agro-ecologically suitable

areas like Jamma and non-staple food crops and off-farm activities in agriculturally less suitable agro-ecological areas like Bati (Kola agro-ecology) and Legambo (Wurch agro-ecology) areas.[14]

6. Size of Operated Farms and Smallholder Farming Systems

As observed in the above analyses, size of operated household farm is a key factor of production, technology adoption and commercialization under Ethiopian rural context. Households in the study areas can be categorized into three farm size groups: (i) small size farm size, 0.50 ha and less; (ii) medium size farm, 0.51 ha - 2.0 ha., and; (iii) large size farm, above 2.0 ha. The role of size of operated farms can also be demonstrated in terms of its association with technology use, soil quality, manure use, and commercialization (Table 6). As shown in the table, large size farm holders are significant users of fertilizer, improved seeds and manure, and they commercialize the largest proportion of food crop produced compared to medium and small size farm holders. Thus, size of operated farm is a crucial factor in the intensification and commercialization of smallholder farming systems in Ethiopia. For a farm household to be sustainably food secure and user of modern improved productive technologies, consolidation of small and fragmented holdings into larger and viable size is therefore essential. This has a clear implication on policies and institutions required to ensure a long-term and secure marketing of land-lease holdings.

Table 6: Distribution of improved seeds, chemical fertilizer, manure, soil quality and commercialization by operated farm size groups

Item	Small farm	Medium farm	Large farm	F-value
Fertilizer, kg.	1.41 (11.868)	23.69 (59.472	27.83 (62.898	5.530***
Improved seeds, kg.	.00 (0.000)	.42 (3.772	2.67 (13.690)	3.940**
Manure use, kg.	16.972 (80.194	74.66 (151.583)	140.92 (278.429)	9.985***
Soil quality index	2.19 (0.595)	2.15 (0.478	2.17 (0.475)	0.247

[14] *Kola*, is an agro-ecology characterized with high temperature, lowland and semi-arid conditions, while W*urch* is an agro-ecology with low temperature, highland and sub-moist conditions.

Commercialization index (CI)	.06 (0.095)	.08 (0.112	.10 (0.129	3.428**

Note: *** =sig. at 1 %; ** = sig. at 5 %

7. Summary and Concluding Remarks

Commercialization of farm production is considered as an important strategy of transforming low productivity subsistence production of small farm holders into surplus - and market-oriented production systems. Data from the study areas of South Wollo in Northeastern Amhara region reveals that the amount of marketed food crops is substantially low (8 % of the total produced food crops). In terms of participation in food crop marketing, commercialization ranges from 36 % in poor cropping year (2000) to 51 % in relatively better cropping year (2001).

Access to marketplace (physical proximity) has been found to significantly affect farmers' commercial participation. Farm households nearer to market participate in food marketing than those far from market place. In the absence of means of transportation, farmers walk to market, in which case long distances to market play a disincentive to marketing. The importance of local and federal governments' efforts to improve roads and transportation services and market infrastructure is clear in stimulating participation of smallholders in marketing. Institutions and policies that encourage private investment in transportation service are also of a paramount importance. Marketing cooperatives would also have important role in facilitating input and output marketing.

Above all, the study asserts the major importance of surplus production or increased production in stimulating participation in food marketing. Enhanced food production is a very critical factor in promoting farm commercialization as also repeatedly indicated in various studies (see section 2). This warrants the need of investigating factors that determine food production. The Cobb-Douglas model estimation of food production clearly showed that size of farm cultivated with food crops and fertilizer are the most important and significant factors that determine food production. Since improved seed and fertilizer are highly co-linear in application, the findings underscore the

importance of markets and service delivery in multiple inputs. This result implies the need for forging appropriate policies that promote land mobility (marketing) in order to create conditions for increasing farm land operated by efficient farmers, by rationalizing the existing leasehold marketing and improving tenure security through efficient land institutions. This accompanied with aggressive technological change in smallholder farming through availability and accessibility of appropriate technologies like chemical fertilizer complemented with improved seeds and water irrigation (wherever necessary and feasible) is necessary to enhance the production side of farm commercialization. Technological change accompanied by change in human capital is a fundamental force to bring the anticipated production increase and farm commercialization.

In connection with this finding, the study attempted also to examine the pattern and constraints of fertilizer use in smallholder farming systems in South Wollo. According to this study, oxen holding, farm size and credit are the most important positive factors. Associated with larger farm size are benefits from economies of scale. As fertilizer is an expensive input for smallholders, the positive role of credit and the importance of strengthening credit service are clear. On the other hand, the study shows that applying fertilizer is feasible for farming located in suitable agro-ecology like Jamma compared to other case areas (e.g. Bati, Legambo). In agro-ecologies that are not suitable for agriculture, other options like non-farm income activities and animal farming are worth considering (Little et al, 2006).

Overall, rationalizing the existing land tenure policies and institutions in such a way to enhance production, technological change and commercialization is an important step that needs consideration by regional and federal governments. In connection with this, agricultural planning that prioritizes agro-ecologies for different agricultural and non-agricultural activities would be helpful.

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Appendix 1: Descriptive Statistics of Major Variables, 2001/02 cropping year

	N	Minimum	Maximum	Mean	Std. Deviation
Distance to Main Market, minutes	420	4.00	300.00	99.7512	50.60825
Age of household head	420	10.00	91.00	47.7024	15.45119
HH Labor (Adult Equivalent)	420	.00	8.40	2.8363	1.26923
HH Size (Adult-equivalent consuming units)	420	.70	10.70	4.1317	1.62785
Total operational holding (ha.)	420	.00	4.63	1.4644	.98205
Livestock ownership other than oxen (TLU)	420	.00	24.35	2.0411	2.52907
No. of Oxen Owned	420	.00	5.00	.7429	.86600
Improved seed used, kg.	420	.00	95.00	.9114	7.48626
Non-farm Income (revenue from own business plus wage labor employment), Birr	420	.00	4729.00	381.8412	710.82177
Total Farm cash income, Birr	414	.00	5440.00	595.6344	656.13704
Cash credit received, Birr	420	.00	2422.00	98.2307	230.87015
Total food crop production, kg.	411	.00	89508.00	967.1607	4418.89306
Fertilizer (Dap+urea) applied	420	.00	400.00	20.8667	55.75091

(2)

Appendix 2: Amount and user percentage technological inputs in 2000/01 and 2001/02 cropping years

Technological input	Woreda	N	2001/02 cropping year		2000/01 cropping year	
			Mean	Number of users (%)	Mean	Number of users
Fertilizer, kg.	Bati	110	0.00 (0.000)	0 (0.00)	0.51 (3.397)	3(2.73)
	Jamma	104	80.90 (87.271)	62 (59.62)	87.60 (76.837)	73(70.19)
	Dessie zuria	100	3.50 (13.771)	8 (8.00)	8.83 (20.199)	24 (24.00)
	Legambo	106	0.00 (0.000)	0 (0.00)	2.90 (12.214)	6(5.68)
	Total	420	20.87 (55.751)	70 (16.67)	24.66 (53.888)	106(25.24)
Improved Seed, kg.	Bati	110	0.00 (0.00)	(0.00)	0.71 (4.532)	6(5.45)
	Jamma	104	3.20 (14.454)	7 (6.73)	8.97 (18.117)	24(23.08)
	Dessie zuria	100	0.50 (3.518)	2(2.00)	3.32 (8.804)	15(15.00)
	Legambo	106	0.003 (0.029)	1(0.94)	1.58 (6.695)	7(6.60)
	Total	420	0.91 (7.486)	10(2.38)	3.60 (11.224)	52(12.38)

Note: Herbicides were not used in all *woreda*, while insecticides were provided to a considerable number of farmers freely by the local government to control the insect epidemics in Bati woreda in 20001/01. In 2001/02 neither herbicides nor insecticides were used in all the *woreda*. Figures in parentheses are standard deviations.

The Implications of Asset Ownership on Child Work in Rural Ethiopia

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Abstract

Children have always been working in industries and enterprises, in shops and stores, on farms and plantations, in domestic homes and habitats, on roads and streets, and in restaurants and hotels. There is by now a virtually unanimous view that poverty is the main, although not the only, cause of child labour. Even altruistic parents who care about the welfare of their children can thus be forced to see their children working because of poverty. If work participation exceeds an acceptable threshold level, the normal development of children could be seriously affected. The main aim of this paper is to provide empirical evidence on the link between asset ownership and child work in the context of a subsistence rural economy. The results show that most children in rural Ethiopia perform some form of work either in the house or on the farm. Although access to physical asset is expected to raise household income and create an incentive for school attendance, it might reduce school attendance and increase the probability of work unless accompanied by technological development. Policies that encourage school participation and help to improve the income generating potential of households and the provision of productive assets to create a more stable economic base are needed to reduce the engagement of children in work activities.

1. Introduction

Child work is a widespread problem particularly in developing countries despite legislations prohibiting the participation of children in harmful work practices. Children continue to participate in work activities, putting at stake their education, their health, their normal development to adult hood, and even their lives. Millions of them work under hazardous conditions, which present dangers to their health, safety, and welfare. They toil in mines and quarries, are exposed to agrochemicals in agriculture, squat in crippling positions to weave rugs and carpets and scavenge in rubbish collection centers. Many more are enslaved in bonded labour, isolated in domestic service, and traumatized and abused in the commercial sex trade.

According to the ILO (1999) estimate, up to 250 million children under the age of 15 years work worldwide. The vast majority of these children do not have access to education. For more than 120 million of these children, work is a primary full time activity while the reminders combine work with schooling or other non-economic activities. More than 95 percent of the global child labour is now largely a developing country phenomenon. In absolute terms Asia, being the most densely populated region of the world, has the largest number of child workers with 61 percent of the global child workers. In relative terms however, Africa comes first in the proportion of children participating in economic activities with an estimated 41 percent of the total number of children aged between five and 14 compared to 22 percent in Asia and 17 percent in Latin America (ILO 1997). The incidence of child labour in Africa is, therefore, about twice the level in Asia. Child labour in Africa has increased mainly due to factors such as rapid population growth, reduced standards of living as a result of economic crisis, limited public spending on social services like education, wars and civil strife, breakdown of family structures, etc. (Hemmer, *et al,* 1996). While the trend in child labour globally shows rapid decline, the number of working children in Africa is projected to increase to 100 million by the year 2010.

Within the African continent, some countries are more prone to child labour problem than others. Eastern Africa has the highest child participation rate within the African continent followed by Western Africa (ILO, 1996). Children's work participation rate in Eastern Africa is estimated to be about 33 percent while West Africa and Middle Africa account for 24 and 22 percent of the child labour, respectively (Kebebew, 1998). It is evident that the less developed a country is, the greater the proportion of the child population who work. One study has reported that the activity rates of children between the age of 10 and 14 are more than 40 percent in Ethiopia, Kenya,

Uganda and Tanzania while it is less than 6 percent in Mauritius and South Africa (ILO, 1997). However, these official statistics have considered only those children between the age of 10 and 14 years. If children below the age of 10 years have been included, the figure would have been much bigger than is reported by the official statistics.

According to some estimates it looks that more boys than girls work, the average ratio being three boys to two girls. Africa also has the highest participation rate of girls among the developing countries. However, surveys do not take into account domestic work in one's own household or caring for sick or disabled family members, which are usually performed by girls than boys. If such work were taken into account, there would be little or no variation between the sexes and the total number of working children, and the number of girls might even exceed that of boys.

It is also clear that the more elementary the type of the economic activity or the kind of occupation that does not need specific skills, the larger the relative size of the working children in that particular industry or occupation. These factors influence the distribution of the total number of working children by branch of economic activity or by occupation in any specific country. As a result, the relative level of the child workforce in any industry or occupation could vary from one country to another. Economic activities related to the agricultural sector are predominant in the proportion of child workers. More than seventy percent of the child labourers in developing countries are engaged in agricultural and related activities. In some countries it can even be as high as 90 to 95 percent. Agriculture absorbs most of the child labourers because agricultural production in developing countries is often labour intensive characterized with primitive and backward technology. Parents also want their children to acquire the basic agricultural skill so that they become good and able farmers when they grew up.

Although some the statistics exist that show the level or the incidence of child labour force participation rate in Ethiopia (Basu, 1999), lack of data has affected the amount of research done on the determinants of child time use decisions. A significant portion of the children working in domestic services and on family farms is usually ignored from the statistics. Even the few empirical works on the topic have disproportionally focused on the more visible forms of child labour. Above all, most empirical studies have focused on the labour intensive manufacturing sectors in South Asia and Latin America. In addition, existing studies do not often consider work in the house, on the farm, on family enterprises etc., as child labour and discriminate between market

based and non-market based work. So, the issue of child labour has not received adequate attention in Ethiopia for these and many other reasons.

2. Statement of the Problem

Child labour should be a concern to any developing country because of the long-term negative repercussions that starting working life too young has on the personal development of the child as well as on the economic and social development of the country. According to Anker (2000) there may be several reasons why we should be concerned with the problem of child labour. First the humanitarian concern emphasizes the protection of children from any form of exploitation and hazardous work. According to this view, children are fragile and need special protection. The second concern relates to the educational concern. Excessive work can be harmful for children since they will not have time to go to school or even if they go they have little time to study. The last concern relates to the macro and micro economic effects of child labour. On the one hand children do make significant contribution to family income in many developing countries. In fact, without the support of their children many parents would not have survived. Children contribute to household income in cash or in kind either by working in the labour market or by directly contributing to the labour demand of households. On the other hand, employment of children in work activities may displace unskilled labour from the labour market. This will create unemployment problems, which will, in turn, results in economic and social problems.

The problem of child labour is closely associated with poverty and technological backwardness. It is both a cause and a symptom of poverty. As argued well by Basu and Van (1998) it is not because parents are irrational and unsympathetic to their children that they send them to work but primarily to increase household income or as part of a survival strategy to minimise the risk of interruption of the income stream. It is often, a mitigation mechanism against a decline in income. Household poverty, which is manifested in terms of low or declining income and asset ownership, has often been singled out as the most important reason why under aged children are pushed into the labour market. Family income is a determining factor in parents' decisions whether a child has to work or not. A steady income that meets the basic necessities of daily life and allows for some savings for occasional big expenses will make it easier to forgo a child's earnings. The children of the poorest families are less likely to have access to primary education. Children from families living on poverty

incomes often start work at the age when their better-off counterparts are attending school.

Poverty is a complex, deep seated and pervasive reality of the modern times. Poverty leads to a vicious circle of poor health, reduced working capacity, low productivity and shortened life expectancy. Poverty expresses itself in the form of material deprivation, low human capital formation such as education and health, vulnerability to risk and lack of power (World Bank, 2000). It is a trap leading to inadequate schooling, low skills, insecure income, early parenthood, ill health, and an early death. Low level of education and health can lead to low income and hence to material deprivation. Vulnerability to risk can lead to inappropriate resource allocation decisions. It hinders growth, fuels instability, and keeps poor countries from advancing on the path to sustainable development. Nearly half of the population of the world lives on a less than US$ 2 a day; about 1.2 billion people struggle on a US$ 1 or less a day and a further 1.6 billion people live on US$ 1 to US$2 a day and are thus also poor, insecure and at risk of falling to the level of bare subsistence (World Bank, 2003).

Child labour leads to the perpetuation of household poverty across generations and slows economic growth and social development. As long as poverty pushes some families to send their children to work, the next generation is condemned to the same fate. While not all child labour is harmful, many children pay a high price for being engaged in work activities in terms of poor or lost education opportunities and poor health. This in turn translates into high social and economic costs for the countries concerned. In its worst form it robs children of their health and education and even their lives. Families on the margins of survival have to weigh their investment on their children's education against the value to the household of the work that a child might do. The bulk of child labour is in the informal sector, on farms and in micro and small enterprises. In family businesses and farms, children may not be paid at all and most of their work serves to release time for adult members of the family to increase household earnings. Even in the context of the family, child labour can be hazardous and constitute a barrier to school attendance and performance.

Although there is very little information on child labour, there is no doubt that it is an enormous problem in Ethiopia. It is hypothesised that many under-age children in Ethiopia are engaged in wage and non-wage works, which could be considered as child labour since many of these activities are both exploitative and deprive children their education and other ingredients necessary for their proper growth (Assefa, 2000; 2002; CSA, 2001). According to recent ILO estimates and projections, the

participation rate of children in the world between the age of 10 and 14 has been estimated to be around 13 percent in 1995. But the corresponding figure for Ethiopia was more than 42 percent (Basu, 1999). Moreover, while the participation rate of children in economic activities of the same age group globally will be less than 10 percent by the year 2010, it will be about 40 percent in Ethiopia (ILO, 1997) .Experience elsewhere shows that children below the age of 10 are also economically active (Assefa 2000 and Assefa 2002). Therefore, the incidence of child labour in Ethiopia could be even higher if the working children below the age of 10 are included in the above figures. Everyday observation also suggests that the incidence of child labour even among those 10 to 14 years of age might be much higher both in the urban and rural areas than suggested by the reports.

The level of poverty in Ethiopia is extremely high in terms of all major indicators of poverty as compared to other countries. The level of deprivation, life expectancy, under-one and infant mortality rates are probably the worst in the world and are all below the sub-Saharan African average. The rural literacy rates in Ethiopia are also one of the poorest in the world. Another indicator is the level of child malnutrition. The figures are again very high as compared to other countries. The proportion of people in Ethiopia who are absolutely poor i.e. those whose total consumption expenditure was less than the total poverty line in 1999/00 was estimated to be around 44 percent (MoFED, 2002). The proportion of absolutely poor people in urban areas was 37 percent while it was 45 percent in rural areas suggesting that the incidence of poverty is much higher in rural areas than in urban areas. Children in rural areas are only given limited opportunities to attend school. The net primary school enrollment rates are very low although gross enrolment rates may be higher. Children are often left out of school to help their parents at home. So, there is a need to break the cycle of poverty and give the Ethiopian children some hope.

Although poverty is usually manifested in terms of low income, finding an appropriate and direct measure of household income is often difficult with respect to rural economies where households rely less on the market. In the case of rural subsistence economies the link between poverty and asset ownership is particularly very strong since greater asset ownership means more wealth. The livelihood of the poor is fundamentally determined by the asset base it owns. It is often argued that the main cause of poverty in developing countries is lack of access to productive assets and hence increased access to productive assets by poor households is the best means of reducing poverty. Physical assets empower poor households by increasing their incomes; serve as reserves against shocks; and provide choices to escape from

harsh or exploitative conditions. Thus, it is better to use household physical assets as proxy measures for income and welfare of rural households. With respect to child labour, ownership of productive assets should decrease children's probability of working and increase their probability of school attendance. If households lack productive assets, they would survive a sudden drop in income by borrowing on the human capital market, meaning let children work instead of attending school.

The main means of livelihood in rural Ethiopia is agriculture, land ownership being an important determinant of welfare. Land ownership and poverty are closely related in Ethiopia. A study showed that the poorest 20 percent of the households owned about 0.28 hectares of land per adult equivalent, compared to 0.59 hectare per adult for the richest 20 percent (Dercon, 1999; Getachew, 1995). Because of increased population, marginal land has been brought under cultivation in many parts of the highland. Due to the absence of market for buying and selling land and the end of repeated land distribution, newly formed households cannot access more land. Many young adults end up being dependent on their families and their largely inadequate resources and as a consequence farm plots are subdivided into ever-smaller parcels.

Another important input in agricultural production is the availability of livestock both as a store of value and for traction power. In all farming systems livestock are the single most important store of wealth. Oxen are crucial in the ox plough farming system, which is most common in the Ethiopian highlands. In other farming systems where oxen are less important for traction, livestock provides a very important source of additional income, via milk and meat, dung, etc. Many studies have confirmed the correlation between poverty and livestock ownership (World Bank, 1998; Webb, et al, 1992; Getachew, 1995; Dercon, 1999). In most communities in Ethiopia owning no or very little livestock is a clear characteristic of the poor. Poor households do not have the oxen for traction power and are thus forced to give out part of their land to another household in the form of a sharecropping agreement.

The poor also typically have limited other durable household assets such as TV and radio sets. A study showed that of the poorest 20 percent only 3 percent have a radio (MEDaC, 1995). Even the distribution of these assets is skewed in favour of urban areas. Access to social and economic infrastructure by the poor is also limited. The poor are typically further away from all services such as road, telephone or post offices. Many rural households depend on rivers and lakes for their water supply. Household labour is often one of the few means of earning income the poor can rely upon. If illness strikes and working days are lost income will be strongly affected.

Illness or death of a household member causes serious labour shortage and high expense for rural households. There are very few health facilities in rural Ethiopia as compared to any other country. So, interventions to reduce rural and urban poverty would have broader implications on child work.

In general, while the incidence of child labour may vary greatly from country to country and even possibly within countries, it is, however, clear that the number of working children in Ethiopia is so high that it deserves to be a matter of priority concern in Ethiopia. Excessive participation of children in work activities jeopardises children's possibilities of becoming productive adults in the future. Having a child to labour will have immense impact on the child's physical and intellectual development. It is an extremely expensive phenomenon both for the child and for the society in general. Although it is generally agreed that the complete abolition of child labour will take a long time, there is a need to ensure that a start is made towards the abolition of this problem and diagnosis of the problem is the first step in this direction. Any intervention policy on child labour should be based on a careful analysis and research rather than just emotion and impulse. This study, thus, attempts to examine the implications of asset ownership on the allocation of children's time in rural Ethiopia, with the aim of suggesting possible areas of interventions. The study will, therefore, have serious implications on child welfare and education policies.

3. The Objectives of the Study

In light of the forgone discussion, the main aim of this study is to provide empirical evidences on the link between poverty, measured in terms of asset ownership and child work in the context of a subsistence rural economy. More specifically the study aims to examine the impact of asset ownership on child time use decisions.

4. The Theoretical Framework

The theoretical framework for analyzing households' decisions about the allocation of children's time is best is captured by the household production function approach formulated by Becker (1965).[1] The household economic theory of labor deployment

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

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

Similarly, a child's non-leisure time can be spent on schooling, on home-based production, on economic activity in the market or on a combination of these. Thus, the three rival claims on the non-leisure time of the child will be school attendance, work and the combination of school attendance with work. A household allocates the time of children between these competing activities, taking into account the private returns to each activity, and the household allocates the time of its children to wherever the perceived private return is highest until the marginal return is equalized across all of the child's time.[2] Thus, child labor becomes a consequence of a rational family strategy if the marginal benefits of child labor (i.e., earnings and saved costs of schooling) are higher than the marginal cost of child labor in terms of the forgone return to human capital investment.

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

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

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

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

constraint, or production technology that depicts the relation between input and output that is given as:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$T_c = T_w + T_s + T_l \qquad \textbf{(7)}$$

Households then maximize household utility subject to the combined time and income constraints with respect to the composite commodities.[3]

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

5. Methodology of the Study

5.1. The Analytical Model Used

The study has adopted a general utility-maximizing framework to model the choices regarding child-time-allocation activities as a function of child-specific, parental, household, environmental, technological and cultural characteristics. It is assumed that the time allocation decisions for the children are made either through a complete agreement among family members regarding the choices or by an altruistic adult, who often is considered to be the household head. Households' decisions about allocating their children's unit-time endowment can be econometrically modeled in different ways depending on the number of options and on the view one holds about the decision-making process. The decision can be modeled on the basis of simultaneous consideration of all the options or on the basis of an ordered decision. If the decision can be modeled in terms of a dichotomous choice model and the decision to work and to go to school are assumed to be independent, then a univariate probit model can be used. But if the two decisions are assumed to be made jointly, a bivariate probit model will be the appropriate approach. Under circumstances with more than two possible states in which a child could be at any one time, the bivariate or univariate probit approach will not be suitable. Hence, when a simultaneous decision-making process is assumed for three or more alternative choices, a multinomial choice model is appropriate.[4]

Although, there may be several activities that children may undertake simultaneously, the study assumes that a child's unit-time endowment can be used for four mutually exclusive activities. At a particular time, a child could be only attending school, only working, attending school and working at the same time or being idle, i.e., neither working nor attending school (leisure). This gives rise to the polychotomous choice framework.[5] Hence, the probability of a child having activity j is given by the following multinomial logit model.

$$prob(Y_i = j) = \frac{e^{\alpha_j + \beta_j X_j}}{\sum_k e^{\alpha_k + \beta_k X_k}} ;..j,k....0,1,2,3 \qquad \textbf{(8)}$$

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

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

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

$$
\begin{aligned}
prob\ (school) &= \frac{e^{x\beta A}}{1 + e^{x\beta A} + e^{x\beta B} + e^{x\beta C}} \\
prob\ (work) &= \frac{e^{x\beta B}}{1 + e^{x\beta A} + e^{x\beta B} + e^{x\beta C}} \\
prob\ (school + work) &= \frac{e^{x\beta C}}{1 + e^{x\beta A} + e^{x\beta B} + e^{x\beta C}} \\
prob\ (inactive) &= \frac{1}{1 + e^{x\beta A} + e^{x\beta B} + e^{x\beta C}}
\end{aligned}
\qquad \textbf{(9)}
$$

Given the above specification, the likelihood function becomes:

$$
L = \prod_s \frac{e^{x_s \beta_A}}{1 + e^{x_s \beta_A} + {}_{+} e^{x_s \beta_B} + e^{x_s \beta_C}} \prod_h \frac{e^{x_h \beta_B}}{1 + e^{x_h \beta_A} + {}_{+} e^{x_h \beta_B} + e^{x_h \beta_C}} \ldots \prod_m \frac{1}{1 + e^{x_m \beta_A} + {}_{+} e^{x_m \beta_B} + e^{x_m \beta_C}}
\qquad \textbf{(10)}
$$

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

$$y_{ij} = \begin{cases} 1..i.....f...the..i^{th}..child..falls..in..the..j^{th}..category \\ 0....otherwise \end{cases} \quad (11)$$

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

$$L = \prod_{i=1}^{n} p_{i0}^{y_{i0}} p_{i1}^{y_{i1}} p_{i2}^{y_{i2}} p_{i3}^{y_{i3}} \quad (12)$$

as:

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

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

By differentiating the log likelihood function given in (13) with respect to the parameters ($ß_i$), the maximum likelihood estimators can be generated through an appropriate mathematical iterative procedure. It should be noted that the signs of the ß coefficients are not necessarily equal to those of the marginal effects.

Unlike the standard regression analysis, the parameter value (ß) is not directly interpretable as the effect of a change in the explanatory variable on the mean or expected value of the dependent variable.[6] The coefficients need to be adjusted to be marginal effects in the case of the logit model. In other words, the marginal effect, which gives the partial derivatives indicating the change in the probability of the dependent variable relative to a unit change in one of the independent variables, needs to be computed. As the relationship between the regressors and the absolute probabilities is nonlinear, marginal effects vary according to the choice of vector X and, consequently, they will vary among individuals according to the point of evaluation. By differentiating the multinomial logit model, we find the marginal effects of the explanatory variables on the probabilities as:

$$\delta_j = \frac{\partial P_j}{\partial X_i} = P_j\left[ß_j - \sum_{k=0}^{J} P_k ß_k \right] = P_j\left[ß_j - \overline{ß} \right] \text{.....(14)}$$

Therefore, the signs of the marginal effects could be different from the signs of the coefficients. For continuous variables the marginal effect is the probability change in response to an increase in the value of the independent variable by one evaluated at the mean value. For dummy variables the marginal effect is computed as the difference in probabilities of the dependent variable between the group with designated value 1 and the reference group. The probabilities are constrained to sum to zero for each variable across the choices in the multinomial logit model.

5.2. The Data Used

The data for this study came primarily from an LSMS-type survey on rural households in Ethiopia. The Department of Economics at the Addis Ababa University undertook five rounds of rural household surveys in collaboration with different organizations, such as the Center for the Study of African Economies (CSAE - Oxford University), IFPRI and USAID. The fifth round survey, which is the latest one covering 18 villages and undertaken during the 1999/2000 crop season, was the main source of data for this study. Additional information from previous rounds of surveys was also used to complement the present data-set. The fifth round survey involved 1,681 households with an average household size of 5.88 members, giving a total of 9,884 individuals. The data included information on the primary and secondary occupations of every member of the household, including children above the age of 4 years. Children between the ages of 4 and 14 years have been the main focus of this study. The upper age limit was chosen because it defines the age at which some pupils begin their secondary education and because that is the minimum age for employment according to the Ethiopian Labor Law (TGE, 1993). There were a total of 3,611 children between the ages of 4 and 14 years, who were either in school and not participating in other activities, specializing in work, combining school attendance with work or were neither in school nor in the labor force. However, the total number of children used in this study has been only 3003 because of missing values. In addition, gender-disaggregated models were also specified and estimated.

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

6. The Results and Discussions

6.1. Some Descriptive Analysis

The early participation of children in work activities, which is very common in Ethiopia, is a cause for concern. The younger the child is, the more vulnerable he or she will be to physical, chemical and other kinds of hazards at the workplace. According to the data some 12 percent of the sampled children have started to participate in work activities by the age of four years (see Table 1). By the age of ten almost all children have started to participate in work activities. Similarly, some children also start going to school at an earlier age[7]. Moreover, because of lack of secondary schools or limited number of places in schools, it is expected that after this age schooling might even be less of a choice.

Table1: Work-starting ages for children in rural Ethiopia

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

Source: Fifth round rural household survey, 1999/2000

It is not uncommon to find children participating in more than one form of activity in rural Ethiopia. A child was assumed to be in one of four different states at any one particular time period: attending school, working, combining school attendance with work or doing none of these activities at any particular time. Close to forty percent of the sampled children are engaged in work activities only while more than a quarter of

[7] The school starting age in Ethiopia is set officially at seven years. But since there is no compulsory education policy many children do not start school attendance at that age. Early school enrolment in urban areas and late school enrolment in rural areas are very common.

them combine school attendance with work activities (see Table 2). One should, however, need to be careful not to conclude that work participation may not affect children's education. Excessive work participation may affect significantly children's scholastic achievements.

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

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

* work includes all work activities including farm work, domestic work, herding, crafts-work, trading, manual work, food selling, or any other type of work.
** others includes non-respondents and disabled children
Source: Fifth round rural survey, 1999/2000.

The empirical evidence also shows that children participate in different types of work activities such as farm work, domestic work, herding, and child care as well as several informal activities (see Table 3). Farm work and domestic chores are the main types of work activities involving children in rural Ethiopia. However, there is a gender difference in terms of the types of work performed by male and female children. Boys have generally greater participation in farm work while girls participate more in domestic work. These activities could be harmful to the children's normal development since they may directly conflict with their education and health.

Table 3: Type of work activities performed by children by age and sex (%)

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

* Domestic work includes activities like cooking, cleaning, child care, fetching water and wood, etc.
** Others include informal activities like food selling, trading, manual work, pottery, crafts work, etc.
Source: Fifth round rural survey 1999/2000

Participation of children in work for too many hours or work beyond their physical strength could have serious implications on children's physical and mental development. Excessive work participation may have several harmful effects including possible damage to the health and psychological development and most importantly their educational development. The result of this study shows that children could be subjected to excessive long hours of work (see Table 4). Many children are forced to work more than 12 hours a day. Such excessive work hours defiantly would affect children's normal physical development and reduce their learning abilities even if they are able to attend school. Boys spend more time in livestock herding and farm work, while girls spend more time on herding and child care activities. Child care could be harmful since it is incompatible with school attendance.

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

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

Domestic work includes all housework except childcare.
Source: Fifth round rural survey, 1999/2000.

6.2. Results of the Econometric Analysis

The link between household income and the allocation of children's time is one of the most important issues related to child labor that has received much attention in the literature (see, for instance, Psacharopolous 1997; Patrinos and Psacharopolous, 1997; Kassouf 1998; Canagarajah and Coulombe, 1998; Grootaert, 1998; Blunch and Verner, 2000). According to the insufficient income hypothesis, households are compelled to send their children to the labor market because their income is low. Several empirical studies have documented that the contributions of children to family

income in developing countries can be substantial, ranging between 10 and 40 percent of the household income (see, for instance, Sharma and Mittar, 1990; Swaminathan, 1998; Cain, 1977; Patrinos and Psacharopolous, 1997; Myers, 1989; Kassouf, 1998). Hence, household poverty, which is manifested in terms of low or declining income, has often been singled out as the most important reason that under-aged children are pushed into the labor market.

Nonetheless, the relationship between household income and child work remains still controversial and inconclusive[8]. Historical evidence does not provide adequate explanations for whether the rise in household incomes has been the instrumental factor in eliminating child labor from the present-day industrialized countries or whether the introduction of relevant legislation was the driving force[9]. Nevertheless, there is now a general consensus that the poorer the household is, the more likely that children are to work. According to Basu and Van's (1998) luxury hypothesis, a family only sends its children to the labor market if its income from non-child labor sources drops very low. When household wealth rises, children will be progressively withdrawn from labor activities in favor of alternative activities such as schooling (Grootaert and Kanbur, 1995; World Bank, 1998). A casual observation of the geographic distribution of child labor today also suggests a negative association between child labor and aggregate income (Basu, 1999).

Empirical evidence about the link between family income and child work within the context of subsistence and non-monetized rural economies is hard to find, primarily due to lack of an appropriate and direct measure of household income. This problem is especially difficult when analyzing rural economies, where households do not rely heavily on the market for consumption and production decisions[10]. Thus, it is better to use proxy measures to examine the effect of household income on decisions about the allocation of children's time. An appropriate proxy for rural household income or wealth is to use the physical and financial assets of households. It is now increasingly being accepted that one of the main causes of poverty in developing countries is the lack of access to productive assets. Thus, increased access to productive assets by

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

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

poor households is the best means of reducing poverty.[11] For these households, the amount of land they own is too small to ensure the nutritional well-being of the family and is also of poor quality. Lack of draft power and fragmented plots are additional factors characterizing poor households. In addition, access to credit can be an important factor, since imperfect capital market arrangements often are considered to be serious obstacles to agricultural productivity on the one hand and to children's school attendance on the other. Some empirical studies have argued that child labor can be observed, despite parental altruism, because there are no markets for loans against the future earnings of children.[12] The availability of credit would encourage parents to incur the direct costs of schooling.

Theoretically, ownership of productive assets should decrease children's probability of working and increase the probability of school attendance. However, some have called for a careful approach to asset-based poverty reduction measures, since asset accumulation may actually lead to an increased incidence of child labor, thereby creating a conflict between asset ownership and human capital formation.[13] Nevertheless, it can be argued that if households lack productive assets, they would survive a sudden drop in income by borrowing on the human capital market, meaning sending children to work instead of school.

The evidence in the pervious section has demonstrated that children undertake a variety of work related activities, which may directly affect their educational progress although some of them were able to combine school attendance with work participation. The real question now is to what extent does poverty as proxied by the asset level owned by households influence children's work participation. The implication of asset ownership on child work is examined next using an econometric analysis. On the basis of the theoretical and empirical model developed earlier, a multinomial logit is used to assess the impact of asset ownership on child work. The

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

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

[12] Lahiri and Jaffrey (1999), Ranjan (1999), Grote et al (1998) and Ranjan (2001) have all presented a variety of theoretical models in which child labour arises as a result of imperfect credit markets.

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

descriptive statistics of the different variables used in the analysis are presented in Table 5.

Table 5: Descriptive statistics of the variables used

Variable	Description	Mean	Std. dev.	Min	Max.
Activity	Dependent - (0) if child is inactive, (1) if child is only attending schooling, (2) if child is doing only work, and (3) if the child combines work with schooling	1.59	1.04	0	3
Household assets					
Roof	1 if roof is made of galvanized iron; 0 otherwise	0.33	0.47	0	1
Wall type	1 if wall is made of stone, concert, brick or cement; 0 otherwise	0.19	0.39	0	1
Farm_Ass	Expenditure on farm equipment over the last two years in Birr	6.27	19.29	0	312.00
Land	Size of own cultivable land in hectares	1.30	1.08	0	8.63
Number_p	Number of farm plots owned in 1999	3.37	2.26	0	15
Share_cr	1 if household practices share cropping; 0 otherwise	0.29	0.45	0	1
Fertility	Average land fertility index; 1 if land was lem (good), 2 if lem-teuf (mediocre) and 3 if teuf (poor)	1.59	0.64	0.5	3.0
Slope	Average steepness of land; 1 if land was medda (flat), 2 if land was dagath-ama (moderately sloped), or 3 if geddel (steep incline).	1.28	0.46	0.5	3
Lu_cattl	Number of cattle owned by household in livestock units	3.20	3.06	0	23.50
Lu_smliv	Number of small ruminants owned by the household in livestock units	0.36	0.67	0	6.50
Lu_equin	Number of equines owned in terms of livestock units	0.62	1.05	0	8.75
Off_farm	1 if household participated in off-farm activities; 0 otherwise	0.24	0.43	0	1
Incom_ac	1 if the household participated in income generating activities; 0 Otherwise	0.44	0.50	0	1
Remitt	1 if the household has received any remittances; 0 otherwise	0.30	0.46	0	1
Labour	1 if the household participated in any traditional labour sharing arrangement; 0 otherwise	0.62	0.49	0	1

With the objective of highlighting the relationship between the allocation of the child-time endowment and household asset ownership, several productive assets were considered in this study[14]. The most important assets included in the model were the size of the land owned together with a measure of its quality, the mode of operation (sharecropping), the number of plots cultivated, the number of large and small livestock owned, the construction material used for walls and roofs and the total expenditure on farm assets, such as hoes, plows and sickles. All of these are important measures of wealth in rural Ethiopia. Land and livestock are the two most important productive resources rural households in Ethiopia own. In a non-monetized rural economy, the construction material used for dwellings is also an important indicator of wealth. While poor households use mostly grass and wood for roof construction, wealthy households often use galvanized iron. Similarly, wealthy households use concrete material or brick for wall construction, while poor households usually use mud or wood. In addition, participation of household members in non-farm[15] and income-generating activities,[16] acquisition of remittances, participation in reciprocal labor-sharing arrangements to ease any labor shortages and households' access to credit also have been included in the analysis. The results of the analysis are presented in Tables 6, 7 and 8.

One of the most important productive assets and major source of income for rural households is livestock. Livestock ownership also reduces risk. For instance, small ruminants require less cash and capital to buy and maintain relative to labor. Livestock also provides draught power and manure for crop production. Livestock embody savings, serving as a store of wealth to which rural households could turn to, in times of crisis and in times of cash needs. In addition, livestock provides an alternative food source for the family. Ownership of large and small livestock is expected to reduce income volatility, thereby inducing households to invest more in human capital accumulation. On the one hand, it generally can be assumed that livestock ownership and child labor may be inversely related, and children in wealthier households will work less and go to school more. However, livestock production may also require more labor particularly that of children, since herding is one of the main activities of children in rural Ethiopia. Herding animals is probably one of the main

[14] The results of the impact of household assets have been generated after controlling other factors such as child and household characteristics, cultural factors such as religion and ethnicity, technology as well as location specific factors.
[15] Off-farm employment includes engagement in wage employment and food- for- work programs, working as a daily labourer and some professional activities, except traditional labour sharing.
[16] Income-generating activities include traditional crafting, collecting and selling firewood, trades in different types of food crops and livestock, food and drink preparation and sale, etc.

reasons for the prevalence of child bondage in some parts of the country.[17] In order to examine the effect of livestock ownership on child work and school attendance, three types of livestock were included in the analysis.[18]

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

Land is the other most important physical resource for rural households in Ethiopia. The amount of land owned reflects the permanent income potential of households and can be used as collateral, thereby indicating the borrowing ability of the household. Since children working on the family farm are not paid an explicit wage, their marginal product is demonstrated by the size of the land operated. The size of the land owned may increase the likelihood of a child working if land-intensive farming activities are undertaken, which require more labor, including child labor. Thus, land size may have a negative effect on school attendance. The effect of land size was significant on both the schooling and work participation equations, with the strongest effect on the school attendance equation. In general, land size has a negative effect on school attendance and a positive impact on work participation. The result shows that increased farm size reduces children's school attendance likelihood by nearly 4 percent and increases their likelihood of work attendance by about 2 percent. Land size does not contribute greatly to explaining the decision to combine

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

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

work with school attendance. The negative and strong effect of land size on school attendance suggests that as land size increases, households need more labor, including child labor, to transform it into a productive resource. On the other hand, since poor households own less of this productive resource, work opportunities for household members are limited. A negative effect of land ownership on school attendance was also reported in other empirical studies (Jensen and Nielsen, 1997; Cockburn, 2000; Bhalotra and Heady, 2000).

The result implies that increased land size might lead to more work, since it requires more labor, including child labor, thereby reducing children's likelihood of attending schools. Land is an important indicator of wealth in rural Ethiopia. It is also one of the most important productive resources that children could inherit from their parents. Therefore, larger farm size might lower the need for an alternative source of income and livelihood through investment in education for the children. Consequently, parents may not see the value of education and invest in it if they have sufficient productive resources that they can pass over to their children.

Investment in children's education might also be seriously affected by the productivity of the available resources. Land and livestock could be more or less productive, depending on the environmental circumstances prevailing in the system. One household's land may be more productive and fertile, while another household may have more livestock units to resort to during times of crisis. The productivity of the land owned by a household is reflected in, among other things, the fertility status of the farm plots and the degree of steepness (slope). Good land quality could reduce child labor, since a fertile and flat plot is conducive to farming and requires less labor but generates higher income. On the one hand, more fertile and flat land will require less labor, including child labor, thereby releasing children from work and creating better opportunities for school attendance. But, less fertile land could reduce household income and increase the risk of income fluctuations, thus demanding intensive agricultural practices and more labor input. Therefore, land size alone may not be an adequate indicator of wealth, unless there are means to transform it into a productive asset.

Two indices were included in the model to account for differences in land quality-fertility and steepness indices. The land-fertility index and the land-steepness index had significant effects only on the work and combined school-work equations. As the land-fertility index declines by one unit, specialization in work activities increases significantly. More specifically, the likelihood of specializing in work activities

increases by nearly 4 percent when land fertility declines by one unit, and the likelihood of combining school and work is reduced by about 2 percent. Cockburn (2000) also reported that land quality reduces child labor. The steepness of the land does not seem to have any significant effect on decisions about the use of children's time.

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

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

specializing in work activities and of combining schooling with work. Household participation in non-farm employment also seems to encourage the probability of school attendance and of combining work with schooling, but reduces the probability of specializing in work.

The link between poverty and child work can also be analyzed by examining the impact of other wealth indicators, such as the construction material used for walls and roofs and the value of farm equipment owned. These indicators could also indicate the relative wealth position of rural households. Wealthy households generally use cement, bricks or stone for wall construction and galvanized iron for roof construction, while the poor ones use mostly grass or other non-durable materials. The productivity of the land owned by a household also depends on the availability of farm equipment. The results of the analysis show that households using galvanized iron for roof construction are 4 percent more likely to send their children to school than households using other construction materials. Similarly, households using brick, stone or cement for wall construction are nearly 5 percent more likely to encourage the combination of work with school attendance. Families owning more farm equipment are more likely to encourage the combination of work with school attendance. All these results imply that wealthier households encourage at least combining work with schooling, if not schooling alone, suggesting a strong link between poverty and child labor.

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

Pooling together available labor resources for specific activities is also a common practice in rural Ethiopia in order to ease the problem of labor shortages, particularly

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

Finally, the special constraints faced by the poorest segments of households were represented by the inclusion of households' access to credit. A negative relation between child labor and credit availability and, correspondingly, a positive relation between school attendance and credit availability was expected, since child labor may be interpreted as borrowing across generations. The result of the study shows that access to credit seems to enhance school attendance and reduce the likelihood of specializing in work activities in general.

7. Conclusions and Policy Implications

The results of this study show that most children in rural Ethiopia perform some form of work either in the house or on the farm. Labour force participation is common even among those below the legal working age or those supposed to be in school. Excessive work, be it on the farm or in the house or in the labour market will have serious implications on the development of children. If work participation exceed an acceptable threshold level the educational development of these children could be seriously affected. The results underscore that the determinants of child labour are complex and many out of which household asset is but only one. A single intervention on the problem, which ignores its complexity, may not produce much success. Hence, the problem can only be addressed through a multifaceted approach that includes social, cultural, economic, and regional factors. The results of this study lead to a strong support for the hypothesis that household asset plays important roles in the allocation of children's time endowment.

Although access to physical asset is expected to raise household income and create an incentive for school attendance, our study shows that asset ownership might

reduce school attendance and increase the probability of work unless accompanied by technological development. The results also suggest some gender differences in which boys are less likely to specialize in work and are more likely to attend school or at least to combine work with school attendance while girls are more likely to take up home care tasks and are less likely to attend school.

Untangling the social, economic and cultural dynamics affecting families' decision whether a child should work or go to school is an important step towards effective action to combat child labour and cycles of poverty. The study clearly underscores the importance of educational investment and the need to broaden access to education to ensure that the future generations would be less impoverished than the present ones. So, policies are needed to encourage school participation improving the income generating potential of the household through the creation of income generating activities and the provision of productive assets to create a more stable economic base. Monitoring the working conditions of children who combine school with work may be an important policy agenda. Although legislation alone will not resolve working children's problems, an appropriate legislative framework can support other programs. Existing laws protecting working children must be better publicized and their implementation monitored.

Adults in all communities must be made aware of their responsibilities towards all children in their Community and community structures, such as religious groups can be used to uncover and monitor hidden forms of child labour and to support children. Working children also need support services, e.g. counselling services, education, skills training and health services. Accumulation of vital statistics is also an important measure to reduce child labour. Finally, additional research is needed to examine the impact of work participation on children's scholastic achievement since many children combine work with school attendance.

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Table 6: Marginal effect on the probability of SCHOOL attendance (All children)

Variable	***Marginal effects***	***Std. error***	*P [/Z/>Z]*
CONSTANT	-0.5669	0.1160	0.00
CONCRETE/BRICK/STONE WALLS	-0.0345	0.0253	0.16
IRON ROOF	0.0344	0.0159	0.03
FARM EQUIPMENT	-0.0003	0.0004	0.41
CATTLE	-0.0096	0.0038	0.01
SMALL RUMINANTS	0.0163	0.0144	0.25
EQUINE	0.0197	0.0091	0.02
LAND OWNED	-0.0367	0.0102	0.00
NUMBER OF PLOTS	0.0102	0.0041	0.01
PRACTICING SHARCROPPING	-0.0486	0.0193	0.01
FERTILITY OF LAND	-0.0074	0.0136	0.58
SLOPE OF LAND	-0.0178	0.0192	0.35
PARTICIPATION IN OFF FARM WORK	0.0246	0.0193	0.20
INCOME GENRATING ACTIVITY	0.0229	0.0153	0.13
REMITTANCE	0.0439	0.0197	0.02
LABOUR SHARING	-0.0378	0.0179	0.03
MODEL SUMMARY STATISTICS			
NUMBER OF OBSERVATIONS	3003		
NUMBER OF ITERATIONS	8		
LOG LOKILIHOOD FUNCTION	-2721.479		
RESTRICTED LOG LIKELIHOOD	-3907.795		
CHI –SQUARED	2372.63		
SINGINFICANCE LEVEL	0.0000		
PERCENT CORRECTLY CLASSIFIED	60.51		

Table 7: Marginal effect on the probability of specializing in WORK (All children)

Variable	***Marginal effects***	***Std. error***	*P [/Z/>Z]*
CONSTANT	1.1289	0.1781	0.00
CONCRETE/BRICK/STONE WALLS	0.0138	0.0332	0.67
IRON ROOF	-0.0105	0.0217	0.62
FARM EQUIPMENT	0.0005	0.0006	0.38
CATTLE	0.0002	0.0047	0.97
SMALL RUMINANTS	-0.0159	0.0179	0.37
EQUINE	-0.0067	0.0125	0.59
LAND OWNED	0.0215	0.0126	0.08
NUMBER OF PLOTS	-0.0096	0.0059	0.10
PRACTICING SHARCROPPING	0.0245	0.0243	0.31
FERTILITY OF LAND	0.0353	0.0179	0.04
SLOPE OF LAND	0.0020	0.0262	0.94
PARTICIPATION IN OFF FARM WORK	-0.0288	0.0259	0.26
INCOME GENRATING ACTIVITY	-0.0045	0.0205	0.82
REMITTANCE	-0.0988	0.0260	0.00
LABOUR SHARING	0.0532	0.0238	0.02
MODEL SUMMARY STATISTICS			
NUMBER OF OBSERVATIONS	3003		
NUMBER OF ITERATIONS	8		
LOG LOKILIHOOD FUNCTION	-2721.479		
RESTRICTED LOG LIKELIHOOD	-3907.795		
CHI –SQUARED	2372.63		
SINGINFICANCE LEVEL	0.0000		
PERCENT CORRECTLY CLASSIFIED	60.51		

Table 8: Marginal effect on the probability of combining WORK with SCHOOL attendance (All children)

Variable	***Marginal effects***	***Std. error***	*P [/Z/>Z]*
CONSTANT	-1.4096	0.0867	0.00
CONCRETE/BRICK/STONE WALLS	0.0489	0.0193	0.01
IRON ROOF	-0.0145	0.0129	0.25
FARM EQUIPMENT	0.0005	0.0003	0.07
CATTLE	0.0111	0.0025	0.00
SMALL RUMINANTS	-0.0054	0.0102	0.59
EQUINE	-0.0080	0.0074	0.27
LAND OWNED	0.0008	0.0072	0.91
NUMBER OF PLOTS	0.0041	0.0033	0.21
PRACTICING SHARCROPPING	0.0388	0.0138	0.00
FERTILITY OF LAND	-0.0187	0.0111	0.09
SLOPE OF LAND	-0.0054	0.0164	0.74
PARTICIPATION IN OFF FARM WORK	0.0102	0.0158	0.51
INCOME GENRATING ACTIVITY	-0.0181	0.0122	0.13
REMITTANCE	0.0639	0.0153	0.00
LABOUR SHARING	0.0102	0.0139	0.46
MODEL SUMMARY STATISTICS			
NUMBER OF OBSERVATIONS	3003		
NUMBER OF ITERATIONS	8		
LOG LOKILIHOOD FUNCTION	-2721.479		
RESTRICTED LOG LIKELIHOOD	-3907.795		
CHI –SQUARED	2372.63		
SINGINFICANCE LEVEL	0.0000		
PERCENT CORRECTLY CLASSIFIED	60.51		

Influence of Micro-Finance Services on Farm Households Income: *The Case of Oromia Credit and Saving Share Company–Kuyu Branch, Ethiopia*

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Abstract

The paper analyzes the influence of microfinance services in improving economic performance of farm households using data collected from 100 randomly selected households. Descriptive analysis of the changes in income level between the baseline and survey year was made whereas binary logit model was used to analyze the determinant of incremental income.

The results revealed the existence of improvement in the household income of the clienteles. Microfinance service related variables such as proper utilization of the disbursed loan, average loan size, appropriateness of loan disbursement schedule, and access to required amount of loan were found to be significant factors influencing the incremental income of the clientele. Other determining factors include land holding, shortage of draught animals, and distance to market.

The policy implications of the results tend to emphasize on the importance of supervision of loan service, improved loan schedules, proper identification of feasible business plan, income diversification of the clientele, and strengthening market access.

Keywords: Determinants, micro-finance, clientele, credit, logit model, Ethiopia

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1. INTRODUCTION

Similar to the other sub-Saharan African countries, the socio-economic situation of Ethiopia is characterized by low growth of income, inadequate social services, high population growth, economic inefficiency, and high unemployment rate, etc. resulting in severe poverty. As a result, diseases, malnutrition, and illiteracy are wide spread affecting more seriously women and children (Tsehay and Mengistu, 2002). Poverty also severely affects investment, which further leads to vicious poverty cycle due to lack of investment capital.

As poverty is a multidimensional problem, its solutions are multifaceted. In the Agricultural Development Led Industrialization (*ADLI*) strategy of Ethiopia, rural finance has been considered as an important tool for agricultural development and food security. Moreover, the Ethiopian Sustainable Poverty Reduction Strategy (SPRSP, 2002) underlines the importance of micro-finance institutions in poverty reduction and sustainable development. From the assessment of the Grameen Bank and even the experiences of some Micro-finance Institutions (*MFIs*) of Ethiopia, one can identify a number of best bet practices as well as challenges in the sector (Belay, 2001). Even though it cannot be a panacea – universal-remedy for poverty and related development challenges, micro finance is an important tool in the poverty eradication program. It can play an important role in facilitating the realization of rural development, and empowering the poor through provision of financial means to increase income and access to social services thereby creating confidence and self-esteem (Wolday, 2002). Micro-finance institutions provide suitable financial and other services using innovative methodologies and systems at low cost to meet the needs of low income sections of the population and act as intermediaries in a genuine sense (Wolday, 2000).

Oromia Credit and Saving Share Company (OCSSC), which was established in 1997, is one of the 21 licensed MFIs in the country with 70 branches and 50,815 clienteles and loan outstanding of about 43.4 million (OCSSCOAR, 2002). The company operates in 190 districts in Oromia and About 99% of the clientele of the company are from rural areas.

2. STATEMENTS OF THE PROBLEM

The major objective of the OCSSC is improving the living conditions of rural households through mobilization of saving and provision of credit. Hence, it is expected that the income of clientele households would increase. Some anecdotal observations[1] on the ground, however, show that there are mixed influences of credit provisions on the incremental income of the clienteles. USAID (1995) revealed that financial schemes of institutions that do not follow sound, sustainable financial principles and facilitate real economic growth might cause more harm than good. A similar study by Pischke et al. (1966) recommended that NGOs offering credit and other financial services should be subjected to national standards and adoption of appropriate standards.

Limited access by rural farm households to financial services is widely recognized in Ethiopia. According to the Microsoft Project Document of UNDP (1999), the economically active but poor in Ethiopia who can potentially access financial services are about 6 million out of which about 8.3% have gained access to the licensed microfinance institutions. Scaling up of the financial services provided by microfinance institutions requires identification of supportive features that are acceptable to the clienteles. Accordingly, it is imperative to analyze the influences of microfinance parameters and other factors affecting the household income in order to provide empirical evidences on the extent of influence of microfinance services. The major question to be answered is whether variables associated with microfinance service significantly contribute to incremental household income or not.

This study was, therefore, designed with the objectives of analyzing the influence of micro-finance services on the incremental income of the target households and identify instruments of microfinance services such as loan size, loan scheduling, utilization, etc. that would affect the performance of microfinance services.

[1] *The major author worked for the company and had informal discussions with the clienteles regarding the benefits of the loan disbursed.*

3. MICROFINANCE SERVICES IN ETHIOPIA

Provision of financial services could be made through saving and credit functions. Both functions could be provided from informal and formal financial markets. Micro-finance institutions are among the formal financial institutions targeting the poor both in urban and rural areas. Micro finance institutions started operations in the country following the issuance of Proclamation No. 40/96, which regulates the businesses of micro finance in the country. The National Bank of Ethiopia, that is the licensing authority, has since then been issuing a number of guidelines that underpin the operation of micro finance institutions in the country. The major target groups of most of the MFIs operating in urban areas are women while the lion's share of the target groups are men in rural areas. These institutions have been trying to enlarge their client and area outreach for the last almost five years (Tsehay and Mengistu, 2002).

Even though few MFIs are being involved in managing the pension fund of Social Security Authority and money transfer, the provision of credit and saving products are the two most important financial products/services delivered by all MFIs in Ethiopia (Woldy, 2002). Loan products of MFIs in the country can be divided into two general categories: viz. agricultural loans and micro-business loans. The agricultural loans are loans for agricultural inputs, livestock production, bee-keeping, etc. The loans are usually term loans; the principal and interest are paid at the end of the loan term, which varies from one week to one year for all MFIs in the country.

Micro-business loans are loans for petty trade, handicraft, and other services, which are repaid weekly, bi-weekly, or monthly on a regular basis. The micro-business loans do have lower risks to MFIs portfolio management and loan loss as compared to agricultural loans, and they diversify household income. Saving is a precondition for investment and consumption smoothing and as a result, it can be an effective instrument to overcome economic shocks. The saving products include center savings, compulsory group savings, individual voluntary savings, and institutional voluntary savings.

Owing to small loan sizes and short loan period, which are major features of informal credit in both rural and urban areas of Ethiopia, the demand for products of MFI has been growing. According to Wolday (2000), delivery of microfinance services has been considered as one of the policy instruments to enable rural and urban poor

increase output and productivity, induce technology adoption, improve input supply, increase incomes, reduce poverty and attain food security.

Microfinance institutions have a surmountable outcome and impacted individual households thereby raising their income level elsewhere and in Ethiopia. The Grameen bank in Asia is a case in point. In Ethiopia, few studies have established a relationship between microfinance institutions and household income. Samson (2002) has indicated that Busa Gonfa Share Company of MFI operating around Modjo areas could increase household income through its lending scheme. However, only 30% of the households in the study area were able to access the service one of the reasons being resource constraint.

Grameen bank based lending methodology, which includes "center", group and individual structures, has been employed. "Center" savings are fixed amount of savings (at least one Birr) by each member per month at center level while group saving is a certain portion of the required loan (10% for OCSSCO) that is deducted and saved with the institution. Individual saving (which can be of compulsory and voluntary) is the amount (minimum of Birr two per member per month), saved by the clientele with the company. Other organizations, associations, and any body having legal entity with company make institutional saving.

The Oromia Credit and Saving Share Company (OCSSCO) was established in 1997, evolving from Oromia Rural Credit and Saving Scheme Development Project. The project had almost the same mandate as that of OCSSCO today, and commenced its operation in four districts/branches in four Oromia zones in February 1996. The branches were Kuyu of North Showa zone, Sinana-Dinsho of Bale zone, Hetosa of Arsi zone, and Shashamene of East Showa zone. This study was conducted in Kuyu branch of the company to assess the influence of the micro-finance services of the company on household economic situation between the year of establishment (1996) and the survey year (2002).

4. CONCEPTUAL FRAMEWORK

Rural incomes fluctuate from season to season in response to weather shocks and related agricultural activities. Due to the risks affecting income levels and

consumption, poor rural households in developing countries demand access to financial services to help stabilize income and consumption, and alleviate food insecurity (Zeller, et al., 1997).

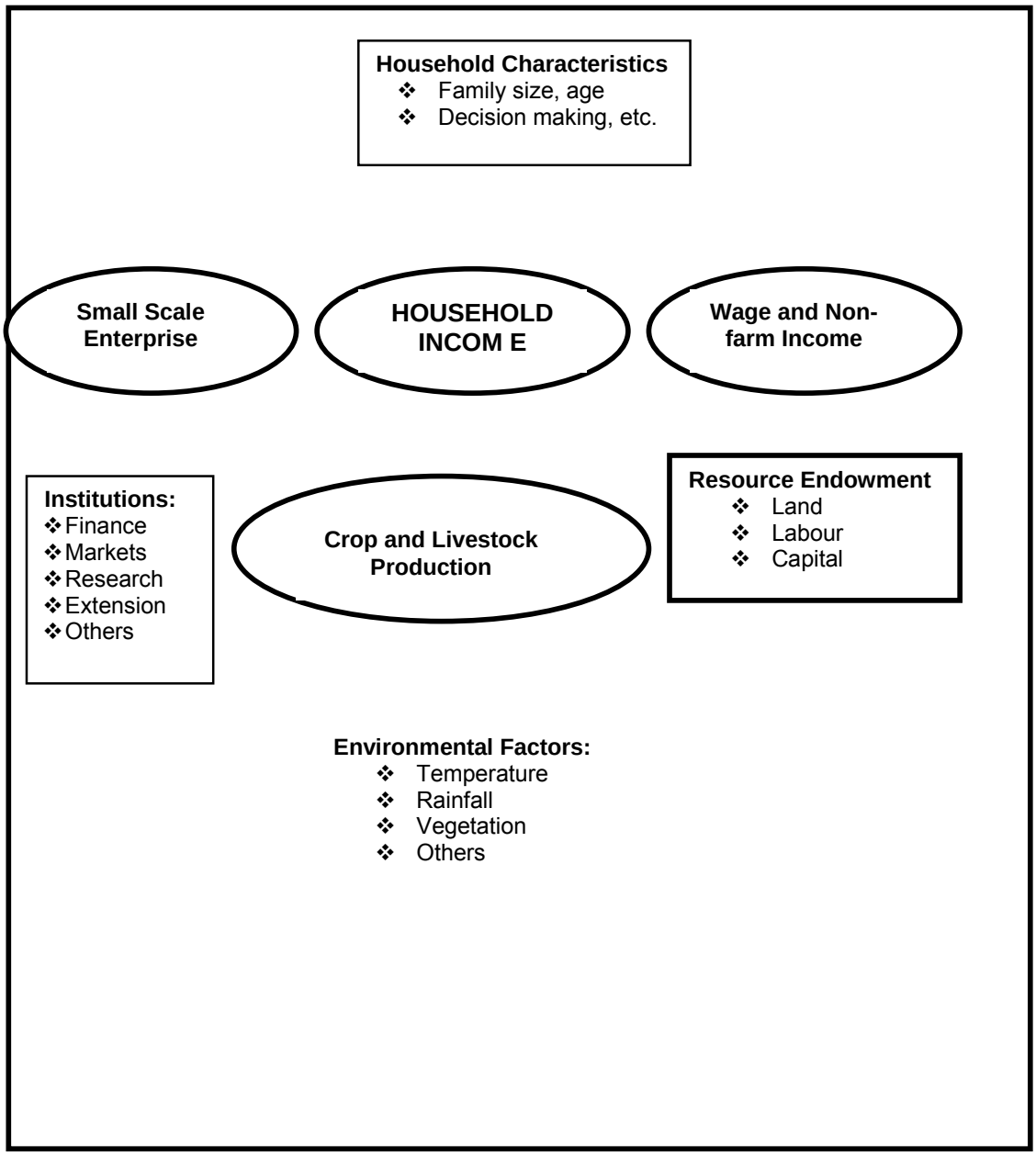
Since farm households earn income from different sources, it is important to aggregate the income from different sources and include the different factors responsible for income generation in the incremental income model described in section 5.2, with major focus on the features of microfinance services. The major source of income is crop and livestock production the level of which is affected by environmental factors such as soil, rainfall and temperature. The amount of production is also a function of the different factors of input such as land, labour and capital. Moreover, the decision-making and management skill of the household affects the factor combination and enterprise selection, thereby affecting the level of agricultural production and income. The level of output and the price of inputs and cost of production, which are determined through institutional factors and market forces, determine the income from agricultural production.

Another source of income is wage income which is affected by institutional factors such as labour market, labour mobility, wage policy, etc. Institutional factors play key roles in terms of finance, markets and research and extension services, which affect innovation and use of technologies, both in production and business sectors with ultimate impact on the utilization of credit received from microfinance institutions.

Another key factor determining the household income is micro-business or small scale enterprises which provide alternative or complementary job opportunities for both women and men in the rural and urban areas. The role of micro-finance institutions is considerable in creating access to financial services to enable income generation activities by engaging in small scale enterprises and use of production technologies to increase household income.

The extent to which microfinance services affect the income changes and improvements in the livelihoods of the clienteles is determined by the company policies such as loan size, loan purposes, repayment schedules and other parameters. In this study, key variables illustrated in Figure 1 were included in the econometric model of incremental household income to determine the extent to which the microfinance services and associated policies contribute to the increase in household income.

Figure 1: Schematic Representation of Factors Affecting Household Income


Household Characteristics
Family size, age
Decision making, etc.
Small Scale Enterprise
HOUSEHOLD INCOM E
Wage and Non-farm Income
Institutions:
Finance
Markets
Research
Extension
Others
Crop and Livestock Production
Resource Endowment
Land
Labour
Capital
Environmental Factors:
Temperature
Rainfall
Vegetation
Others

5. METHODOLOGY

5.1 Data

The data used in this paper were collected from farm households who have been clienteles of the OCSSCO for five subsequent years. In order to analyze the changes in the income of the clienteles, two types of data were collected and analyzed. Firstly, primary data were collected from 100 randomly selected from 2197 clienteles of the OCSSCO-Kuyu branch during the year 2002. Structured questionnaire consisting of variables relevant for attaining the objectives of the study were used for data collection.

Moreover, the baseline data that was collected by OCSSCO-Kuyu branch at the very beginning of client-ship of the two parties in the year 1996 were collected from the files of the sample households at the branch office of the company. The major data included in baseline survey were annual income, family size, total land holding, total livestock holding, land use pattern, housing condition, health, access to financial services, farm household characteristics such as sex of the head, age and education level, etc. The data sets are consistent with the data requirement of the study.

5.2 Analytical Model

In this study, both descriptive and econometric analyses were conducted. The descriptive statistics was used to evaluate the significances of changes in some key parameters between the year of first intervention and the study period. Accordingly, frequency distribution, mean, minimum, and maximum values of some important variables were computed to compare the changes in relevant parameters over the five years.

Contribution of MFIs services to poverty alleviation is determined by institutional factors such as loan purposes, loan term, loan size, land size, intensity of off-farm economic activities, marketing services, etc. Variation in the contribution of MFIs services to incremental incomes of the target groups may be due to any or all of these factors, which also vary spatially and temporally. In order to analyze the influences of these factors and identify the relative importance of these variables, a binary model was used. Accordingly, a logit distribution model was defined following Liao (1994), Gujarati (1988) and Aldrich and Nelson (1984):

$$Pi = \frac{1}{(1+e^{-Zi})} = \frac{e^{Zi}}{(1+e^{Zi})} \qquad (1)$$

Where P_i: is a probability that the income of ith farmer is improved.

e^{Zi}: stands for the irrational number *e* to the power of Zi

Z_i : is a function of N-explanatory variables which is also expressed as:

$$Z_i = \beta_o + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_n X_{ni} \qquad (2)$$

Where X_1, X_2, …, X_n = Explanatory variables

βo - is the intercept

$\beta_1, \beta_2, ---, \beta_n$ are the logit parameters (slopes) of the equation in the model.

The slopes tell how the Log-odds in favor of improved income changes as independent variables change. The unobservable stimulus index Z_i assumes any values and is actually a linear function of factors influencing improvement in income. The Z_i ranges form $-\infty$ to $+\infty$, P_i ranges between *0* and *1* and that P_i is non-linearly related to the explanatory variables. P_i is non-linear in X_j, and in the β's as well.

It can be shown that $\frac{P_i}{1-P_i}$ is simply the odds ratio in favor of improvement in income level. It is the ratio of the probability that the farmer would have increased income to the probability that he/she would not have improved income. Finally, taking the natural log of odds ratio can be written as:

$$Li = Ln(\frac{Pi}{1-Pi}) = Ln(e^{\beta_0 + \sum_{j=1}^{n} \beta_j X_{ji}}) = Zi = \beta_0 + \sum_{j=1}^{n} \beta j X_{ji} \quad (3)$$

Where L_i is log of the odds ratio in favor of increased income, which is not only linear in X_j, but also linear in the parameters. This model can be estimated using the iterative maximum likelihood estimation procedure.

5.2.1 Definition of Variables and Hypothesis

Dependent variable

The incremental income of the clientele of the company was defined as binary dependent variable, where a dichotomous variable takes *1* for those with increased income and *0* otherwise. The incremental income was defined taking two points in time, i.e. the survey year and the baseline year. The base year is the year in which the clientele joined the company, i.e. year 1996, whereas the survey year is the year of data collection, i.e. year 2002.

Explanatory variables

In this paper, the explanatory variables included in the econometric model could be categorized into socioeconomic and institutional factors, which are hypothesized to have influences on the household income of the clientele. Based on the review of literature and actual conditions of the study area, the following explanatory variables were expected to explain the probability of having increased income situation (Belay and Belay, 1998, Asfaw, et al., 1997; Zeller, et al., 2001).

1. Appropriateness of loan disbursement time (discrete variable). In the world of banking in general, and micro finance services in particular, loan by its nature is both time and purpose sensitive. The clientele of the company would be more benefited if loan processing is made in accordance with these conventional views. Therefore, appropriate loan disbursement schedule is expected to have direct influence on the financial performance of clientele. The variable is discrete assuming a value of *1* if the clientele indicates appropriateness of loan disbursement and *0* otherwise.

2. Appropriateness of loan term (discrete variable). Loan term is a schedule, which fixes duration of the loan and specific date of loan repayment, which is governed by the lending institution with agreement of the borrower. In most cases

loan term is a function of loan size and loan purpose. Accordingly, the lending institution and the borrowers attempt to convince one another to set terms of the loan. Missing this concept will lead to setting repayment schedule for a given purpose quite before or after its maturity, which in turn leads to loan default. Therefore, appropriate loan terms can have positive effect on the success of loan purposes, improving the economic condition of the clienteles. In this paper, this variable is discrete assuming a value of *1* if the clientele indicates appropriate loan term and *0* otherwise.

3. Average loan size of the client (continuous variable). Loan size depends on the purpose of the loan. In the study area, where capital is scarce as compared to labour and land, larger loan size is needed to acquire productive factors of production and engage in micro-business activities. Hence, the magnitude of loan the clientele received over the last five years is expected to have direct relationship with the improvement in income of the household.

4. Acquiring required amount of the loan (discrete variable). In principle, borrowers are expected to propose loan size along with loan purpose(s). However, there are cases in which local community representatives or committees together with branch staff(s) determine the loan size, based on production capacity, repayment capacity, social characteristics, etc. of the borrower and his loan purpose(s). Failure to provide the required loan size is expected to have negative repercussion on the loan performance. It is, therefore, hypothesized that provision of the required loan size would have high probability of increasing the income of the clienteles. In this study, the variable assumed a value of *1* if the client received the amount he/she requested and *0* otherwise.

5. Utilization of the loan for the intended purpose (discrete variable). Upon loan processing, all clienteles specify their respective loan purpose(s), for which they use the loan, and they are not allowed to divert the loan to other purposes. But some times, clienteles are found to divert the loan to other purpose(s), may be due to incompatibility of loan size, unexpected circumstances, social problems, etc. This will have an impact on the loan performance. Basically, in addition to their indigenous knowledge, the clienteles are given training on all aspects of micro finance services, feasible loan purposes(s), utilization of the loan, etc. before loan processing by the company. Therefore, utilization of the loan received, for the intended purpose(s) has

direct relationship with the improvement in income level. The variable assumes a value of *1* if the loan is used for the intended purpose and *0* otherwise.

6. Shortage of draught animals (discrete variable). Draught animals are one of the components of capital as a factor of production. The availability of this capital enhances the income generating capacity of farmers through increased crop production as well as oxen rental incomes. If the loan disbursed is used for productive purposes, availability of draught power would complement the loan to increase productivity. That means, despite loan acquisition, shortage of draught animals has negative effect on income generating capacity of the farmers. The shortage can be traced from the baseline information of households since the resources at hand are assumed to be available to complement the credit received to generate income. In the econometric model, the oxen variable assumed a value of *1* if the client had problem of draught oxen at the beginning of the loan period and *0* otherwise.

7. Extension service (discrete variable). Extension services provide technical skill to enable improved crop and livestock management and increase productivity. Coexistence of extension services along with micro finance services has direct influence on the improvement of income of the target groups. The variable is assigned a value of *1* if the client gets extension service and *0* otherwise.

8. Off-farm income (continuous variable). Off-farm activities are economic activities other than agricultural production. These include petty trade, handicrafts and other activities, directly reflecting the small-scale enterprises shown in Figure 1. These economic activities create employment opportunities by absorbing the disguised employment in rural areas through enhancement of diversification of economic activities and reduction of risks. Therefore, engagement in off-farm economic activities is expected to have a direct relationship with improved income of the clienteles.

9. Distance to market center (continuous variable). Access to market is crucial for business undertaking. This has critical importance for loan performance. Usually markets are situated at towns, even though there are small markets at village level. Farmers residing closer to markets have more access to information about the lending institutions and requirements for acquiring loan and business information, as compared to those away from the towns. On the other hand, experiences show that those residing near or in towns divert loan from the intended purposes or consume

the loan they have received. Moreover, mostly, farmers residing away from market centers /towns are believed to be more genuine and less extravagant. Therefore, the nature of relationship between distance to market and loan performance could depend on the prevailing situation.

10. Family size (continuous variable). Income from agricultural production is a function of labour. Family size, adjusted for dependency, is supposed to have direct relationship with the level of income. Children of less than 14 years and elders of more than 60 years were considered as dependent and do not as such contribute to income generation. Besides family size, gender differential is important in microfinance analysis. Unfortunately, the female households coverage of the microfinance services at the survey period was so limited to consider gender difference in the model.

11. Land holding (continuous variable). Land is also one of the major factors of production. Crop production is entirely dependent on land. Land is also crucial input for mixed farming through supply of grazing land, forages, and other feeds. Therefore, land holdings and improvement in income level are expected to have direct relationship.

5.2.2 Sensitivity Analysis

Significant explanatory variables discussed above would influence the change in income level. But the extent of the influence would not be the same for all the significant variables. The relative effect of a given quantitative explanatory variable on the changes in income level is measured by examining the elasticities, defined as the percentage change in probabilities that would result from a percentage change in the value of these variables. To calculate the elasticity, one needs to select a variable of interest, compute the associated P_i for 'Typical Clientele'. Then vary the X_j of interest by some small amount and re-compute the P_i, then measure the rate of change as $\partial P_i/\partial X_j$. Where ∂X_j and ∂P_i stand for percentage changes in the continuous explanatory variable (X_j) and in the associated probability (P_i), respectively: when dX_j is very small, this rate of change is simply the derivative of Pi with respect to X_j and is expressed as follows (Aldrich and Nelson, 1984; Maddala, 1992):

$$\frac{dP_i}{dX_j} = \frac{e^{zi}}{(1+e^{zi})^2}\hat{\beta}_j \text{ ---------- } (4)$$

$$= P_i(1-P_i)\hat{\beta}_j \qquad (5)$$

The impact of each significant qualitative explanatory variable on the probability of improvement in income is calculated by keeping the continuous variables at their mean values and the dummy variables at their most frequent values (*0* or *1*).

6. RESULTS AND DISCUSSIONS

6.1 Socioeconomic Changes between Baseline and Survey Years

Descriptive statistics of some key indicators, which might be influenced by improvement in income due to micro-finance service, was analyzed. Apparently MFIs improve household income that can be used to stimulate savings and investment in livestock and oxen holdings, housing, and renting land resources. More savings imply the capacity of the farmer to avail more inputs, which enable him/her to produce more and generate more income. As discussed earlier, oxen provide draught power for cultivation and increased oxen holding contributes to improved wealth and household income.

Better housing condition results in healthy and productive life. Land rented-in contributes to incremental income due to its complementary use with other yield increasing inputs which would not have been used when land is scarce.

In addition to the above quantitative variables that measure impacts of micro finance services on the 'beneficiaries', there might also be other qualitative variables, such as children schooling, nutrition, clothing, etc. Employment generation and human capital formation can also be indicators of impacts of micro-finance services.

Assessment of the impacts of micro-finance services were made by asking the clienteles their perceptions of the impacts on variables listed in Table 1. The results indicate that living condition of 86% of the sample clienteles improved while that of 14% showed no improvement of which 3% of the clienteles had no changes in their living condition and that of 11% deteriorated. Disaggregated analysis shows that the

impact of the micro-finance service is highly associated with income generation (70%), asset creation (65%), improved nutrition for the family members (63%) and increased livestock holding (57%) (Table 1).

Table 1: Proportions of Clienteles with Improved Living Conditions

Indicator	Clienteles with Improved Conditions (%)
Children schooling	55.81
Better clothing	13.97
Improved nutrition	62.78
Improved housing condition	22.10
Increased livestock number	57.00
Increased asset	65.11
Improved income level	70.00

Source: Own Computation

In this paper, annual income of the clientele was considered as the most appropriate variable for the assessment of the influence of the micro-finance services. Hence, the improvement in income level was used to categorize the clientele in to those with improved income and those without improvement (Vasthoff, 1968; Tesfaye, 2001). Household incomes during the base year and survey year were compared. Those with increased household income were defined as *"Improved"* while those with no improvement, i.e. same level of income or worsened income level, were defined as *"Not Improved".*

Table 2 compares the mean level of the continuous economic variables of the clienteles with improved conditions and clienteles the economic conditions of whom were not improved. The comparisons were made at the base year and the survey year, i.e. five years after the commencement of the loan scheme. The economic improvement between the two reference years was statistically significant at 1% level. Income from agricultural production and off-farm income and the asset accumulation were significantly higher after the commencement of the micro-finance services. The difference between the clienteles with "Improved" and "Not Improved" groups in terms of the economic variables listed in Table 2 was insignificant at the initial stage and

became significant after the loan scheme was commenced. The factors underlining these differences are further analyzed under section 6.3.

Table 2: Mean Comparison of Some Economic Variables during the Base and Survey Years

	Base year			Survey year			Total		
	Improved	*Not Improved*	*t-values*	*Improved*	*Not Improved*	*t-values*	*Base year*	*Survey year*	*t-values*
Agricultural income (Birr)	1800	2119	-1.091	4270	2191	6.714***	1895	3647	-8.916***
Off-farm income (Birr)	114	42	1.656	728	299	2.850***	92	597	5.481***
Oxen owned	2.01	1.89	0.834	2.63	2.33	1.639	1.97	2.51	5.103***
al livestock holding (TLU)	6.48	5.74	1.003	8.38	6.29	2.348**	6.26	7.75	4.285***

* Significant at 10% level, **Significant at 5% level, ***Significant at 1% level.

6.2 Results of Multicollinearity Test

Existence of income differentials among the clienteles calls for identification of factors responsible for the variation in the household's incremental income. Accordingly, econometric analysis of factors affecting the probability of income improvement was made. Before estimating the model, it was necessary to check for the functional relationships between the explanatory variables. If multicollinearity is less than perfect, the regression coefficients, although determinate, possess large standard errors (in relation to the coefficients themselves), which means that the coefficients cannot be estimated with great precision or accuracy (Gujarati, 1995). In this paper, existence of serious multicollinearity was tested using Variance Inflation Factor (VIF) for continuous explanatory variables and contingency coefficient for discrete explanatory variables. Table 3 and 4 display the VIF and the contingency coefficients respectively.

Table 3: Tests for Existence of Multicollinearity among Continuous Variables

The Continuous Variables	Collinearity Statistics		
	Tolerance	VIF	R_i^2
Average loan size (Birr)	0.912	1.096	0.088
Total family size of the household (No.)	0.929	1.077	0.071
Total land holding (ha)	0.948	1.055	0.052
Distance to market (Kms)	0.872	1.147	0128
›ff-farm income during the base year (Birr)	0.976	1.024	0.023

Source: Own computation

R_i^2 is the coefficient of multiple determinations when the variable X_j is regressed on the other explanatory variables. A rise in the value of R_j that is an increase in the degree of multicollinearity, does indeed lead to an increase in the variances and the standard errors of the OLS estimators. The R_i^2 and the value of VIF are directly related while the value of VIF is inversely related to tolerance level. A VIF value greater than 10 is used as a signal

for the strong multicollinearity between the two considered continuous variables (Gujarati, 1995). The result of the test, therefore, indicates lack of serious multicollinearity problem among the continuous variables.

The values of contingency coefficient, which basically range between 0 and 1 are significantly small (Table 4). Low value of contingency coefficient indicates absence of serious multicollinearity problem between the considered discrete variables.

Table 4: Tests for Existence of Multicollinearity among Discrete Variables

	Loan disburse-ment time	Loan term	Problem of draught power	Extension service	Loan requested	Utilization of loan
Loan disbursement time	1.000					
Loan term	0.220	1.000				
Problem of draught power	0.1361	0.088	1.000			
Extension service	0.007	0.050	0.066	1.000		
Amount of loan requested	0.054	0.059	0.567	0.105	1.000	
Utilization of loan	0.238	0.247	0.043	0.120	0.059	1.000

Source: Own computation

6.3 Econometric Results

Using the explanatory variables defined above, a logit model was estimated using Maximum Likelihood Estimation procedure, of the SPSS computer software. Equation (3) was used to estimate the logit model. Table 5 shows the parameter estimates and statistical significance of the coefficients.

Table 5: Maximum Likelihood Estimates of Logit Function

Variables	Coefficients	Odds ratio	Wald statistics	Sig. level
	2.553	12.85	3.778	0.052*
Appropriateness of loan time	0.902	2.465	1.846	0.174
Appropriateness of loan term	0.004	1.004	5.051	0.025**
Average loan size	-0.466	0.627	0.603	0.437
Shortage of draught power, base year	0.064	1.067	0.013	0.911
Extension service	0.001	1.001	0.926	0.336
Off-farm income	0.279	1.321	0.736	0.391
Provision of loan demanded	0.116	1.123	2.721	0.099*
Distance to market	0.024	1.025	0.036	0.849
Family size	0.638	1.893	5.373	0.020**
Land holding	2.979	19.661	7.906	0.005***
Utilization of loan	-11.174	0	11.767	0.001
Constant				

-2 Log likelihood Ratio = 91.026
Likelihood Ratio Index (McFadden R^2) = 0.7450
Chi-square (χ^2) = 31.147
Correctly predicted (Count R^2) = 78.00%
*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

The econometric result shows that the probability of improved income level due to micro-finance intervention is positive and significant. The model predicts 78% of the cases correctly, which is considered as statistically significant. Among the microfinance service variables, appropriateness of time of loan disbursement, utilization of loan for the intended purposes, and loan size affected the probability of incremental income positively and significantly.

Moreover, the availability of land needed for crop production and distances to market center have positive influences on the probability of increased income, which implies positive loan performance in terms of impacting on the well being of the clienteles. These factors are essential for utilization of credit both for production and business undertaking since they serve as complementary factors.

6.4 Marginal Effect Analysis / Sensitivity Analysis

As discussed above, the improvement in income of the sample clienteles was attributed to different factors, the statistically significant ones being loan disbursement time, loan size, loan utilization for the intended purposes, proximity to markets and land availability. The contributions or relevance of these significant factors may not be equally important. Ranking of these variables in terms of their relative importance requires defining a 'typical clientele' in terms of the most frequent values of the explanatory variables, discrete variables and mean values of the continuous variables, included in the model (Gujarati,1995), .

After estimating the parameters β_i in Equation (3) and identifying significant variables, it is possible to know the effect of change in any of the significant explanatory variables on the probabilities of observations belonging to either of the two groups i.e. those with improved income and those without. The marginal contributions of the variables for the logit model are given by Equation (5). The relative importance of quantitative variables can be measured by examining elasticity of the variables that would result from a change in the value of the variables. Thus, elasticities were computed for a typical farmer using the significant quantitative explanatory variables.

Then by taking the mean values of continuous variables, and the most frequent values of discrete variables, values of Z_i and P_i, from equation 1, would be 3.893 and 0.98 respectively. Then the elasticities of P_i with respect to x_{ij} (Equation 5) can easily be computed to determine the relative importance of these variables.

For instance, if the average land holding of the farmers increased by 10%, which is equal to 0.268 ha, the probability of income improvement for a "typical clientele" will be about

0.32%. With a further 20% increase in land holding, which is equal to 0.536 ha, the probability of income improvement for a "typical clientele" will be about 0.58%. The procedure holds true for other significant continuous variables in the model. Therefore, a "typical clientele" of the MFI services would have higher probability of increased income provided that these explanatory variables are set in appropriate combinations. Table 6 summarizes changes in probability levels of the significant continuous variables, with their mean values increased by 10%.

Table 6: Relative Importance of Continuous Significant Variables

Variables	P_{i1}	P_{i2}	ΔP_i (%)	Relative Importance
Average loan size	0.980	0.9883	0.85	1st
Land holding	0.980	0.9831	0.32	2nd
Distance to markets	0.980	0.9826	0.27	3rd

Source: Own computation

In assessing the relative importance of proper utilization of the loan as per the agreement made between the two parties, we use the "with" and "without" approach. Considering the existence of all variables in the model, dummy variables will be given the most frequent value of a discrete variable i.e. 1, and the continuous significant variables will assume their mean values. Accordingly, the value of Zi will be 3.893 and that of P_i is 0.980. The importance of loan utilization for the intended purpose would be observed by assigning a 0 value for this variable while keeping other variables constant. The result shows that at a 0 value of loan utilization, the new P_i will be 0.714 where Zi equals 0.914. A considerable change in probability of improved income is observed due to change in the variable from 0 to 1. Changing the loan utilization variable from 1 to 0 would reduce the probability from 98 % to 71%. This shows that the relative importance of this variable is considerably high. Similarly, it would be possible to identify the relative importance of the remaining significant discrete variables. Table 7 summarizes changes in probability levels of the significant discrete variables using the "with" and "without" approach.

Table 7: Relative Importance of Discrete Significant Variables

Variables	P_{i1}	P_{i2}	ΔP_i (%)	Relative Importance
Utilization of the loan	0.980	0.7138	27.16	1st
Appropriateness of loan disbursement time	0.980	0.7925	19.13	2nd

Source: Own computation

7. CONCLUSIONS AND POLICY IMPLICATIONS

The study confirms the relevance of micro-finance service to improve the economic conditions of the poor by enabling access to rural finance. Among the 100 sample clients of the OCSSCO, Kuyu branch, 86 perceives improvement in their socioeconomic conditions during the five-year client-ship with the MFI. Actual comparison of income during the survey year with the baseline data indicates that improved income level is visible for 70% of the cases. The impact of the micro-finance service is highly observed in terms of increased asset creation, improved nutrition for the family members and household income.

Comparative analysis of the economic variables shows that the income from agriculture and off-farm activities increased over the loan period indicating the opportunities created to increase agricultural productivity and income diversification. The econometrics results indicate that the probability of improved income was affected by the appropriateness of loan disbursement time, loan size, utilization of loan for the intended purposes, proximity to markets and land availability. The policy implications of the results could be the following:

1. Due to seasonality of agricultural production, for which timely procurement of inputs and crop management are crucial, timely provision of rural credit is of paramount importance. Moreover, financial resources needed for small scale enterprises, particularly if needed for purchases of agricultural goods for trading would be affected by time of loan disbursement.

2. Level of capital used determines the economic scale of business transactions. Micro-finance institutions, however, provide small loan size. The econometric result revealed the importance of loan size on economic performance of the clienteles. Hence, considering the nature of the loan and other parameters, it would be of paramount importance to increase loan size and work out business plan.
3. The fact that utilization of loan for intended purposes implies improving business skill and innovativeness of the clienteles, identifying feasible income generation activities and proper business plan for clients would be essential.
4. Land availability is also one factor that contributed to increased income of the households. In case of use of improved agricultural technologies such as crop farming and dairy production, land plays complementary role to the loan disbursed. Assessment of such alternative complementary factors of production would encourage the farmers to seek credit and improve their socio-economic conditions. Provision of loan for agricultural production to farmers facing land shortage should consider possibilities of land transaction.

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INTENSIFICATION AND CROP COMMERCIALIZATION IN NORTHEASTERN ETHIOPIA[1]

Workineh Negatu[2]

Abstract

Due to low farm production and productivity the majority of subsistence farmers in Ethiopia are not self-sufficient in food, and deliver meager amounts of farm output to consumers and agro-processing industries. Agricultural growth, an important pathway to food security, is realized through increases in per capita farm endowments (physical and financial assets and resources) and adoption of appropriate and proven technology and requires a transformation out of the semi-subsistence, low-input and low-productivity agriculture into a high productivity commercial agriculture.

This article investigates farm commercialization from two perspectives - output-oriented and input-oriented farm commercialization. Logistic model was applied to examine factors of commercial participation and use of chemical fertilizer, while Cob Douglass production function was employed for the analysis of production determinants. The data used for the analysis was collected from farm households sampled from communities in Northeastern Ethiopia.

The regression analysis of commercialization asserts that lack of market access (measured by distance) and engagement in livestock and off-farm employment significantly and negatively impact food crop commercialization. Total food crop production has been found to impress a strong and significant effect on commercialization. The production analysis indicated that farm size operated and technology (chemical fertilizer) are the most important production factors under the context of the study areas. Results of estimation of fertilizer use show the important and positive role of access to oxen and credit, and size of operated farm.

The findings of the study generally imply the need for rationalization of policies and institutions in order to create incentives and rules that promote land transaction and markets for credit, product and input.

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[2]

1. INTRODUCTION

Ethiopia's economy is primarily based on agriculture, accounting for 50 % of GDP employing 85 % of its labor and 90 % of total foreign exchange earnings. According to CSA (2002) 10,738,000 small farm households cultivated 9,133,510 ha. in 1999/2000 comprised of 93 % annuals, the rest permanent crops, at average area of 0.79 ha./household. About 95 % of cultivated land is under smallholder agriculture, the rest under state and commercial farms. Ethiopia's food security and agricultural development are thus highly dependent on the performance and development of smallholder farming systems. Cereals occupy more than 70 % of cultivated land and are the main staple foods in Ethiopia.

At the level of developing countries, about 440 million farmers still practice mainly subsistence agriculture, and subsistence crops cover more than 50 percent of cultivated land in the majority of low-income countries (von Braun and Kennedy, 1994). Ethiopian small farm holders who produce more than 90 % of agricultural production of the country are by and large subsistence producers. It is estimated that only 20 % of smallholder production goes to markets, mostly by a small percentage of farmers with access and means. Smallholders in the highlands of central and northern Ethiopia in particular produce mainly food crops, and for the most part are not involved in conventional cash crops (coffee, cotton, sugar cane, groundnuts, and vegetables)[3].

Due to low farm production and productivity, majority of subsistence farmers are not even self-sufficient in food, and deliver meager amounts of farm output to consumers and agro-processing industries (markets).

Intensification, an important mechanism for transforming subsistence smallholder farms into economically viable and commercially oriented farming units (Hinderink and Sterkenburg, 1987; von Braun and Kennedy, 1994; Pender, Place and Ehui, 1999), is at low level in Ethiopia. For example, on average, cereals yield 12 qt[4]. per hectare and pulses about 9 qt per hectare, both very low by world standards[5].

[3] Farmers in southern, western and eastern low lands and mid-altitudes of the country are engaged considerably in the production of cash crops, particularly coffee, and in livestock and livestock products.
[4] 10 qt. = one metric ton
[5] For instance, the 2000 average per hectare yields of teff (*Teff eragrostis*), sorghum, maize, wheat and barley, the five major crops in the country in terms of area allocated to their production, are 7.96 qt, 11.54

The basic research question of this paper are thus what constrains small farm households from pursuing an outward-looking market orientation, producing surplus over and above their consumption requirements, or from devoting land and labor to cash crop cultivation.

This paper attempts to show: (i) determinants of food crop commercialization, and (ii) farm input intensification; and (iii) combined with the former, the contribution of resource access and technology to agricultural output, hence marketed surplus.

2. FARM COMMERCIALIZATION PERSPECTIVES

Food security is a key policy objective in Ethiopia's social and economic development strategy (FDRE, 2001). Agricultural growth, an important pathway to food security[6], is realized through increases in per capita farm endowments (physical and financial assets and resources) and adoption of appropriate and proven technology (Hayami, 2001) and requires a transformation out of the semi-subsistence, low-input and low-productivity agriculture into a high productivity commercial agriculture. Given population growth and limits of area expansion, yield growth and market oriented patterns of crop production (commercialization) are prerequisites to agricultural economic growth (Strasberg et. al.1999). Commercialization, along with specialization, intensification and development of markets and trade, are fundamental building blocks for achieving economic growth. (von Braun and Kennedy, 1994).

However, the sale of incidental surpluses does not transform farming units automatically into commercial farms (Hinderink and Sterkenburg, 1987). Commercial farming involves also profit and loss accounting in financial terms, and a wage earning labor system (Carpenter 1971 as cited in Hinderink and Sterkenburg, 1987). Practical achievement of marketed surplus and commercialization thus include indicators of effective market participation: gross value of sales; importance of purchased inputs; share of hired labor as a percentage of total labor; time spent on

qt., 18.25 qt., 13.79 qt. and 10.82 qt., respectively (CSA, 2002). The world average per hectare yields of wheat, maize, barley and sorghum in 2000 are 27.189qt, 42.880 qt., 24.419qt and 13.679qt.respectively, while the average yields of the same crops for Africa are 17.805 qt, 17.246qt., 5.096qt and 8.791qt. in that order (http://faostat.fao.org).

[6] Food importation at the national level through expanded growth in international trade, or food purchase at the household level through expanded income, are other important pathways.

growing cash crops versus crops for self consumption; and, acreage planted with crops for sale as a percentage of total cultivated area (Hinderink and Sterkenburg, 1987).

Hinderink and Sterkenburg (1987) distinguished between three perspectives of farm commercialization:

(i) Economic-technocratic perspective: emphasizes economic and technical measures of increasing productivity and production for the market, where commercialization is tightly associated with modernization, and technology and market development are key determinants of agricultural transformation. Development is seen as a uni-linear process in which agricultural development in developing countries must follow the path of developed economies. The role of green revolution technologies is emphasized and combined with integrated rural development to remove institutional and infrastructural bottlenecks for market penetration.

(ii) Psychological-cultural perspective: attitudes, motivation and other farmer behavior are emphasized. According to Rogers (1970, cited in Hinderink and Sterkenburg, 1987), subsistence farmers: are inclined toward mistrust which negatively affects cooperation and organization beyond the family circle; lack interest in innovations; are fatalistic, village centered, and not very individualistic; have low level of aspiration; limited attention for the future; and have little inclination to save and invest. Less commercialized communities are isolated vis a vis the outside world which negatively affects specialization of production, trade, technological innovation and social change. The hierarchical authority structure and the subordination of individuals to community interests prevail over personal contractual relationships and economic decisions. Social controls limit the already limited choice of subsistence farmers in land use, cropping patterns and production technology (Abercrombie 1961 cited in Hinderink and Sterkenburg, 1987).

(iii) *Political-economic perspective*: political context and the nature of power relations at various geographical scales motivates the choice of economic system and the degree of integration into the global economic system. Agricultural commercialization contributes to development, but only when accompanied or preceded by structural change at various geographical scales. The political-economic and institutional context is proposed as a major sphere explaining longitudinal and spatial differences

in socioeconomic development. Spatial differentiation is related to the intensity of market integration, interpreted as a process of structural change from subsistence to market economy. Four aspects of market integration are identified: increasing importance of wage labor, growing crops for sale, markets developed for consumer goods and production inputs, and purchase of consumer goods and services (Dietz and Van Haastrecht, 1982 in Hinderink and Sterkenburg, 1987)

Each perspective plays a partial role in explaining agricultural commercialization in Ethiopia. Agricultural commercialization cannot be understood without taking into account the socio-cultural, political-institutional and economic-technical contexts that condition the nature of capital formation, the organization of production, technological changes and crops grown. For purposes of this study, the definition of Hinderink and Sterkenburg (1987:19) is used: agricultural commercialization involves "deliberate action on the part of agricultural producers - of their own free will or by means of coercion - to use the land, labor, implements and annual inputs (owned, purchased, hired, borrowed, obtained on credit or through customary arrangements - reciprocal or not) in such a way that a greater or smaller part of crops produced and /or animals raised is for exchange or sale".

Von Braun and Kennedy (1994) argue that one of the main reasons for the choice of subsistence production over commercial production in Sub-Saharan Africa is that own-production of food is a response to high transaction costs and risks related to production, markets, and employment. Subsistence production can largely be viewed as an insurance policy of farm households in response to risky income and market environment. Because subsistence farmers devote their time and land resources largely to own farm production, mechanisms that increase farm output impact food security in two ways: (i) directly increasing food availability and (ii) promoting production for market that increases cash income to enable food purchase. This second path is made possible by enhancing cash crop production and marketable food crops and livestock products. In addition, off-farm income, if accessible, augments household income and purchasing power. The commercialization pathway is dependent off course on local comparative advantages in agricultural potential, population density (demand) and market access (Pender et al., 1999).

However poor, risk-averse farmers with little land and resources are usually reluctant to gamble on new and highly risky crops, regardless of their potential profitability, unless their food security is first assured (von Braun et. al., 1991). Holden and Hailu

(2002) in their empirical study in southern Ethiopia conclude that poverty and subsistence constraints undermine the ability to intensify production through the purchase of farm inputs or the planting of perennial cash trees. Adewumi and Omereshi (2002), based on their study of 291 sample farm households in Kwara state of Nigeria, conclude that meeting food requirement is the primary objective of farming households even prior to maximizing gross margin. Farming households there view agricultural activities as a personal non-monetary need first and an income need only second (ibid). Notwithstanding the importance of self-sufficiency in the psychic of poor farmers, Dembele et al (2003) in assessing the commercialization of cereals in Mali after the 1980 market reform observed that cereal commercialization was enhanced by use of productivity increasing inputs and technologies, and that commercialization varied by farm size, crop type and type of farming.

Recent studies (Von Braun and Kennedy, 1994; Strasberg et. al., 1999) show that the conclusion sometimes made in the literature that commercialization has a negative effect on food crop production and nutrition is flawed. Von Braun and Kennedy (1994) observe that improved technology helps subsistence farmers to commercialize in low-risk ways; commercialization of agriculture entails a substantial expansion of demand for hired labor; and, commercialization contributes to food security via increased income and food availability. Although commercialization of agriculture is generally a matter of stimulated private-sector activity, they also argue that public action in Sub-Saharan Africa is crucial to facilitate the power of its driving forces - macro economic and trade policy, market reform, rural infrastructure improvement, and the development of legal and contractual rules under which farmers, traders and processors operate.

3. DATA AND EMPIRICAL MODEL

Data for this study were collected from 420 randomly selected farm households in Bati, Jamma, Dessie-Zuria, and Legambo woredas (districts) in Ethiopia by BASIS-CRSP project in 2000 and 2001.

Regarding the analytical models, let production (Y) be determined by the relation Y = f{A, L, K, T} where A is land, L is labor, K is capital, and T is technology. Consumption (C) is determined by household size in adult-equivalent consuming units (CU) and

investment (I) made on non-consumption expenditures, i.e. C= f (CU, I). Fertilizer and improved seeds, depicted by technology, T, represent an input-oriented measure of farm commercialization. Marketed surplus (MS), defined as MS = Y-C, is an output-oriented measure of farm commercialization measured in this study via two constructs: percentage of farm households who participate in food crop marketing (Commercialization Participation, CP), and the ratio of total quantity of food (cereals, pulses and oil seeds crops) sold relative to total output produced (Commercialization index, CI).

As indicated in Table 1, except for Jamma farmers whose participation in marketing declined, the participation of farmers (CP) in other *woredas* increased in 2001/02 compared to 2000/01 (36.2 % to 51.1 %), due to better rainfall distribution. The commercialization index (CI), however, remained relatively static, and is generally low for all woredas. Jamma farmers who sold the highest proportion (CI-0.13) of food produced in 2000/01 sold a lower proportion (CI=0.07) in 2001/02 due to frost in the area, while CI in Dessie-Zuria and Legambo showed a slight increase. CP however showed considerable variability across woredas, hence was chosen as the output-oriented indicator of commercialization in the multivariate analysis that follows.

Table 1: Farmer Participation in Food Grain Marketing and Commercialization Index

Year	Item	Bati	Jamma	Dessie-zuria	Legambo	All *woredas*
2000/01	Commercial Participation (CP), %	34.9	60.4	24.7	20.5	36.2
	Commercialization Index (CI)	0.06 (0.14)	0.13 (0.16)	0.07 (0.17)	0.07 (0.17)	0.08 (0.16)
	N	106	106	97	83	392
20001/02	Commercial Participation (CP), %	35.8	48.5	58.8	62.1	51.1
	Commercialization index (CI)	0.05 (0.10)	0.05 (0.10)	0.10 (0.13)	0.10 (0.13)	0.08 (0.11)
	N	106	103	97	103	409

Source: BASIS-Ethiopia survey data. N= Number of respondents. Figures in parentheses are standard deviations.

Agricultural technology (T) - chemical fertilizer and improved seeds - plays an important role in commercialization, via their purchase from markets or government sales depots. Their adoption is generally influenced by size of farm holding, credit access, educational level of household members and agroecology. For the multivariate analysis of participation in input-oriented commercialization and adoption of agricultural technology, a logit model was employed based on the functional form in equation (1) (Maddala, 1992):

$$\log [p_{i} / (1-p)] \approx \beta_{o} + \sum_{j=1}^{k} \beta_{j} x_{ij} \qquad \textbf{(1)}$$

Where, log $[p_{i/(1-P)}]$ is log of odds ratio, β_o is constant term, β_j are coefficients, and x is independent variables. The dependent variable (log-odd ratio) is the natural logarithm of the ratio of the probability that the i-th farmer participates in food crop commercialization (or adopts technology) to the probability that the i-th farmer does not (1-p).

Neo-classic economic theory informs us that land, labor and capital are the basic factors of production. Recent theory (Ray, 1998) explains that in addition to these conventional factors, technology and human capital play crucial roles in transforming agricultural production by helping to accelerate partial and total factor productivity. The relationship of these factors to determination of agricultural output in the Ethiopian highlands is examined in this analysis by employing the Cobb-Douglas function in equation (2):

$$Q = aX_1^b X_2^c X_3^d --- X_n^m \qquad \textbf{(2)}$$

where, Q is food production, X_n refers to n-th factor of production, and b, c, d …… m are factor elasticities associated with the possible influencing variables. See Table 2 for variable names and definitions, and Appendix 1 for descriptive statistics. A priori expectation of the influence of explanatory variables on farm output follows.

*Market distance i*s used as a proxy for market access, as remote villages are exposed to poor road and telecommunication infrastructure and high transportation costs. Farmers nearer to market towns are expected to have higher participation in food crop marketing and technology adoption because transport and information costs increase with distance.

Table 2: Names, Definitions and Measures of Explanatory Variables

Variable name	Definition	Measure
Head's gender [SEX3]	Gender of household head	1=male, 0= female
Consuming units [AE_CU_4]	Household size in adult-equivalent consuming units	Number of consuming units
Labor units [AE_LU_4]	Household labor in adult-equivalent labor units	Number of labor units
Agro-ecology [jamadumy]	Agro-ecological zone of the village in which the household resides and farms	1=Jamma woreda, 0= other woredas
Livestock-TLU [LIV_TLU4]	Livestock size (excluding oxen)	Tropical livestock units (TLU)
Land operated [LA_OP45]	Total farm size operated during 2001/02 cropping year (*belg+meher* seasons)	Hectares
Oxen [OXENOWE3]	Number of oxen owned	Count
Head's education [EDULEVE2]	Educational status of household head	0=non-literate, 1=read and write, 2= primary school, 3=post-secondary school
Head's literacy [LITRAT2]	Literacy status of household head	1=literate 0=non-literate
Market distance [DISMARK]	Distance to main market place	Minutes to walk
Credit [CREDIT_2]	Value of credit received	Birr
Food crop output [C_OUTPU2]	Total food crop output	Kg.
Non-farm income [NFI_YR2A]	Non-farm income (business and wage employment income)	Birr
Head's age [AGE_RND3]	Age of household head	Years

Note: Numbers in variable names indicate year or survey round.

Agro-ecology affects commercialization of food crops and input procurements through locational factors, but also indirectly affects technology choice and application (chemical fertilizer and improved seeds) through biophysical interactions. Jamma woreda is agro-ecologically suited for crop farming because it is endowed with relatively better rainfall, soil, temperature, and topography (flat) that enable superior yield responsiveness of modern inputs compared with other study sites.

Food crop production, the total production of cereals, pulses and oilseeds, is taken as a measure of aggregate food output (Q). All else constant, an increase in food crop production either decreases the food gap between own-production and consumption within the household, or increases food grain surplus for sale to outside markets.

*Oxen***:** as the major source of traction power and an important capital asset, is expected to influence farm production positively by enabling farmers to accomplish seedbed preparation and seed covering on time and thoroughly, thus facilitating the use of other complementary technological inputs such as fertilizer and improved seeds.

Non-oxen livestock holding, measured in Tropical Livestock Units (TLU)[7] is taken to measures livestock wealth, the principal asset in the Ethiopia's highlands. Livestock activities compete with crop production for labor and other resources in ways that negatively affect food crop commercialization. Animal manure is also a substitute for fertilizer if widely and substantially applied on farmers' fields. But, income generated by livestock activities could also be used for the purchase of inputs that benefit crop-oriented and input-oriented commercialization positively.

Operated farm size[8]*:* is hypothesized to affect food production and technology adoption positively. As landholding size in the Ethiopian smallholder sector is very small, even a slight increase in farm size operated can be expected to substantially increase household food production and hence marketed surplus.

Household consumption, approximated by household family size in terms of standard adult-equivalent consuming units[9], is expected to negatively affect crop commercialization through three mechanisms: a) household labor time for crop production is decreased because of demands for household maintenance and reproduction; b) increased food demand derived from more mouths to feed; and c)

[7] Tropical livestock unit is calculated as 1.00 for a cow, 0.60 for heifer or young bull, 0.10 for calf, 1.43 for a camel, 0.80 for a horse, 0.70 for a mule, 0.50 for a donkey, 0.10 for a goat or sheep, and 0.01 for a chicken.

[8] Operated farm is land cultivated that includes own farmland held and land obtained in cash renting (rented-in) or in share cropping (shared-in) from other farm landholders. Leased-out farmland includes farm parcels rented-out on cash or shared-out in sharecropping arrangement to other farmers.

[9] Male (female) less than 1 year of age are assigned a weight of 0.3 (0.3), ages 1-6 a weight of 0.5 (0.5), ages 7-13 a weight of 0.7 (0.7), ages 14-19 a weight of 0.9 (0.9), ages 20—59 a weight of 1 (0.9), and ages greater than 59 a weight of 0.9 (0.7), respectively (source?)

decreased labor productivity in the event that low consumption for poor households erodes human nutrition.

Household labor refers to the number of adult-equivalent labor units[10] within the household. For a high land/labor ratio, a positive effect on total food production would be expected, but the effect would tend to converge toward a small, minimum subsistence wage (reflecting a flattening of marginal labor productivity) as the land/labor ratio grows tight under conditions of high land use pressure.

Age of household head is used as proxy for management experience. It is expected to influence production and technology adoption positively during the most productive working years, then decline as labor productivity falls toward retirement.

Literacy of household head measured by educational level is assumed to positively influence commercialization as literate or educated farmers tend to have better access to extension service and advice of local development agents, and make better use of internalizing that information.

Chemical fertilizer, the amount of chemical fertilizer (Di-Ammonium Phosphate (DAP) plus Urea) applied by a farm household for food crops is expected to increase food production, given certain preconditions (timely application, sufficient soil moisture, favorable climate).

Off-farm income, including business and wage employment, theoretically could affect commercialization and adoption of technology either positively by easing cash liquidity constraints that impede the purchase of modern inputs, or negatively by competing with crop production for a limited supply of labor within the household.[11]

Credit. Cash credit augments the household budget constraint enabling farmers to purchase (or expand their purchase of) farm inputs, in particular fertilizer and seeds that would enhance farm productivity.

[10] Coefficient for converting household labor into adult-equivalent standard labor units were as follows: for a male (female) less than 8 years of age 0.00 (0.00), 0.50 (0.50) for ages 8-14, 1.00 (0.70) for ages 15-65, 0.50 (0.35) for ages 66-75), and 0.00 (0.00) for ages above 75.

[11] The robustness of labor rental markets in rural areas is a critical conditioning factor, as hired labor if available could help augment a binding household labor constraint.

4. REGRESSION RESULTS

4.1 Food Crop Commercialization

The regression results in Table 3 seek to identify the main determinants of food crop-oriented commercialization. Results show that distance to main market is negatively and significantly related with participation in food crop commercialization as expected. An increase in market distance by 1 minute is predicted to decrease market participation by about 0.06 % (1- 0.994). Non-farm income is also negatively related to food crop commercialization. As non-farm income increases by 1 Birr, odds of market participation decline by 0.001 %, as non-farm income activities compete with crop farming for labor and other resources. It is also common observation that farmers who are not well endowed with farm resources and production capacity, resort to low-paying non-farm activities, in particular petty trading and selling of firewood.

Table 3: Logit Regression Estimates for Farmers' Participation in Food Crop Marketing in South Wollo, Ethiopia, 2001/02 Cropping Year

Variable	B	S.E.	Wald	Exp(B)
Market distance	-0.006	0.002	7.966***	.994
Head's gender	0.254	0.268	0.895	1.289
Head's age	0.007	0.008	0.930	1.007
Consuming units	-0.032	0.080	0.155	.969
Non-oxen-livestock	-0.168	0.057	8.712***	.845
Non-farm income	-0.001	0.000	10.634***	.999
Food crop output	0.001	0.000	13.506***	1.001
Head's literacy	0.409	0.250	2.679*	1.505
Constant	-0.108	0.683	0.025	.897

Dependent variable: Participation in food crop marketing (commercialization), 1=participant, and 0 = non-participant

Note: Exp(B) shows the predicted change in odds for a unit increase in the predictor.

Omnibus tests of model coefficients: Chi-square= 51.083; df. = 8; sig. level = 1 %

Cox and Snell R^2 = 11.9 %; Nagelekerke R^2 = 15.9; percentage of correct prediction: 66.2 %; N included: 402 (95.7 %); *** = sig. at 1%; * = sig. at 10 %

Livestock holding (excluding oxen) is also negatively related with crop-oriented commercialization. An increase in one TLU results in a decline in the odds of market

participation by 15.5 %, due to competition between livestock activities and crop farming for labor and other resources. Crop output, however has a significant and positive impact on food crop commercialization. As crop output increases by one unit, the odds of market participation increases by 100 %.

The regression analysis also shows the positive and significant (at about 10 % level) relation of literacy and participation in commercialization of food crops. Farm households with better education level seem to be keen to participate in food crop marketing. The education effect could be direct (market-orientation) or indirect via better production skill and knowledge. Household size measured in adult-equivalent consuming units, which reflects household subsistence needs, is negatively related with participation in food crop commercialization. The negative sign suggests that households with large family size are forced to consume much or all of their production, supplying an insignificant amount or none for market, but the finding is not statistically significant. Neither gender nor age shows any significant impact on market participation.

In short, the regression analysis confirms that lack of market access (measured by distance) and engagement in livestock and off-farm employment significantly and negatively impact food crop commercialization. Literacy and total food crop production play a positive role, but only the latter has a strong significant effect. The logical question is therefore what determines food crop production in ways that stimulate marketed surplus, the focus of the next section.

4.2 Determinants Food Crop Production

Results of the Cobb-Douglass production function estimation are shown in Table 4. The empirical model (F-value=3.865, sig. level=1 %) estimated coefficients of farm size operated, household labor, age of household head (proxy for knowledge, skill and experience), oxen owned, fertilizer used, and cash credit received. Beta coefficients in the model are elasticities reflecting the percentage change in output resulting from a percentage change in input use.

As Table 4 shows, land size operated is highly significant with an elasticity of 0.518. A doubling of the present size of land operated (mean size=1.46 ha.) would result in an increase of food production by 51.8 %, other factors remaining the same. The

coefficient for chemical fertilizer[12] is also significant and implies that doubling of the current level of fertilizer application would result in an increase in food production by 35.5 %. As the average amount of fertilizer used in the study areas is small (20.87 kg. per household, as shown in appendix 1), there are sizable output gains to be made from expanded fertilizer application. The result for oxen however is not statistically significant, suggesting the social capital is enabling oxen-less households to borrow or rent oxen in ways that prevent yield-deterioration.

Table 4: Cobb-Douglass Estimation of Food Crop Production in South Wollo

Variable	B	Std. Error	Beta	t-value
(Constant)	8.504	1.259		6.757
log of household labor	-0.0558	0.228	-0.038	0.245
log of oxen owned	0.233	0.219	0.149	1.062
log of land operated	0.518	0.215	0.377	2.406**
log of credit received	-0.124	0.098	-0.199	1.262
log of head's age	-0.755	0.276	-0.378	2.738**
log of fertilizer (DAP+Urea)	0.355	0.148	0.387	2.391**

Dependent Variable: log of food crop production; ** = sig. at 5 % level

Age of household head is negatively related to food production. This could be due to the better educational level of younger farmers; a bivariate statistical association test has shown that more of younger household heads are literate, while most of older farmers are non-literate. The credit coefficient in the regression is insignificant and negative, which is consistent with Damite and Negatu (2004) findings that the small cash credit obtained by farmers is used for smoothing consumption of food-short households. Household labor is negative but highly insignificant. This negative relation, though statistically insignificant, could be probably due to larger size of family labor in relation to other factors of production.

In sum, farm size operated and technology (chemical fertilizer) are found to be the most important factors of production under the context of the South Wollo in the 2001/02 cropping year. Policies and institutions that facilitate access to farmland (in particular via land rentals and sharecropping) require attention, particularly in

[12] In the production function improved seeds and fertilizer were tested and found to show a high level of co-linearity problem, and thus excluded.

situation where land underutilization is evident. Similarly, one has to focus on policy and institutions that promote technological change in smallholder agriculture. The next section deals with the adoption patterns and constraints of agricultural technology, particularly chemical fertilizer in the study area.

4.3 Farm Input Intensification

Smallholder farming households in the study *woredas* use limited chemical fertilizer, improved seeds, herbicides, insecticides, and farm implements. Chemical fertilizers are applied mainly to cereals, but its application to pulses and other crops is not common (Demeke et al., 1997). Improved seeds and chemical fertilizer are the dominant improved technologies used by farmers in the study areas (see Appendix 2 for the percentage of users of improved seeds and fertilizers). Maize and wheat are the main crops for which improved seeds are extensively promoted, the rest benefiting less from improved seed technology. Both a greater proportion of farmers and the average amount of seeds and chemical fertilizer applied in Jamma woreda are greater than in the other study woredas in 2000/01 and 2001/02. Bati farmers use the least improved seeds and chemical fertilizer both in terms of average amount of inputs used and percentage of users. However, a higher proportion of Bati farmers apply manure, and rates of manure application are the highest in Bati, compared with other study woredas.

The results of the regression estimation of fertilizer use are shown in Table 5. Regression estimation was also carried out for Jamma, a study woreda in which the highest proportion of farmers use chemical fertilizer (Appendix Table 1), for more insights.

The regression results show that operated farm size has a positive and statistically significant impact on fertilizer use in both South Wollo and Jamma woreda. A unit change in size of farm operated entails more than two and half times and eight times higher chance to use chemical fertilizer in South Wollo and Jamma, respectively. This could be due to economies of scale, for fertilizer transaction cost per unit of operated land is lower for larger farms. Also larger farms often have greater influence (social capital) on personnel involved in fertilizer distribution.

Table 5: Logit Regression Estimation of Use of Chemical Fertilizer in South Wollo

Variable	South Wollo (All Study woreda)				Jamma woreda			
	B	S.E.	Wald	Exp(B)	B	S.E.	Wald	Exp(B)
Market distance	.007	.007	.944	1.007	-.016	.011	2.026	.985
Head's age	.003	.015	.037	1.003	-.008	.020	.149	.992
Labor units	.071	.222	.103	1.074	.124	.369	.112	1.131
Farm size operated	.974	.351	7.686***	2.648	2.147	.750	8.202***	8.557
Soil quality	.860	.502	2.934*	2.363	1.499	.746	4.033**	4.477
Oxen	1.482	.448	10.942***	4.400	1.649	.677	5.931**	5.203
Non-oxen livestock, TLU	-.344	.140	6.070**	.709	-.512	.220	5.432**	.599
Non-farm income	-.001	.001	1.333	.999	-.002	.002	.852	.998
Credit	.003	.001	9.668***	1.003	.003	.002	2.375	1.003
Head's literacy	.877	.542	2.615	2.403	1.221	.745	2.684	3.390
Jamma-dummy	5.995	.981	37.361***	401.426	-	-	-	-
Constant	-10.665	2.072	26.492	.000	-3.355	2.344	2.050	.035

Dependent variable: use of chemical fertilizer (DAP and/or urea), 1=user, 0 = non-user

Note: Exp(B) shows the predicted change in odds for a unit increase in the predictor.

Omnibus tests of model coefficients for all woreda (South Wollo): Chi-square= 229.679; df. = 11; sig. level= 1 %

Cox and Snell R^2 = 43.6 %; Nagelkerke R^2 =74.6 %; Percentage of correct prediction: 95.5 %; N included: 401 (95.5%).

Omnibus tests of model coefficients for all Jamma woreda: Chi-square= 70.465; df. = 10; sig. level= 1 %

Cox and Snell R^2 = 51.3 %; Nagelkerke R^2 =69.0 %; Percentage of correct prediction: 86.7 %; N included: 98 (94.2 %).

*** =sig. at 1 % level; ** = sig. at 5% level; * = sig. at 10 %

Fertility status of soil, traditionally measured as low fertility (*tuff*), medium fertility (*lem-tuff*) and high fertility (*lem*), also has a role in the decision of whether and how much fertilizer to use. Findings of the regression analysis show that farm households with better soil quality tend to use chemical fertilizer. Soil quality is positively induced by the application of organic manure, rotation and residual fertilizer carry-over. Landscape may also affect soil fertility via its effect on erosion. A change in soil quality towards better level in South Wollo and Jamma woreda results in the increase of odds of applying fertilizer by 2 times and four and half times respectively, other factors remaining constant. These results are consistent with the findings for

agroecology, as proxied by the Jamma dummy variable, which also shows a positive and significant effect on fertilizer use. This could be probably better quality soils respond to chemical fertilizer better than poor quality soils, for good quality soils have better organic matter that enhances the productivity impact of chemical fertilizer.

Increasing oxen holdings by one unit increases the odds of using fertilizer in South Wollo and Jamma by more than four times and five times, respectively, other factors remaining unchanged. Oxen power is a critical production factor for small farm holders (Negatu, 2004). The relationship between livestock holding (excluding oxen) and fertilizer use is found to be negative and significant in both South Wollo and Jamma. An increase in one TLU in South Wollo and Jamma, other factors remaining constant, reduces the odds of applying chemical fertilizer by 29.1 % and 40.1 %, respectively, reflecting both competition for household labor, and substitution effects between manure and fertilizer need.

An increase in the credit received in one unit would increase the chance of applying fertilizer in South Wollo by 100 %. In Jamma, credit coefficient is positive but not significant at 10 %. The results indicate in general the importance of credit in improving farmers' access to chemical fertilizer.
The fertilizer adoption estimation results in general imply the need and importance of policies and institutions that promote farmers' access to oxen, that increase size of operated farm, and access to credit. The results imply also the need of agricultural diversification through promoting food crops production in agro-ecologically suitable areas like Jamma and non-staple food crops and off-farm activities in agriculturally less suitable agro-ecological areas like Bati (Kola agroecology) and Legambo (Wurch agroecology) areas.[13]

6. SIZE OF OPERATED FARMS AND SMALLHOLDER FARMING SYSTEMS

As observed in the above analyses, size of operated household farm is a key factor of production, technology adoption and commercialization under Ethiopian rural context. Households in the study areas can be categorized into three farm size groups: (i)

[13] *Kola*, is an agroecology characterized with high temperature, lowland and semi-arid conditions, while W*urch* is an agroecology with low temperature, highland and sub-moist conditions.

small size farm size, 0.50 ha and less; (ii) medium size farm, 0.51 ha - 2.0 ha., and; (iii) large size farm, above 2.0 ha. The role of size of operated farms can also be demonstrated in terms of its association with technology use, soil quality, manure use, and commercialization (Table 6). As shown in the table, large size farm holders are significant users of fertilizer, improved seeds and manure, and they commercialize the largest proportion of food crop produced compared to medium and small size farm holders. Thus, size of operated farm is a crucial factor in the intensification and commercialization of smallholder farming systems in Ethiopia. For a farm household to be sustainably food secure and user of modern improved productive technologies, consolidation of small and fragmented holdings into larger and viable size is therefore essential. This has a clear implication on policies and institutions required to ensure a long-term and secure marketing of land-lease holdings.

Table 6: Distribution of improved seeds, chemical fertilizer, manure, soil quality and commercialization by operated farm size groups

Item	Small farm	Medium farm	Large farm	F-value
Fertilizer, kg.	1.41 (11.868)	23.69 (59.472	27.83 (62.898	5.530***
Improved seeds, kg.	.00 (0.000)	.42 (3.772	2.67 (13.690)	3.940**
Manure use, kg.	16.972 (80.194	74.66 (151.583)	140.92 (278.429)	9.985***
Soil quality index	2.19 (0.595)	2.15 (0.478	2.17 (0.475)	0.247
Commercialization index (CI)	.06 (0.095)	.08 (0.112	.10 (0.129	3.428**

Note: *** =sig. at 1 %; ** = sig. at 5 %

7. SUMMARY AND CONCLUDING REMARKS

Commercialization of farm production is considered as an important strategy of transforming low productivity subsistence production of small farm holders into surplus - and market-oriented production systems. Data from the study areas of South Wollo in Northeastern Amhara region reveals that the amount of marketed food crops is substantially low (8 % of the total produced food crops). In terms of

participation in food crop marketing, commercialization ranges from 36 % in poor cropping year (2000) to 51 % in relatively better cropping year (2001).

Access to marketplace (physical proximity) has been found to significantly affect farmers' commercial participation. Farm households nearer to market participate in food marketing than those far from market place. In the absence of means of transportation, farmers walk to market, in which case long distances to market play a disincentive to marketing. The importance of local and federal governments' efforts to improve roads and transportation services and market infrastructure is clear in stimulating participation of smallholders in marketing. Institutions and policies that encourage private investment in transportation service are also of a paramount importance. Marketing cooperatives would also have important role in facilitating input and output marketing.

Above all, the study asserts the major importance of surplus production or increased production in stimulating participation in food marketing. Enhanced food production is a very critical factor in promoting farm commercialization as also repeatedly indicated in various studies (see section 2). This warrants the need of investigating factors that determine food production. The Cobb-Douglas model estimation of food production clearly showed that size of farm cultivated with food crops and fertilizer are the most important and significant factors that determine food production. Since improved seed and fertilizer are highly co-linear in application, the findings underscore the importance of markets and service delivery in multiple inputs. This result implies the need for forging appropriate policies that promote land mobility (marketing) in order to create conditions for increasing farm land operated by efficient farmers, by rationalizing the existing leasehold marketing and improving tenure security through efficient land institutions. This accompanied with aggressive technological change in smallholder farming through availability and accessibility of appropriate technologies like chemical fertilizer complemented with improved seeds and water irrigation (wherever necessary and feasible) is necessary to enhance the production side of farm commercialization. Technological change accompanied by change in human capital is a fundamental force to bring the anticipated production increase and farm commercialization.

In connection with this finding, the study attempted also to examine the pattern and constraints of fertilizer use in smallholder farming systems in South Wollo. According to this study, oxen holding, farm size and credit are the most important positive

factors. Associated with larger farm size are benefits from economies of scale. As fertilizer is an expensive input for smallholders, the positive role of credit and the importance of strengthening credit service are clear. On the other hand, the study shows that applying fertilizer is feasible for farming located in suitable agro-ecology like Jamma compared to other case areas (e.g. Bati, Legambo). In agro-ecologies that are not suitable for agriculture, other options like non-farm income activities and animal farming are worth considering (Little et al, 2006).

Overall, rationalizing the existing land tenure policies and institutions in such a way to enhance production, technological change and commercialization is an important step that needs consideration by regional and federal governments. In connection with this, agricultural planning that prioritizes agro-ecologies for different agricultural and non-agricultural activities would be helpful.

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Appendix 1: Descriptive Statistics of Major Variables, 2001/02 cropping year

	N	Minimum	Maximum	Mean	Std. Deviation
Distance to Main Market, minutes	420	4.00	300.00	99.7512	50.60825
Age of household head	420	10.00	91.00	47.7024	15.45119
HH Labor (Adult Equivalent)	420	.00	8.40	2.8363	1.26923
HH Size (Adult-equivalent consuming units)	420	.70	10.70	4.1317	1.62785
Total operational holding (ha.)	420	.00	4.63	1.4644	.98205
Livestock ownership other than oxen (TLU)	420	.00	24.35	2.0411	2.52907
No. of Oxen Owned	420	.00	5.00	.7429	.86600
Improved seed used, kg.	420	.00	95.00	.9114	7.48626
Non-farm Income (revenue from own business plus wage labor employment), Birr	420	.00	4729.00	381.8412	710.82177
Total Farm cash income, Birr	414	.00	5440.00	595.6344	656.13704
Cash credit received, Birr	420	.00	2422.00	98.2307	230.87015
Total food crop production, kg.	411	.00	89508.00	967.1607	4418.89306
Fertilizer (Dap+urea) applied	420	.00	400.00	20.8667	55.75091

Appendix 2: Amount and user percentage technological inputs in 2000/01 and 2001/02 cropping years

Technological input	Woreda	N	2001/02 cropping year		2000/01 cropping year	
			Mean	Number of users (%)	Mean	Number of users
Fertilizer, kg.	Bati	110	0.00 (0.000)	0 (0.00)	0.51 (3.397)	3(2.73)
	Jamma	104	80.90 (87.271)	62 (59.62)	87.60 (76.837)	73(70.19)
	Dessie zuria	100	3.50 (13.771)	8 (8.00)	8.83 (20.199)	24 (24.00)
	Legambo	106	0.00 (0.000)	0 (0.00)	2.90 (12.214)	6(5.68)
	Total	420	20.87 (55.751)	70 (16.67)	24.66 (53.888)	106(25.24)
Improved Seed, kg.	Bati	110	0.00 (0.00)	(0.00)	0.71 (4.532)	6(5.45)
	Jamma	104	3.20 (14.454)	7 (6.73)	8.97 (18.117)	24(23.08)
	Dessie zuria	100	0.50 (3.518)	2(2.00)	3.32 (8.804)	15(15.00)
	Legambo	106	0.003 (0.029)	1(0.94)	1.58 (6.695)	7(6.60)
	Total	420	0.91 (7.486)	10(2.38)	3.60 (11.224)	52(12.38)

Note: Herbicides were not used in all *woreda*, while insecticides were provided to a considerable number of farmers freely by the local government to control the insect epidemics in Bati woreda in 20001/01. In 2001/02 neither herbicides nor insecticides were used in all the *woreda*. Figures in parentheses are standard deviations.