

ADDIS ABABA UNIVERSITY
GRADUATE STUDIES
SCHOOL OF ECONOMICS

**THE IMPACT OF EDUCATION ON FARM AND OFF-FARM INCOME IN
RURAL HOUSEHOLDS OF ETHIOPIA**

BY

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Contents

Acknowledgment	i
List of Tables	vii
<i>Abstract</i>	viii
Chapter One	1
Introduction.....	1
1. Background of the study	1
2. Statement of the problem	2
3. Objective of the study	4
4. Significant of the study	4
5. Scope of the study.....	5
6. Data source and methods of the study	5
7. Organization of the study	6
Chapter Two	7
Literature Review.....	7
2.1 Evolution of Agricultural Household Model.....	7
2.1.1 The Chayanov farm household model.....	7
2.1.2 The New Home Economic Model of Agricultural Households.....	10
2.1.3 Barnum-Squire Household Model	12
2.1.4 Low Farm Household Model.....	13

2.2 Income diversification of rural household.....	15
2.3 Household Labor Supply Model.....	17
2.3.1 Intra Household Decisions.....	18
2.4 Education and Human Capital.....	20
2.5 Ethiopian Education and Training Policy	22
Empirical Literature Reviews.....	24
Chapter Three.....	37
Econometric Model and Methodology	37
3.1 Theoretical framework.....	37
3.2 Farm Household Modeling.....	38
3.3 Econometric model.....	41
Chapter Four	51
Empirical Analysis	51
4.1 Data Description.....	51
4.1.1 Demographic Characteristics of the Households	51
4.1.2 Education of the household	53
4.1.3 Off-farm wage employment income	55
4.1.4 Farm income	55
4.1.5 Assets of the household.....	57
4.1.6 Livestock of the household.....	57
4.1.7 Size of farm land.....	58
4.1.8 Non labor income.....	59
4.1.9 Health status of the household	59
4.2 Econometrics Estimation and Discussion	62
4.2.1 Determinants of labor supply.....	62

4.2.2 Determinants of farm and off farm income	69
Chapter Five.....	76
Conclusions and Policy Implications	76
5.1 Conclusions	76
5.2 Policy Implications	79
Bibliography	80

List of Tables

	Page
Table 3.1 Description of variables.....	48
Table 4.1 Education level of the household heads	54
Table 4.2 Farm income of households.....	57
Table 4.3 Total farm size by region.....	59
Table 4.4 Descriptive statistics of variables.....	61
Table 4.5 OLS estimates of farm labor supply (in days).....	64
Table 4.6: OLS estimates of farm labor supply with household head education.....	65
Table 4.7: OLS estimates of farm income and off farm income with average education.....	71
Table 4.8 OLS estimates of farm income with household head education.....	73
Table 4.9 Instrumental (2SLS) regression of farm income with average education.....	74
Table 4.10 Instrumental (2SLS) regression of farm income with household head education...	75

Abstract

This study analyses the impact of education on farm and off- farm income of rural households of Ethiopia. The study is conducted to analyze how education of the household affects the labor allocation and hence the income of the rural households of Ethiopia. Farm household model is constructed to see how farm households allocate their time to farm and off-farm activities. The Seventh round Ethiopian Rural Household Survey data, collected by the School of Economics, Addis Ababa University, in collaboration with other organizations is used for analysis. The labor allocation of the households in to farm and off- farm activities is affected by average education of the household. In addition the household head's education alone also affects labor allocation of the household. As the households get more education, they reduce labor supply to farm and increase it to off-farm wage employment. The effect of education goes beyond determining labor allocation; it also affects farm and off--farm income. Even though education reduces labor allocation to farm, its overall effect on farm income is positive. This finding suggests that expanding education in rural increases farm income, though it reduces on farm labor supply. Therefore, expansion of education in rural Ethiopia is important to improve farm income and alleviate poverty.

Chapter One

Introduction

1. Background of the study

In most developing countries, agriculture remains a principal source of income for the majority of the population, important sources of foreign exchange, and hence a central concern of government policymakers (Inderjit Singh, Lyn Squire, and John Strauss, 1986). Agriculture in Ethiopia, like other developing countries, is fundamental for the country's economy. The agricultural sector greatly influences economic performance. About 11.7 million smallholder households account for approximately 95 per cent of agricultural GDP and 85 per cent of employment. About 25 per cent of rural households earn some income from non-farm enterprises. The agricultural sector accounts for roughly 43 per cent of GDP, and 90 per cent of exports (MoARD, 2010).

Small-scale agricultural households are the main form of economic organization in developing countries. Most of the labor forces in low-income developing countries are employed in the agricultural sector. Even in the middle-income developing countries and developed countries, some of the labor force is employed in agricultural sector, even though the proportion and degree of involvement are different from those of developing countries (Reardon, 1997).

One of the unique features of farm households is that they produce partly for consumption and partly for sale. They are both producers and consumers of their own products. They also participate in input market especially in providing labor force and purchase inputs required for their production.

In rural households many issues are interrelated. A change in one economic activity may have direct or indirect effect on another activity of the households. To do analysis on these rural farmers' activities, it requires understanding the microeconomic behavior of the households. To do so agricultural household model is important. As Singh et.al (1986) explains agricultural household models integrate production and consumption decisions in rural farm households.

In rural areas households may allocate the time of their members to farm or off farm activities or both. In standard farm household models, households are assumed to participate in off farm activities when the market wage is equal to the shadow value of its time weighted by the marginal utility of income. Apart from the marginal value of on farm labor, Tassew (2000) point out two factors that determine participation of households in off farm work. These are transaction – rationing effect and liquidity constraint effect. The first is the cost of looking for off farm jobs and the rationing in the labor market, which reduce the labor allocation to off farm activities. The second is lack of money; when households face immediate liquidity constraints, they participate in off -farm activities, which increase the allocation of labor to off farm work. Since these allocations have important impact on household income and implications for policy makes, analyzing factors, which influence household labor allocation is crucial.

2. Statement of the problem

In many developing countries off farm activities are considered as alternative sources of income and employment opportunities. Off farm activities also help reduce income uncertainty in rural areas. Diversification of employment is important to smooth income through spreading risk among different activities (Gordon, 1999). To get these and other related advantages households allocate

their labor into farm and off farm activities. Farm household education may influence the allocation of labor in to farm and off farm activities

Schultz (1975) suggests that education improves an individual's ability to allocate resources in response to changing economic conditions or economic disequilibria. It is obvious that education is one of the most determining factors of economic growth.

Most of the literatures on education focus on either the relationship between education and farm income or the return to education in wage work. Admassie and Asfaw(1997) , Arega et al(2007) found significant productivity enhancing effect of schooling and extension contact for improved technology , Sharada(1999) identify private benefit of schooling for farmers productivity. These literatures indicate that education is important for farm activities. On the other hands education has positive impact for off farm activities as well. Yang (1997) concluded that better educated farmers are more likely work off farm.

These literature show that educated farmers get more skill and knowledge to adopt new technologies which in turn increase their farm productivity. On the other hand more educated households have better chance to participate in off-farm activities. These show that education has a positive impact on farm and off farm activities. The question is that how households allocate labor between farm and off farm activities, when they are educated. In other words how educated farmers allocate labor between on far and off- farm activities is of interest.

This study tries to investigate whether there is any evidence that education improves the incomes from farm and off farm work and how it affects the allocation of labor between on farm and off farm activities.

3. Objective of the study

The government of Ethiopia has given strong emphasis to education to increase the human capital of the country. The expansion of education has taken place both in rural and urban areas. The main objective of the paper is to examine the return to education between farm and off-farm activities and consequently the role of education in determining the allocation of labor. In addition to this main objective the paper achieve the following specific objectives.

- Analyze the determinants of farm income
- Analyze the determinants off farm income
- Examine the level of education in rural household

4. Significant of the study

It is obvious that education plays a crucial role in the overall development of the country. Different studies have been conducted to confirm its significance. These researches on the contribution of education to rural household's welfare are many in number. But these researches, most of the time, focus on either the role of education on farm income, role of education on off farm income or the role of education on farm productivity. Research results on the combined effect of education on farm and off farm income are scanty. Most research conducted in Ethiopia on farm households and education are one sided, i.e. they analyze the role of education from productivity point of view, its role in on farm income or its role on off farm income. This

underestimates the role of education. This paper fills the gap in this area, that is, it analyses the impact of education on farm and off farm income and how it determines the farm household labor supply. In addition the paper will give policy recommendation based on results of the analysis.

5. Scope of the study

This research paper covers the rural household of Ethiopia in which the rural household survey conducted. The rural household survey data collected from four regions of the country namely, Amhara, Tigray, Oromina and Southern Nations, Nationalities and Peoples (SNNP).

6. Data source and methods of the study

Data: To achieve the above objectives, the research paper use Ethiopian rural household survey (ERHS) data which collected by the school of Economics, Addis Ababa University in collaboration with the Ethiopian Development Research Institute, International Food Policy Research Institute and the Center for the Study of African Economies, university of Oxford. The basic economic and demographic data for this study are drawn from The Seventh round of the Ethiopia Rural Household Survey (ERHS) data.

This study involves both economic and econometrics model analyses. Farm household model is constructed to examine how rural farm households allocate their time to farm work, off farm work and leisure. Based on the economic analysis, econometric model is developed to show which factors determine the off farm and farm labor supply. To show the impact of education on farm and off farm income, farm and off farm income be estimated as a function of different variables, including education.

7. Organization of the study

The rest of the paper is organized as follows. Chapter two presents reviews of literature. Chapter three is devoted to research methodology and econometric models. Chapter four is concerned with statistical and econometrics analysis. In Chapter five, we present conclusions and policy implications.

Chapter Two

Literature Review

2.1 Evolution of Agricultural Household Model

2.1.1 The Chayanov farm household model

Chayanov¹ was the first scholar who believed that behaviors of farm households were best understood in a household-firm framework. The Chayanov model can be explained in two different cases: the first case is the absence of labor market and the second is with the presence of labor market.

Chayanov model without labor market: The model explains the decision of household in relation to the amount of family labor to commit to farm production. The model suggests that the need to feed family member is a driving force for working. The demographic structure of the farm household is a major determinant of the labor allocation decision which is determined by the ratio of the consumers(c) to workers (w). Therefore, when consumer to worker ratio is low, there is less incentive to participate in the laborious farm works. The model contains both production and consumption decision making. For the production, $Y = P_Y f(L)$, So, income is a function of output market price and labor input.

The utility function is maximized subject to: the production function, the minimum acceptable level of income and the maximum number of working days. The solution to this problem exists when the ratio of the marginal utility of leisure (MU_H) to marginal utility of income (MU_Y) is equal to marginal value of labor productivity. That is $MU_H/MU_Y = MVP_L$

¹ Alexander V. Chayanov(1888-1937) was a Soviet agrarian economist and scholar of rural sociology and advocates of Agrarianism and Cooperatives. Chayanov's theory of peasant household (originally published in Russian in 1925) was first translated in to English in 1966 by Daniel Thorner.

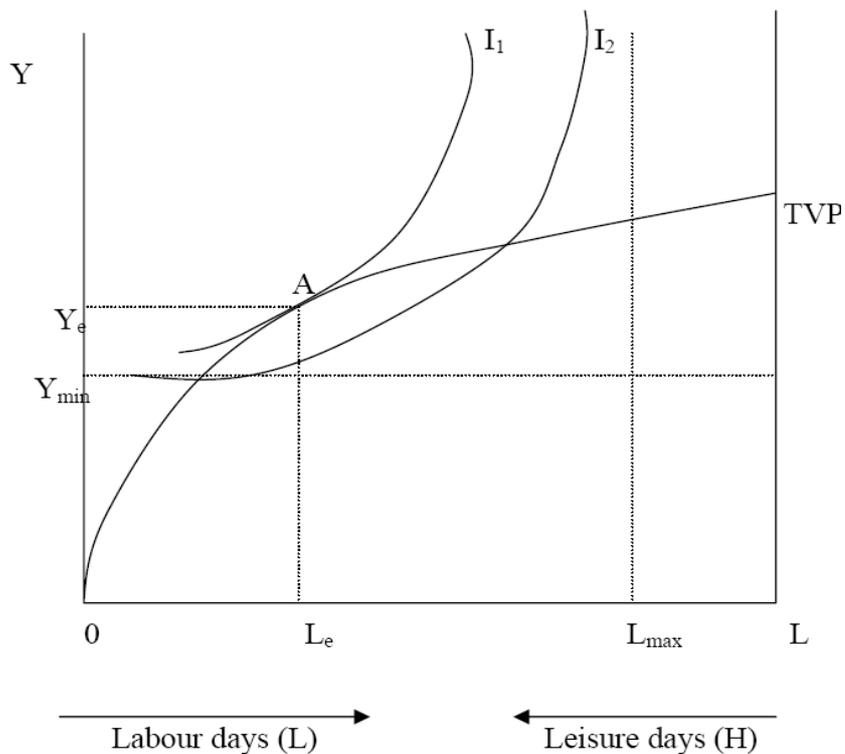


Figure 1 Chayanov model without labor market

The above fig1 illustrate how farm household allocate their time for leisure and work in the absence of labor market. The vertical axis show the income(Y) and the horizontal axis show the labor that household has. Y_{min} is the minimum amount of income (output) required. The solution is attained when the indifference curve (I) becomes tangent with the production function (TVP).

Chayanov Model with Labour Market: When labor market exists the household has possibility to hire or hire out labor when the number of labor in the household is less than the required amount and more that the work demanded respectively. The equilibrium is attain when $MVP_L = w$.

In fig 2, the amount of labor which the family is prepared to commit to farming is L_e , where the $dY/dZ=w$. However, optimum labor use in farm production is given by L_T , where the $MVP_L=w$. The difference between L_T and L_e is the labor hired by the farm household.

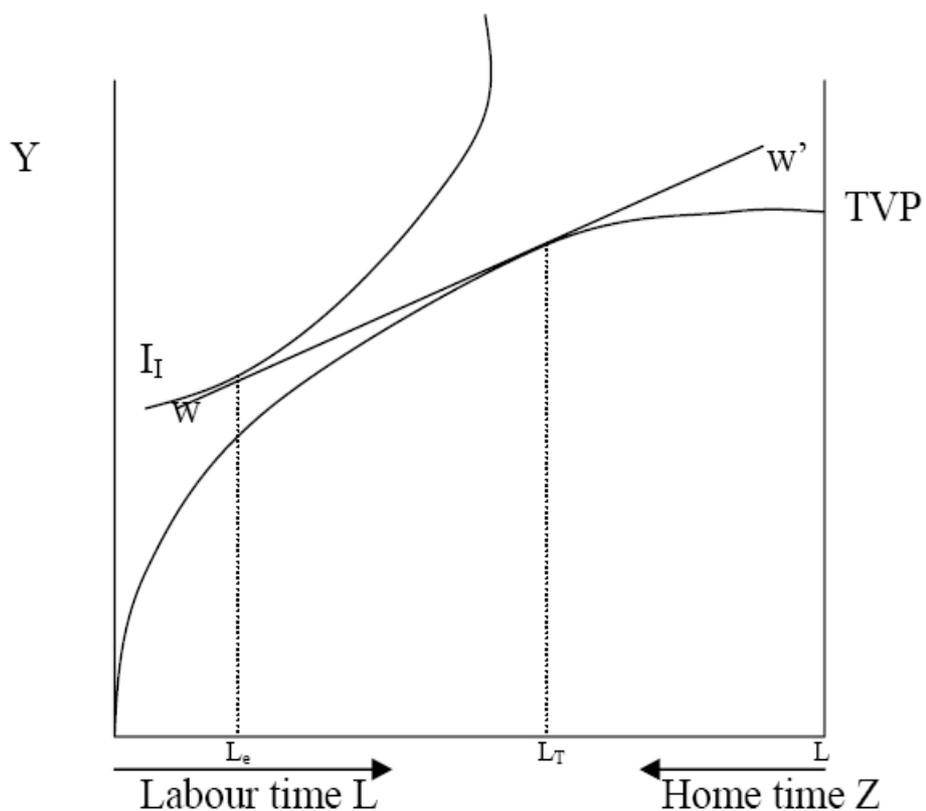


Figure 2: Households hiring in labor

When the number of labor in the house is more than what the production requires, the household hire out some of the labor. In the fig below, the amount of labor which the family is prepared to commit to farming is L_e , where the $dY/dZ=w$. However, optimum labor use in farm production is

given by L_T , where $MVPL=w$. Because L_T is lower than L_e , farm household must hire out part of their labor. The difference between L_e and L_T is the labor hired out by farm household.

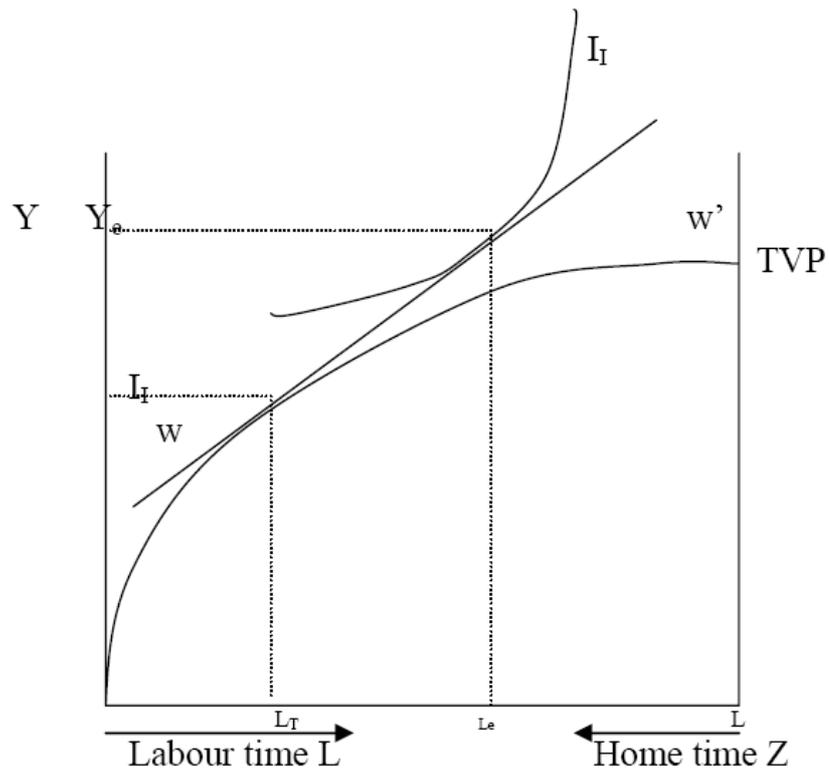


Figure 3: Households hiring out labor

2.1.2 The New Home Economic Model of Agricultural Households

The new home economic model of agricultural households considers the household is a production unit that produces farm product and services that must be converted to final use value that yield utility when consumed. The main feature of the new home economic model is that utility is obtained from final products “use values”. These goods are called z-goods. Therefore utility is

given as $U = f(Z_i)$. Inputs of household time and purchased goods and services are needed to make z-goods. The production function becomes:

$$Z = f(x_i, T_i)$$

Utility is maximized subject to production function, time and income constraints. Total time T is expressed as a sum of work time outside the household (T_w) and time used in preparing z-good ($\sum T_i$). Money income constraint (Y) is determined by market wage rate multiplied by time for wage work (wT_w).

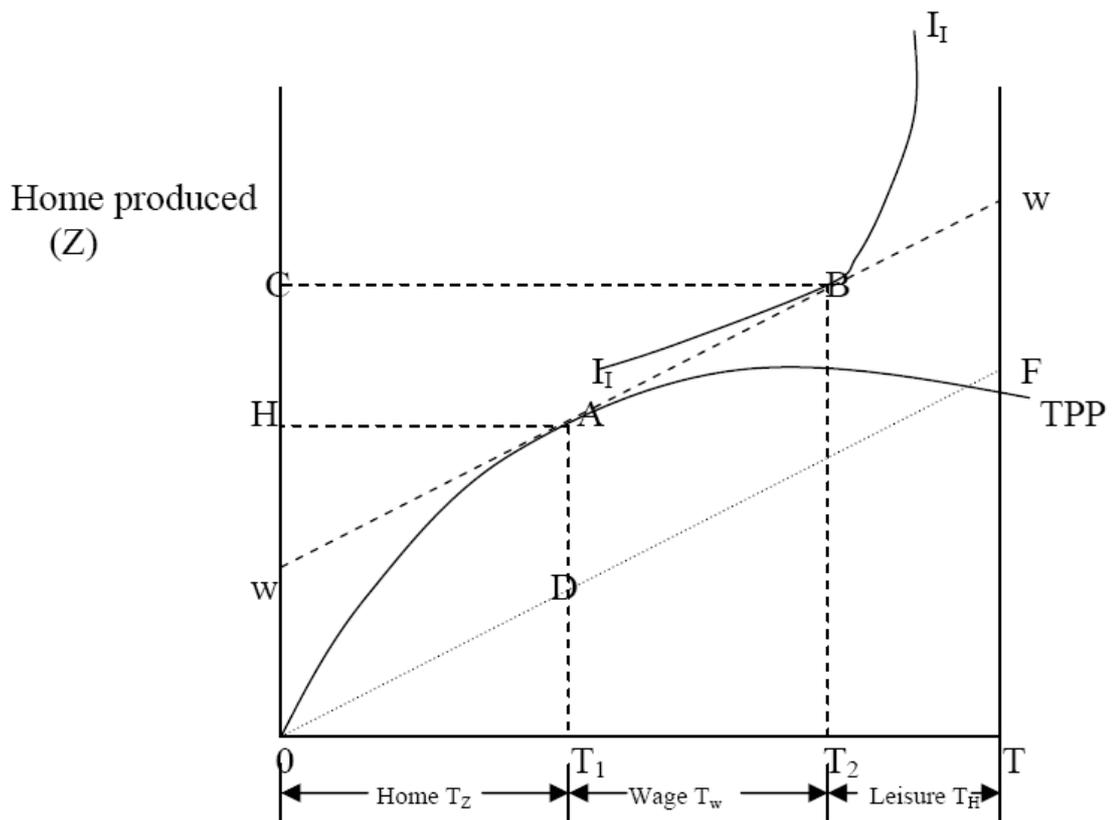


Fig 4: New home economic model

From fig 4 total time available is T, the time is divided between Home work time (T_z), wage work time (T_w) and leisure (T_H). The opportunity cost of time is given by the real wage w/p , where w is the money wage and p is the price level of purchased goods. Line OF with slope w/p shows rise in total real income as hours increased. The production function (TPP) shows the transformation of home work time into final home output Z . The indifference curve contains the same level of satisfaction derived from different combinations of Z and leisure time. The equilibrium of the household in the consumption of Z is given at B where MRS of leisure for Z is equal to $(MU_L/MU_Z) = w/p$

2.1.3 Barnum-Squire Household Model

This model was proposed by Barnum and Squire and further developed by Singh. To introduce suppose, for any production cycle, the household is assumed to maximize a utility function:

$U = U(x_a, x_m, x_l)$, Where the commodities are an agricultural staple (X_a), a market purchased good (X_m), and leisure (X_l).

Utility is maximized subject to a cash income constraint

$$p_m x_M = p_a (Q - x_a) - w(L - F)$$

where P_m and P_a are the prices of the market-purchased commodity and the staple, respectively, Q is the household's production of the staple (so that $Q - X_a$, is its marketed surplus), w is the market wage, L is total labor input, and F is family labor input (so that $L - F$, if positive, is hired labor and, if negative, off-farm labor supply).

The household also faces a time constraint - it cannot allocate more time to leisure, on-farm production, or off-farm employment than the total time available to the household:

$$x_l + F = T$$
 , Where T is the total stock of household time.

It also faces a production constraint or production technology that depicts the relation between inputs and output

$$Q = Q(L, A)$$

Where A is the household's fixed size of land

The three constraints (time, production and income) on household behavior can be collapsed into a single constraint.

2.1.4 Low Farm Household Model

Allan Low developed this model focusing on agricultural production problems in South Africa.

The major conditions of concern to Low were the existence of labor market in which wages vary for different categories of workers. This differs from Barnum-Squire model where a single wage rate is assumed.

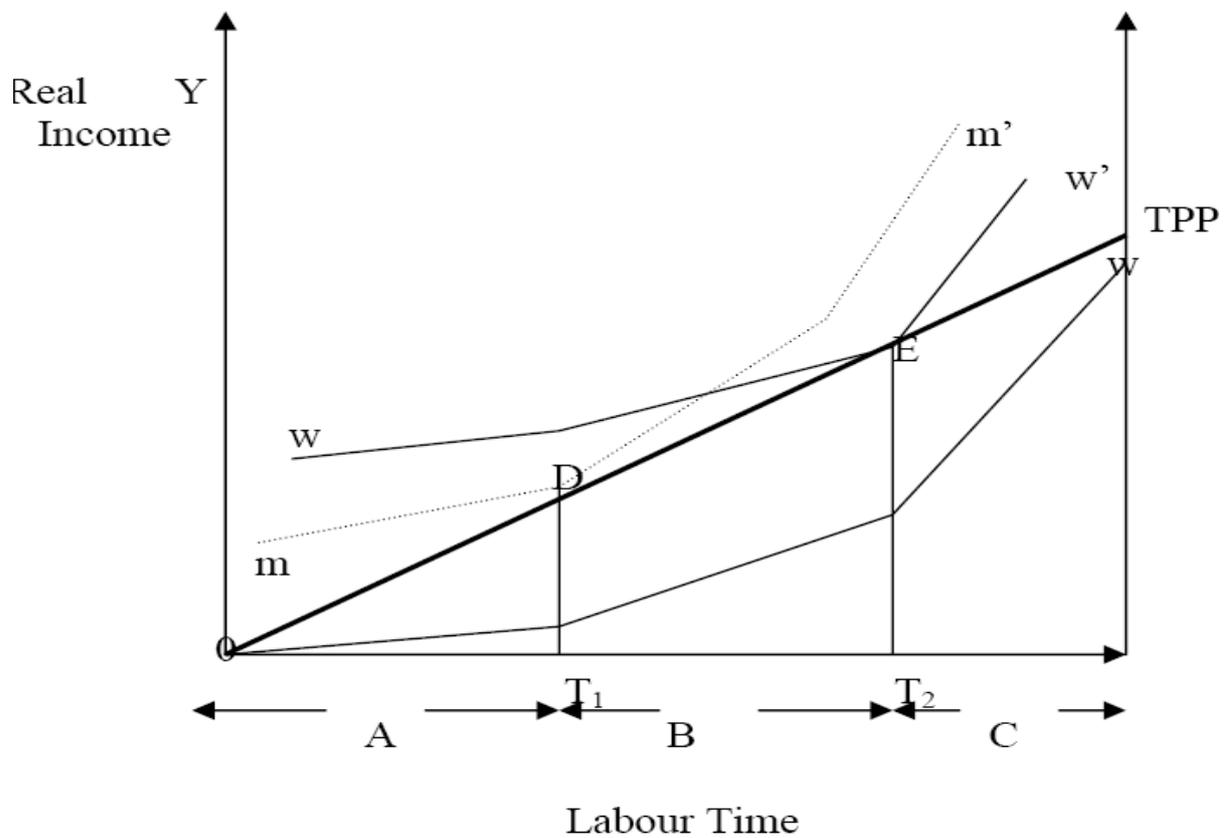


Fig 5: Low farm household model

The vertical axis show Real income and the horizontal line show labor time. The model assumed that there are 3 individuals A, B, C having the same marginal physical productivity (MPP) for labor but commanding different wages. W/p is the real wage shown by line $0W$. ww' is the corresponding real wage line that touches TPP at point E. This implies that A and B should work on the farm, while C sources for better income off-farm. Suppose the retail price fall leaving the real wage rate as mm' , B will also leave the farm work for off-farm work.

2.2 Income diversification of rural household

It is uncommon, in rural household, to collect all income from one source. That is why diversification in rural households looks normal and norm. Participation in multiple activities by farm families is not new, nor is it only confined to the rural sectors of developing countries (Ellis, 2000). The household economic model predicts diversification as a function of on-farm returns to labor time compared to off-farm earning opportunities. With a given asset base and a given total amount of labor time, the household makes comparisons between the return to using more of that time on the farm or deploying it in off-farm wage or other income-generating activities. Factors that increase the return to time spent on farm activities would tend to reduce the motivation to diversify.

Off farm employment refers to employment in activities not on his/her farm. It includes employment on another farmer's farm. Off farm activities can be wage employment and self employment in which farm household participate. Rural nonfarm activities by definition include all activities other than those performed on the farm or related to farming.

Most of the time African farmers lead persistent way of life. Even though this persistence way of life looks entirely farm activities, non-farm activities are also practice. The role of nonfarm activity is increasing overtime. Nonfarm income sources may already account for as much as 40-45% of average household income and seem to be growing in importance (Reardon 1997).

Farm and nonfarm activities are interlinked. According to Reardon (1997) the linkages occur as "upstream" and "downstream". Upstream linkage exists when growth in the farm sector encourages the non farm sector to increase its activity by investing in productivity or additional capacity for supplying inputs and services to the farmer. Downstream linkage exists in case where

non farm sector induces to invest in capacity to supply agro processing and distribution service using farm products as inputs.

Households are motivated to undertake rural nonfarm activity by either "pull" or "push" factors. "Pull" factors, such as better returns in the non-farm sector relative to the farm sector; and "push" factors, which may be

1. An inadequate farm output, resulting either from temporary events (e.g. a drought) or longer term problems (e.g. land constraints)
2. An absence of or incomplete crop insurance and consumption credit markets, the risks of farming, which induce households to manage income and consumption uncertainties by diversifying and undertaking activities with returns that have a low or negative correlation with those of farming; and
3. An absence or failure of farm input markets or input credit markets, compelling households to pay for farm inputs with their own cash resources.

Decisions made by rural households concerning the form and extent of their involvement in rural nonfarm activities (either starting enterprises or entering the wage labor market) generally depend on two main factors:

- The incentives offered, such as the relative profitability and risk of farm and rural nonfarm activities;
- The household's capacity (determined by education, income and assets and access to credit, etc.) to undertake such activities.

2.3 Household Labor Supply Model

The neoclassical theory of labor supply states that each individual disposes of a limited amount of time which can be allocated for work or leisure. The household labor supply model is different from the basic labor supply model in some ways. The first difference is that there is intra household bargaining in the labor supply and the second difference is that there is production within the household which can substitute wage income from work.

In the household, goods consumed may be purchased in quantity (C_m) or produced domestically (C_d).

So, Consumption (C) is $C_m + C_d$. The total endowment of time available (L_o) breaks down into paid working time h_M , household working time h_D , and leisure L , hence $L_o = h_M + h_D + L$.

The efficiency of household tasks is represented by a production function, $C_d = f(h_D)$, linking the amount of the good produced to the time spent on household work.

Income is made up of wage earnings, wh_M , and nonwage ones, R . The consumer must choose the quantities C_M , C_d , h_D , h_M , and L that maximize utility under the budget constraint

$$C_m \leq wh_m + R$$

Potential income can be written as $R_o = wL_o + R$

Since $h_M = L_o - h_D - L$ the budget constraint is again written as

$$C_m + wL \leq R_o - wh_D$$

Taking into account the identity $C_M = C - f(h_D)$, the consumer's optimization problem becomes:

$$\text{Max} U(C, L) \text{ s.t. } C + wL \leq [f(h_D) - wh_D] + R_o$$

Since household production comes into the consumer's optimization through the expression of the household profit, its optimal value h_D^* is that which maximizes the value of this profit.

The optimal value of the household profit function can thus be given by $f'(h_D^*) = w$

The equality $f'(h_D^*) = w$ shows that the allocation of working time between household and waged activities is determined by the relative productivities of the two types of activities.

Consequently the wage reflects the individual productivity of wage labor.

The agent has an interest in devoting working time to household activities to the extent that the marginal productivity $f'(h_D)$ of an hour of this type of work is superior to an hour's wage.

The agent therefore augments the length of time devoted to household work to the point where

$$f'(h_D^*) = w$$

2.3.1 Intra Household Decisions

The family has considerable influence on the behavior of its members, affecting the labor supply of members. This requires a theory that goes beyond the basic individual frame of reference.

The analysis of family choices has developed along two different lines – the unitary and collective models. The unitary model starts from the principle that the family can be likened to a sole agent having its own utility function. The collective model, on the other hand, postulates that making choices is fundamentally something individuals do, and that the family is no more than a particular framework that enlarges (or constrains) the range of choices of each individual member of it.

The Unitary model

The unitary model considers a family composed of two persons. The model postulates that the preferences of this entity to be represented by a utility function $U(C, L_1, L_2)$, where C is total consumption and L_1 and L_2 represent the leisure of the couple.

Denoting by w_i and R_i the wage and non-wage incomes of individual i , optimal choices of the two family members are determined by maximizing utility under a single budget constraint

The optimization problem of the household can be given by:

$\max U(C, L_1, L_2)$ s.t. the constraint

$$C + w_1L_1 + w_2L_2 \leq R_1 + R_2 + (w_1 + w_2)L_o$$

This optimization problem suggests that the distribution of non-wage incomes has no importance and that the only thing that matters is their sum $R_1 + R_2$ (income pooling). That is, it is not necessary to know which member of the couple is the beneficiary of transfer income.

The Collective Model

It starts from the principle that household choices must arise out of individual preferences. Unlike the unitary model, it disaggregates the preferences of household members (assumes that decisions made within a household are efficient).

If we use $U_i(C_i, L_i), i=1,2$ to denote the individual preferences of the persons composing the household, the efficient allocations will be the solution to the following optimization problem:

$\text{Max}U_1(C_1, L_1)$ s.t. the constraint

$$C + w_1L_1 + w_2L_2 \leq R_1 + R_2 + (w_1 + w_2)L_o$$

The optimization problem of agent i thus take the form:

$\text{Max}U_i(C_i, L_i)$ s.t the constraint

$C_i + w_i L_i \leq w_i L_o + \Phi_i$, where Φ_i is a “sharing rule,” depending on the parameters w_i and R_i , and such that $\Phi_1 + \Phi_2 = R_1 + R_2$.

In other words, it is as if each member of the household receives a fraction of the total non-wage income of the household.

2.4 Education and Human Capital

Most of the time, education is considered as both consumer and capital good because it offers utility to a consumer and also serves as an input into the production of other goods and services. As a capital good, education can be used to develop the human resources necessary for economic and social transformation. The focus on education as a capital good relates to the concept of human capital, which emphasizes that the development of skills is an important factor in production activities. The economic prosperity and functioning of a nation depend on its physical and human capital stock. Human capital represents the investment people make in themselves that enhance their economic productivity. Based upon the work of Schultz (1975) many human capital theorists argue that an educated population is a productive population.

Human capital theory emphasizes how education increases the productivity and efficiency of workers by increasing the level of cognitive stock of economically productive human capability which is a product of innate abilities and investment in human beings.

There are different explanations for the role of education. According to Becker (1964) education is an investment that produces knowledge acquisition and increased productivity, which in turn lead to higher income. However Spence (1973) states that the essential aspect of education is to

facilitate selection. The educational system plays the role of filter: it selects individuals on the basis of their intrinsic ability, allowing them to signal their abilities to potential employers.

The human capital theory hypothesizes that education is an investment producing income in the future. In this context, wage differentials are influenced by differences in individual productivity, which are themselves influenced by investments in education or training made by individuals throughout their lives.

Education as signaling device

Spence (1973) put forward the idea that education also serves to select individuals, without really influencing the productive efficiency that they will display in their future professional lives.

The premise of Spence's theory is that those persons who perform most effectively in active life are also the ones who perform best while studying. If productive efficiency is not observable by potential employers, then success as a student simply serves to signal the presence of such productive characteristics. From this standpoint, a person pursues education in order to signal her/his ability.

Spence shows that workers have a tendency to overeducate themselves with respect to the standard of social efficiency, if education does serve to signal their productive capacities to employers.

The model assumes that employers observe the productivity of workers imperfectly, but view a degree, or the length of time spent in schooling, as an indicator of potential productivity. In this context workers may have an interest in investing in education in order to signal their abilities to employers. Under these circumstances, Spence argues that a signal can be used to distinguish workers only if the costs of signaling are negatively correlated with worker skill. He constructs a

simple model in which there are two types of worker: high productivity and low productivity. The high productive worker can acquire education at a lower cost (in terms of time, money, etc) than the low productive worker. Spence shows that in this model, there will be a signaling equilibrium in which high productivity workers will seek more education than low quality workers, and employers will offer higher wages to those with higher levels of education. In Spence's model, education merely serves as a reliable signal rather than increasing worker productivity. This conclusion is contrary with human capital theory which argues that education increases productivity.

2.5 Ethiopian Education and Training Policy

Modern education was introduced to Ethiopia nearly a century ago. However, the education and training offered during these long years had limited positive impact on the lives of the people and national development. The education offered has not been able to solve the problems of farmers, pastoralist, and change the lives of the over whelming majority of the people (MoE, 1994). Due to lack of clear and coherent direction and other problems related with education, majority of the people of Ethiopia were not beneficiaries of the advantage of modern education. Recognizing this fundamental problem, the then government launched and began to implement the 1994 new education and training policy. The policy encompasses overall and specific objectives, implementation strategies, including formal and non-formal education, from kindergarten to higher education and special education.

General Objectives of Ethiopian education and training policy

As stated by Ministry of Education, the Ethiopian education and training policy which started in 1994 has the following major objectives.

1. Develop the physical and mental potential and the problem-solving capacity of individuals by expanding education and in particular by providing basic education for all.
2. Bring up citizens who can take care of and utilize resources wisely, who are trained in various skills, by raising the private and social benefits of education.
3. Bring up citizens who respect human rights, stand for the well-being of people, as well as for equality, justice and peace, endowed with democratic culture and discipline.
4. Bring up citizen who differentiate harmful practices from useful ones, who seek and stand for truth, appreciate aesthetics and show positive attitude towards the development and dissemination of science and technology in society.
5. Cultivate the cognitive, creative, productive and appreciative potential of citizens by appropriately relating education to environment and societal needs.

In addition to this general objective the policy has many other specific objectives all of which are support and derived from general objectives.

The structures of education start from kindergarten to higher level. The duration and focus area of education in each structure vary accordingly. Non formal education provided beginning and integrated with basic education which focus on literacy, numeracy, environment , agriculture crafts, home science, health services and civic. Diversified technical and vocational training is

provided for those who leave school from any level of education. Special education and training is also provided for people with special needs.

The Ministry of Education prepares a separate document for national adult education strategy, national technical and vocational education and training (TVET) strategy and pastoralist's education strategy.

Empirical Literature Reviews

Yang (1997), based on study Education and off farm Work, using cross sectional farm household data from China; concludes that schooling does not contribute to physical efficiency in farming but raises off farm wage. The researcher found three empirical results. The first is that labor productivity with respect to routine tasks is the same for household members, regardless of their year of schooling. The second is that better educated members may contribute to agricultural management while participating in off farm wage activities. The third is that schooling increase off farm wage rate, a better educated worker has a comparative advantage in off farm work and the corresponding selective assignment by education maximizes the household income. In addition to this research **Yang (1997)** has conducted another research. The study was conducted to show the role of education in production. He used the 1991 survey data of China. The survey contains detailed production, income, and demographic information of households. To do this the paper specified a Cobb-Douglas, value-added function, which includes proxies of labor quality and managerial skills as explanatory variables.

The finding shows that education of the head of the household is not significantly associated with value-added in farming. The result of the finding is contradicts with theory which explain that the head of the household's schooling may affect farm efficiency in an important way. But average schooling is positively associated with value added in farming. However, this coefficient alone may not lead to meaningful conclusions because the education regressors are highly correlated in sample of small farms.

The result suggests that highest education is the most important education variable to explain farm profitability. The empirical results indicate a significant return to the highest farm education but no significant return to education of other household members. Finally the paper explain the special features of farm production which determine the returns to education of its members, in turn, determine the household's demand for education investment.

Vildan et.al (2009) look at factors that influence the annual income of farmers in Turkey. The researchers used 676 farmers based on annual income category. Logistic regression model is used to determine the factor influencing farmer's income. The model tries to explain dependent variable, farm income, which are regressed on independent variables; education, household size, estate size, estate ownership, fallowing, contractual farming, sale period, processing, consulting, marketing, membership and region as dummy variable. Estate size, fallowing, and sale period are statistically significant at 1% and education, and consulting are significant at 5 %. The estimated results are given in units of ordered logits. The researchers found that a unit increase in education variables would increase farmer's income by 0.24 units.

Areag et al (2007) conducted a research in northern Nigeria for 2003/2004 cropping season. The study is interested in the effect of schooling and extension contact on traditional and improved cowpea production. The result shows that schooling and extension contact have differential effects on cowpea production under traditional and improved technology. An additional year of schooling of the heads as well as other members has no significant effect on productivity. Four years of schooling has required having a significant positive effect on productivity under improved technology. The result shows four years of schooling of the household head raised improved cowpea production by an average 25.6%. However, schooling had no significant effect on traditional cowpea production. The research concludes that farmers' education has a higher payoff for farmers cultivating improved variety and applying a package of new inputs than for farmers using largely traditional technology. The reason for this one is that when the production technology is traditional; it can be formalized and passed on from generation to generation by example; as a result formal education may have little or no contribution. Under improved technology, agriculture requires new knowledge and skills and better educated farmers. Educated farmers are likely to adjust themselves to new technology more successfully than less educated farmers.

Sharada (1999) uses 1994 Ethiopian rural household survey data, to estimate internal and external benefit of schooling in 14 cereal producing villages of Ethiopia. The paper use frontier and non frontier production functions. The non frontier results show that there are positive and significant returns to formal schooling in agriculture in Ethiopia. But this is applicable if the farm household head has upper primary schooling (grade four to six). Using frontier production function technique, farm level efficiency was estimated at approximately 55 percent of potential on average

for the farmers sampled. Increased schooling is found to have a significant impact on reducing inefficiency. The social benefit of schooling outweighs private benefit. An additional year of formal schooling on average in the village has a much larger impact upon farm productivity than additional years of schooling on average within the household.

Singh (1974) examine the impact of education on farm production on 288 farm households of Haryana. The analysis show that impact of farm decision makers' education- increase managerial skill- on the farm production is positive and significant. But the impact differs between the levels of education. Relatively secondary education has strong effect. It is weak in primary and middle education even if it is positive. The paper also analyses the relationship between farm size and impact of education on farm production. The impact of education is dominant on large farm size.

Huffman (1980) using the 1964 agricultural censuses data of America, conducted analysis on farm and off farm work decision. The result shows that the coefficient of farmer's education and extension are positive and statistically significant. Education coefficient implies that increasing farmers education increases their off farm work directly.

Beyene (2008) conducted a research on determinants of off farm participation decision of farm households in Ethiopia in four administrative regions: Amhara, Tigray, Oromia and SNNP using 1999 rural household survey data. The research concludes that human capitals, education of the household heads has no effect on off farm work decision. As the researcher justifies, off farm activities do not require formal education.

Jolliffe (2002) using the Ghanaian living standard survey data explain whose schooling is important in the determination of household income. Jolliffe didn't consider the household head education level only; rather he used the household's minimum, average maximum and head of household's school level. He estimates the household total, farm and off farm income separately using the household minimum, average, maximum and head of household's school level. But average and maximum values of schooling serves as better measurement of household schooling level. There is difference in total income estimating using maximum schooling and head of household's education. The return to schooling using the maximum level of schooling to predict total income is twenty seven percent higher than using head's schooling. In addition return to schooling from using the average household level to predict farm and off farm income is 22 percent and 29 percent respectively higher than from using head's schooling. The paper also examine the gender difference in the household income determination whether the male or female education determine the income. The paper concludes that gender of the individual with the minimum or maximum level of schooling has no effect on the determination of household income. In addition to this research **Jolliffe (2004)** analyze the impact of education in rural Ghana using living standard survey data. He examined the impact of education on household labor allocation and return on farm and off farm profit. Ordinary least square (OLS) and least absolute deviation (LAD) were applied to estimate equations. The result shows that higher level of schooling are associated with higher level of household labor supply in off farm work. Increased level of schooling increase off farm profit by much greater amount than farm profit.

Marcel et.al (1999) examine whether human capital affect the productivity and labor allocation in nonfarm activity of rural household of Pakistan. The research analyzes not only the direct effect of human capital on output and income but also its indirect effect on labor allocation. The finding

shows that education raise off farm productivity and induce rural household to shift labor allocation from farm to off farm activities. One additional years of schooling for all adult males raise household income by 8.9 percent. For this additional income one-fifth is achieved by reallocating labor always from farming and towards non farming working. Another finding is that, even though wife's education has positive and significant effect on total income, it is not strong. In addition to education, nutrition is important for productivity but it is more effective for male than female.

Edward et.al (2000) Using Mexican survey data in eight villages, analyze the effect of schooling on income. Using OLS estimation, they examine the effect of an additional year of household head's schooling, average family schooling and other variables on net income. Total return from schooling is significant, both statistically and quantitatively. The estimated return from an additional year of the household head's schooling is \$502 and the return from an additional year of average family schooling is \$210. Schooling of the household head discourages participating in staple production but has little effect on participation in other activities. Schooling of other family members is significant in selecting families into wage work and international migration. A one year increase in average family schooling is associated with a 10% increase in household income from wage work. Family schooling is also positively associated with crop income. A year of average family schooling raise staple income by 16% and it is associated with a 13% increase in cash crop income. Neither household head's education nor other family members schooling has significant economic return in non crop production. The paper finally concludes that, controlling other activities, the return from schooling is higher in rural Mexico. Schooling significantly links rural household to new income source, including local wage work and migration.

Mark and Klenow (2000) examine a model with finite-lived individuals. The research paper uses a data from countries report of UNESCO at schooling attainment of age groups 20 to 54 or older in the year 1946 to 1977. The data construct a time series for schooling attainment. A panel of 85 countries is estimated.

Human capital can grow with rising schooling attainment and thereby contribute to a country's growth rate. According to the research each generation learns from previous generations. In addition the research paper incorporates the model a positive externality from the level of human capital onto the level of technology in use.

The researchers ask a question "If high rates of schooling are not generating higher growth, what accounts for the very strong relationship between schooling enrollments and subsequent income growth?" They give the 1960 high schooling enrollments and the subsequent 1960 to 1990 growth in labor supply as evidence. They also explain the rapid growth in total factor productivity from 1960 to 1990 is due to the high level of schooling. The paper account for the existence of reversal causality that is schooling could be responding to the anticipated rate of growth for income.

The paper finally found that countries with higher enrollment rates do not display faster human-capital growth from 1960 to 1990. However, that one more year of schooling enrollments in a country in 1960 is associated with a very modest increase in schooling attainment in the working population between 1960 and 1990 of only 0.042 additional years. This reflects the high persistence of cross-country differences in enrollment rates. Because countries with high enrollment rates in 1960 also had relatively high enrollments pre-1960, these countries are largely just maintaining their relatively high attainments.

The research paper also calibrates a model channel from expected growth to schooling. Even though the estimation is capable of generating much of the empirical coefficient, part of the relationship between schooling and growth may reflect omitted factors that are related both to schooling rates in 1960 and to growth rates for the period 1960 to 1990.

E. Lockheed, et al (1980) summarizes the analyses of 37 data sets discussed in 18 studies on education and small-farm production in 13 countries of Africa, Asia, Europe, and Latin America. In 17 of the data sets the effects of education on technical efficiency in the production of a cereal crop (rice, wheat, or maize) were examined; in the remaining data sets, the effect of education on the production of a mixed crop, typically including a cereal, was examined. The researchers used a production function for agricultural output as their basic tool for analyzing the impact of education on productivity.

The first hypothesis what the researchers set is that education has a positive effect on farmer efficiency. The research paper finds confirmation for this hypothesis. For each of 37 data sets, the coefficients of education on agricultural productivity, the statistical significance of the estimate, and the estimated percentage increase in output for each additional year of education. In six of these data sets education was found to have a negative (but statistically insignificant) effect, but, in the remaining 31, the effect was positive and usually significant.

The research paper also hypothesized that exposure to extension or other non formal agricultural education experience should have a positive effect on output. Based on the available data set, the analysis of eight provided evidence that extension was significantly positively related to productivity, one provided evidence that extension was significantly negatively related to productivity, and the remaining seven showed no significant effect.

The researchers also explored whether formal education and non formal education acted as substitutes or complements. Most of the coefficients of interaction were positive, suggesting, therefore, a possible complementary relationship between the two forms of education, even though few of the coefficients were statistically insignificant.

The papers finally find that the effects of education were much more likely to be positive in modernizing agricultural environments than in traditional ones. The researchers share common idea with Schultz (1975) who hypothesis that the effectiveness of education is enhanced in a modernizing environment.

The overall conclusion of the paper is that farm productivity increases, on the average, by 7.4% as a result of a farmer's completing four additional years of elementary education rather than none; the 7.4% is a weighted average of values from those studies for which an estimate could be computed.

Eisemon (1989) revealed few significant differences between unschooled and schooled farmers or between farmers with various levels of schooling. The effects of school knowledge and skills were evident in how farmers understood modern production technologies and in what information they sought from extension officers about agricultural chemicals and how they used this information. Schooling profoundly influenced the ways they thought about and practiced agriculture.

Verbal protocols obtained from administration of an instrument designed to assess agriculture knowledge provide much insight into how schooled and unschooled farmers perform problem-solving tasks in daily life that may involve the use of modern agricultural technologies. Most tasks

required identification of common diseases of maize, vegetables and other crops from visual signal, and specification of measures to control or prevent the diseases.

Farmers with little or no schooling usually gave incomplete and /or inaccurate descriptions of stalk borer infestation. This farmer mentions three possible causes of damage to maize - weeds, birds and hailstones - none of which are responsible for producing the symptoms in the specimen of maize shown to the farmer. Among farmers with no schooling, weeds were often mentioned as causing plant diseases. The farmer indicates that fertilizer may prevent the disease, but in fact, while fertilizing may benefit general plant health, it cannot prevent this form of crop damage.

Farmers with some primary schooling often knew the name of the disease; the disease is correctly attributed to stalk borers which 'break the leaves of the plant.' The farmer suggests spraying agricultural chemicals to improve the health of the plants, combining a technological intervention with a cultural practice, uprooting plants. Well-educated farmers generally gave specific, concrete and usually accurate descriptions of the symptoms of stalk borer infestation, knew that the disease was caused by insects and could be prevented by spraying and, more importantly, understood that the effectiveness of the chemicals depended on synchronizing applications with the plant's growth cycle to coincide with the insect's life cycle as well as with appropriate climatic conditions.

Another illustration of the effects of schooling on cognition relating to use of modern technologies can be taken from a study of Kenyan mothers' comprehension of instructions for the use of premixed commercial oral rehydration salts solutions for the treatment of diarrheal dehydration in children. Schooling changes the ways mothers explain diarrheal illnesses. Maasai mothers with some primary schooling usually attribute diarrhea to environmental conditions. Better descriptions of the symptoms of diarrhea, identification of environmental causes and belief in the effectiveness

of treatments derived from modern medicine were obtained from mothers with higher levels of schooling.

Sumner (1982) analyze the off farm labor supply of Illinois farmers based on a 1971 survey data. The survey data gathered information about farmer's on farm activities, off farm work and personal characteristics. A sample of 832 farm operators was used to estimate off-farm work participation. The researcher applied Maximum likelihood estimation of a probit function. The research found that education increases the probability of working at off-farm job. But Health has no significant effect on off-farm work. More over men with some vocational training for non-farm work were more likely to work off their farms. While farm-related training did not reduce off-farm work.

Using the first and the fourth rounds Rural Household Survey data of Ethiopia, Adugna (2006) determine factors affect the dynamics of off-farm activities. The study performs three different estimations in relation to the factors that affect participation in off farm activities and intensity of off-farm activities. These three separate equations are participation, intensity, and dynamics. For the participation equation Probit estimation technique was employed to estimate the model. For the intensity and the dynamic models, quartile regression technique was used.

The research investigate that participation in off-farm activities in 1994 is mainly influenced by demographic factors and not by asset holdings or seasonality. Households with more dependents and female-headed households have less participation in off-farm activities. In addition poor farm household having poor land quality participate less in off farm activities. This is because they spent more time in farm land to secure the subsistence food supply of the households. Unlike the results for the determinants of participation in off-farm activities, results for intensity show that not

only demographic factors but also asset holdings, seasonality influence the level of intensity in off-farm activities even more than the demographic effect.

Once farmers decide to engage in off-farm activities, intensity is driven by asset ownership, farm income, and cash flow. Asset holding factors, education, and value of agricultural tools in 1997, and value of livestock owned, total size of land owned as well as proportion of rented land in 1994 significantly affect intensity. Farm households with more educated members or more number of students increase off-farm intensity.

Stifel (2010) analyze nonfarm economy, livelihood strategies and welfare of Madagascar using 2005 nationally representative integrated household survey data. The research paper, based on household livelihood strategies, suggests that in households adopting family farm and non-farm activities strategies members with less education are more likely to remain on the farm. On the other hand those with more education perform higher-paying non-farm wage activities. With the household livelihood choice models, education is associated with higher probabilities of non-farm employment. Individuals with a lower secondary education are 7% more likely to work in non-farm wage activities than those with no education. Individual having upper secondary education increase the chance by 19% to work in nonfarm wage activities. Individuals having lower or upper secondary education has less probability to work on the family farm for their primary employment. Poor households with low levels of education generally face greater barriers than the non-poor in their choices of high-return livelihood strategies.

Returns to schooling are largest among those in the non-farm sector in general and among the wage employed in particular. The researcher found that returns to schooling for non-farm employment are considerably larger than in farming. The paper finally concludes that education is an important factor associated not only with non-farm employment opportunities for the rural

population in Madagascar but also with higher earnings for those employed in the non-farm sector. Individuals and households with little or no education face barriers not only to acquiring non-farm jobs, but also to reaping the full benefits of the potentially high-return non-farm sector.

Chapter Three

Econometric Model and Methodology

3.1 Theoretical framework

Separable and non separable concept

In rural area, where markets fail or do not exist, households consume what they produce and decision on their labor, production and consumption are made simultaneously. The situation in which households don't separate consumption and production decision is known as non separable. On the contrary in separable household model production decisions are entirely independent of consumption decision and labor supply decision. Lopez (1986) calls separable as recursive. Recursive and separable are synonymies and used interchangeably. But recursive is possible when market exist for goods and for labor. In addition there must be perfect substitution between homes produced and purchased goods as well as hired labor and family labor. As Lopez (1986) reason out, recursive model is not applicable. Transaction cost associated with off farm activities, difference in skill required by on and off farm work or rationing in labor market, absence of market for some goods make recursive model difficult to apply.

Unitary and collective household models

Unitary household model consider all household members as if they were one. Unitary household model is inconsistent with differences in individual welfare within a household. Even though households differ in their consumption and leisure time usage unitary model consider all members have the same consumption and leisure time. Treatments given to household members also differ because of gender, age, or relation to household head differences. Therefore, such harmony for pooling resources together is not always present in farm households, making unitary decision

making invalid. Collective household model, unlike unitary household model, allows the preferences of household members to differ.

3.2 Farm Household Modeling

The agricultural household model is one that combines production and consumption of rural households (Squire et al 1986).

As Lopez (1986) explains there are different reasons that separable household model is not applicable in the rural farm households. These reasons are also reflected in most rural part of Ethiopia. There are transaction cost, imperfect substitution between family and hired labor, absence of market for some goods in rural farm household of Ethiopia. In such situation, it is reasonable to construct a non separable farm household model for the study area.

Therefore, the farm household model is set based on the following assumptions.

- Well behaved utility function of the household
- Market is assumed to be imperfect and commodities are heterogeneous
- Households have different preferences farm and off work
- Farm wage and off farm wage are not equal. Farm wage is determined endogenously by variables related with production and consumption.
- Land and other capital inputs are assumed to be fixed for the production cycle.

Labor supply decision of farm household members is viewed as the result of household utility maximization subject to constraints on human time, income, and farm production. Household

members are assumed to received utility from a vector of members leisure (l), a vector of purchased goods (y_1) and vector of exogenous variables to current household consumption decisions (y_2)

$$u = u(l, y_1, y_2) \text{-----(1)}$$

Household is assumed to face three constraints on resource. These are

1. Time(T) allocated between farm work(T_f) and off farm work(T_{of}) and leisure(l)

$$T = T_f + T_{of} + l \text{-----(2)}$$

2. Household income- received by members of household from off farm work at wage rate (W_{of}) net farm income and other household income(A).

$$P_f Q_f - P_x X_f + T_{of} W_{of} + A \geq P_1 Y_1 \text{-----(3)}$$

Where Q_f is total output, P_f is price of farm output, P_x is price of variable inputs, X_f is variable farm inputs, P_1 is price of purchased goods.

3. Potential size of the household output

$$Q_f = Q_f(T_f, X_f, K_f) \text{-----(4)}$$

K_f is anything that affecting farm production but exogenous to current production decision.

The utility function is maximized subject to these three constraints using the Lagrange method.

$$L = U(l, y_1, y_2) + \lambda(T - T_f - T_{of} - l) + \gamma(P_f Q_f - P_x X_f + T_{of} W_{of} + A - P_1 Y_1) + \delta(Q_f - Q_f(T_f, X_f, K_f)) \text{-----(5)}$$

$$\frac{\partial L}{\partial T_f} = -\lambda + \delta \frac{\partial Q}{\partial T_f} = 0 \text{-----(6)}$$

$$\frac{\partial L}{\partial T_{of}} = -\lambda + \gamma W_{of} = 0 \text{-----}(7)$$

$$\frac{\partial L}{\partial l} = U_l - \lambda = 0 \text{-----}(8)$$

$$\frac{\partial L}{\partial X_f} = -\gamma P_x - \delta \frac{\partial Q}{\partial X_f} = 0 \text{-----}(9)$$

$$\frac{\partial L}{\partial y_1} = \frac{\partial u}{\partial y_1} - \gamma P_1 = 0 \text{-----}(10)$$

$$\frac{\partial L}{\partial \lambda} = T - T_f - T_{of} - l = 0 \text{-----}(11)$$

$$\frac{\partial L}{\partial \gamma} = P_f Q_f - P_x X_f + T_{of} W_{of} + A - P_1 Y = 0 \text{-----}(12)$$

$$\frac{\partial L}{\partial \delta} = Q_f - Q_f(T_f, X_f, K_f) = 0 \text{-----}(13)$$

Where λ, γ, δ are Lagrange multiplier's

The quantity of off farm work by each household members equal his time less time for leisure and for farm work.

$$T_{of} = T - T_f - l \text{-----}(14)$$

Equation (7) provides the optimal condition for off farm participation. If

$-\lambda + \gamma W_{of} > 0$ or $W_{of} > \frac{\lambda}{\gamma}$, then off farm wage offer is greater than the marginal values of an

individual's farm work or leisure.

3.3 Econometric model

Education enhances an individual ability to adopt and engage in different types of work. Welch (1970, cited in Jolliffe(2004)) model education as contributing to the production of two products. The model show that education can directly increase production of each item and it also improve the allocation of resources thereby increase production. Jolliffe modified the model of Welch (1970) where two goods are farm and off farm income and ask whether there is any evidence that education improve the income from both type of work. The model for this paper is adopted from Dean Jolliffe (2004). To find out how the return to education influence farm and off farm work and whether the farm household allocates labor accordingly, it is better to examine how education affects farm income, farm labor supply, off farm income and off farm labor supply.

Therefore, household utility is modeled as a function of leisure (l) and sum of farm (y_f) and off farm (y_o) income. Household leisure is the different between total stock of household time and sum of hours worked on and off farm.

$$U = u(y, l) \text{-----} (1)$$

$$U = u(y_f + y_o, l) \text{-----} (2)$$

$$y_f(E, l_f, x_f, \theta_f)$$

$$y_o(E, l_o, x_o, \theta_o)$$

$$l = l_{(xh)} - l_f - l_o \text{-----} (3)$$

$$\text{Max}U\{y_{fm}(E_f, l_f, x_f, \theta_f) + y_o(E_o, l_o, x_o, \theta_o), L(x_H) - l_f - l_o\} \text{-----} (4)$$

$$\text{subject to: } L(x_H) \geq l_f + l_o, l_f \geq 0, l_o \geq 0$$

where y_f and y_o are income from farm and off farm activities , E is education, l_f and l_o is household labor supply to farm and off farm activities , x_f and x_o measures factors that affect farm and off farm income (asset, land, non labor income, etc) and θ represents unforeseen shocks in farm and off-farm income . The subscript, f, denotes a farm variable and o denotes off-farm. The total stock of potential household labor supply, L, is a function of a vector of household characteristics including composition of the household which is given by X_h .

Cotlear (1990) describes three different types of education: formal², non-formal³ and informal⁴. Whose education matter in farm and off farm labor supply and income is another question should answer first. Most researchers use years of schooling of the head, average education of the household and maximum education in the household. Basu and Foster (1998) argue that only one person need be educated in the household for the whole household to benefit from schooling. Jolliffe(2002) argue that average education of the household is more significant than one (

² institutionalized, chronologically graded and hierarchically structured educational system

³ any organized, systematic, educational activity carried on outside the framework of the formal system to provide selected types of learning to particular subgroups in the population, adults as well as children

⁴ the lifelong process by which every person acquires and accumulates knowledge, skills, attitudes and insights from daily experiences and exposure to the environment

household head) person education in the household. This paper considers both cases i.e. both the household head education and average education of the household.

Production and consumption decisions of the household are separable, when markets do not fail for a given household. A household model is said to be separable model when the household behaves as a pure profit maximizing producer. The profit level achieved in turn affects consumption, but without affecting production decisions. By contrast, non-separable model is household's decisions regarding production (use of inputs, choice of activities, desired production levels) are affected by its consumer characteristics (consumption preferences, demographic composition, etc.). For those households that supply labor to the wage market, solving Eq. (4) results in an allocation of household labor such that the values of the marginal product of farm and off-farm labor are equated to an exogenously determined market wage. But markets are not complete in developing countries.

When labor markets are not complete, an allocation of household labor is equated to an endogenously determined shadow wage, w^s :

$$\frac{\partial y_f(E_f, l_f, x_f, \theta_f)}{\partial l_f} = \frac{\partial y_o(E_o, l_o, x_o, \theta_o)}{\partial l_o} = w^s \text{-----} (5)$$

When w^s is a function of household characteristics and all factors that affect income, and the household supply of labor into farm and off-farm activities is given by:

$$L_i = L_i(X_h, y_f(E_f, l_f, x_f, \theta_f), y_o(E_o, l_o, x_o, \theta_o)) = L_i(E, x_i, \theta_i) \text{-----} (6)$$

$$Y_i = y_i(E, l_i^*(E, x, \theta), x_i, \theta_i) \text{-----} (7)$$

$$Y_i = y_i(E, x_i, \theta_i) \text{-----} (8)$$

Estimation of Eq. (6) provides a measure of the extent to which education affects the allocation of labor into farm and off-farm activities. Estimation of Eq. (8) provides an estimate of the total effect that education has on farm and off-farm income. Estimation of Eq. (7) provides the measure of the direct effect of education on farm and off-farm income by conditioning on the level of household labor supply.

$$L_i = f(\text{Education}, \text{HHsize}, \text{Ndpt}, \text{Mhhead}, \text{HHage}, \text{asset}, \text{nonlaborincome}, \text{plotsize}, \text{livestockvalue}, \text{DillH}, \text{DillW}, \text{Dregion})$$

$$Y_i = f(\text{Education}, l_i^*, \text{asset}, \text{nonlaborincome}, \text{plotsize}, \text{livestockvalue}, \text{DillH}, \text{DillW}, \text{Dregion})$$

$$Y_i = f(\text{Education}, \text{asset}, \text{nonlaborincome}, \text{plotsize}, \text{livestockvalue}, \text{DillH}, \text{DillW}, \text{Dregion})$$

Description of variables

1. **Education-** the paper takes household head's education and average education of the household. The study considers that the household head is a decision maker in the house and his/her education has influence on labor allocation of the household. The household head's education is analyzed in different level. In some cases the overall human capital in the household may have more influence on the allocation of labor in the household than the household head's education. To see the effect of these two different education in the household labor supply and income, the paper take both household head's education and household average education as explanatory variable alternatively.

2. **Household size-** Household size accounts for the number of individuals in the house. Having larger household number increases the labor supply of farm and off-farm activities. Beyene (2008) in his study of Determinant of off farm Participation Decision in Rural Household of Ethiopia states first and second reason why households participate in off-farm activities. In the first reason

limited agricultural incomes take the highest share and in the second reason large family size take the first rank. This study also expect those household having more family size supply more labor for farm and off farm activities.

3. **Number of dependents** - This is the number of individuals in the household whose age is less or equal to 7 years or whose age is greater or equal to 65. The age limit to include a member as dependent differs from research to research; some take children aged less than 15 years. In case of Ethiopia, Beyene (2008) takes this to be less than five years and above sixty five as dependent. The questionnaire has one question "At what age did they (children) participate in farm/household activities for the first time? The answer for this varies from household to household and from region to region, but the most frequently expressed year is 5-7 years. In addition when the questionnaire ask about marital status it specify age ≥ 7 years. It implies that those individual above seven years old can participate in labor force. So it is logical to take age of dependency less or equal to seven years in case of Ethiopia. A rural household with more number of dependents is expected to have less participation in the labor supply. But, there is also another argument that more number of dependent in the household requires more money. To fulfill money demand the household may reduce their leisure and supply more labor.

4. **Age of the household head**- age of the household head also matter in labor supply. Even though older household head generate experience that increase the marginal value of time in off farm and farm activities, the overall labor hours reduce and demand for leisure increase. So, older household head is expected to participate less in the labor supply.

5. **Marital status** of the head- the marital status of the household head may be married, single, divorced or windowed. It is expected that a household headed by married person supply more

labor to farm activities. Most of the time those who do not married has a tendency to move from place to place to search the off farm activities.

6. **Asset**- this is the monetary value of all assets that the household seize in the house. Some assets are important for farming activities and some are important for off farm activities. Those farmers having more assets which relevant for farming have more chance to participate in farm and those household having more asset which is important for off farm activities can participate in off farm activities. The household also have asset which improve the wellbeing of the household. It is difficult to determine the sign in which asset affect the labor supply of the household.

7. **Non-labor income**- this includes all income as gift, remittance, donation/ aid, other transfer and compensation. These types of income reduce the working hours and increase time to leisure. Hence, households having more of non labor income is expected to supply less labor to farm and of farm activities.

8. **Farm size**-farm size, in this study, is the farm area in hectares that households seize. All the local unit of land measurement convert in to standard unit i.e. hectare. Land in the rural household is beyond factor of production. Land can determine not only the labor allocation of the household but also determine many other issues in the community. Those household having more farm land allocate more labor to farm activities and those farm household who have less farm area may allocate their household labor to off farm activities.

9. **Value of Livestock** – this is the monetary values of all livestock that the household own. Either type of livestock or number of livestock determines the labor allocation of the household. Those households who have more value of livestock are expected to allocate more labor for farm activities. This is because some livestock are important for farm activities itself.

10. **Health status** of the husband and wife- different unexpected things can determine the labor allocation of the household as well as the income. Among these, the illness of the husband or/and the wife is one. It has adverse effect in labor allocation and income generating of the household. It is taken as dummy, 1= yes there is illness of husband 0 otherwise in the last 12 months (using 2001E.C as reference).

11. **Regional dummy**- these regional dummy set to capture the regional difference.

Table 3.1: Description of variables

Variables	Description
-Dependent variables	
Lnfarmlaborday	This is the labor day spent on farm activities by a household.
Lnofffarmlaborday	This is labor day spent on off-farm activities by a household.
Lnfarmincome	Income from farm activities
Lnofffarmincome	Income from off farm wage employment activities.
Hhsize	Household size- number of individual in the house.
Ndpt	Number of dependents
HHage	Household head age
Mhhead	=1 if the head is married, 0 otherwise
Dadultedu	=1 if the household head has attended adult literacy program otherwise

Dprimary	=1 if the household head has primary education, 0 otherwise
Dsecondary	=1 if the head has secondary education, 0 otherwise
Dchedu	=1 if the head has some church/mosque school
Averageedu	This is average education of the household
Lnasset	The monetary value of asset
Lnvaluelivestock	Value of livestock
lnNonlaborincome	Non labor income
lnTotalpotsize	This is the farm plot in hectares
DillH	=1 if the head is ill, 0 otherwise
DillW	=1 if the wife is ill, 0 otherwise
Dregion	Regional dummy. Damh=1 if region is Amhara,0 otherwise. Dsnnp=1 if region is SNNP, 0 otherwise. Dtig=1 if region is Tigray, 0 otherwise. Oromia region is used as a reference.

*ln is natural logarithm

These four dependent variables, i.e. farm labor supply, off farm labor supply, farm income and off farm income are regressed on the set variables including education. Ordinary least square (OLS) is used to estimate all relationships.

The above equations can combine the effect of education on farm and off farm income of the rural household. Dean Jolliffe (2004) has done the same analysis in rural Ghana. Most research conducted in Ethiopia considered education as a determinant of off farm income (Beyene 2008,

Aadugna 2006) others focus on how education increase labor productivity and efficiency in rural households (Assefa and Asfaw 1997). There is a research gap to deal with the impact of education simultaneously on the farm and off farm income. In Eq(6) we can determine how education affects the labor allocation. This labor allocation between farm and off farm activities can cause income differences. But to know that this income difference is due to labor allocation or directly due to education, eq(7) and eq(8) are estimated. This research paper, therefore, has the advantage of estimating the effect of education on both farm and off farm income.

The estimation is that, first estimate the farm and off farm labor supply (Eq6) and farm and off farm income (Eq.8). All four independent variables (farm labor, off farm labor, farm income and off farm income) are regressed on the set of variables which includes education. Estimation of farm income and off farm income based on Eq(8) combine the direct and indirect effect of education together . In order to separate these effects Eq(7) is estimated. This equation is estimated for farm and off farm income as a function of household labor supply to farm and off farm activities.

When labor is included as explanatory variables, endogeneity is suspected and found that labor supply is endogenous. One solution for endogeneity is using instrumental variables (Cameron, 2009). These instrumental variables must be correlated with labor supply. In order to instrument household farm and off farm labor, it is necessary to find variables that are correlate with labor supply but not with farm and off farm income. This can be variables used to estimate labor supply but not for farm and off farm- income. Variables that are correlated with household labor supply and are excluded from farm and off farm income estimation are household characteristics i.e. household size and number of dependents. These two variables have correlation with labor supply

but not with farm and off farm income directly. So labor supply in this case is instrumented. The estimation is two stage least square method. In the first stage labor supply is estimated from Eq(6) and predicted value of labor is saved and used to estimate Eq(7).

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One of the main assumptions for the ordinary least squares regression is the homogeneity of variance of the residuals. The study tests whether heteroskedasticity is present. White's general heteroskedasticity test is confirmed the existence of heteroskedasticity. So, heteroskedasticity in this study is corrected by using heteroskedasticity-robust standard errors estimation.

Chapter Four

Empirical Analysis

This chapter has two main sections, data description and model estimation. The first section presents the statistical description of data used for analysis and the second section is econometric model estimation.

4.1 Data Description

4.1.1 Demographic Characteristics of the Households

The demographic characteristics of the households are basic determinants of household labor supply to farm and off farm activities. Some of the household characteristics included in this study are household size, number of dependents, age of the household head and marital status of the household head.

Household size

The household size accounts for the number of individuals in the house. From large family size there is a chance to get more labor force. The average household size of the sample households is 5.79. The minimum and maximum household size is one and sixteen respectively. The average household sizes as well as individual household sizes differ from region to region. The maximum household size and the average household size are 16 and 6.10, respectively, in Oromia region. The Amhara region has the minimum of both.

Number of dependents

The numbers of dependents in this study are defined as members under 7 or greater than sixty-five years of age. The number of dependants determines the household labor supply, but it is difficult in which direction it does so. Some argue that as the number of dependents increases, households decide to supply more labor to fulfill the household basic needs and satisfy the daily requirements of the household; others argue that the number of dependents deter the household to participate in the labor market because the household requires time to take care of dependents. From the total households sampled, 165 do not have dependents in their houses. The remaining have dependants varying from one to seven. The average number of dependents in the households is 2.63. On average, 2.63 individuals are depending on the remaining members of the household.

Age of the household head

Age has its own effect on the labor supply. As the household head gets older and older, she/he can get more experience in farm or off-farm activities. But most of the time, at adult age, off farm activities participation increases. At older ages the overall labor supply reduces and demands for leisure increases. There is a single person who is a household head at the age of 14 and a single person who is a household head at the age of 120. The average age of the household heads is 52.66 years.

Marital status of the household head

The sample of the household head shows that 65.20% of the household heads married single spouse and 2.5% married more than one spouse. The remaining is single (3.26%), divorced (5.79%) and windowed (23.16%).

4.1.2 Education of the household

The rural households of Ethiopia have access to both formal and non-formal educational in their surroundings. From the total of 1565 household heads, 729 household heads (46.58%) did not have any formal or non-formal education. The remaining 53.42% have either formal or non-formal education.

Table 4. 1: Educational level of the household heads

Educational level	Number of household heads	percent
Not educated	729	46.58
Adult literacy program	288	18.40
Primary education ⁵	426	27.22
Secondary education	73	4.66
Above secondary education	2	0.12
Some church/mosque schoo	47	3.00
Total	1565	100

Table 4.1 depicts that 46.58% of the household heads do not have any education. Even those who have education are concentrated around primary and adult literacy program. The numbers of household heads who have the next higher education reduce as the education level increases. These show that most of the rural households of Ethiopia are not educated. If they are, it is mostly adult and primary education. Only few household heads have secondary and above secondary education.

⁵ Primary education of Ethiopia is of eight years duration(1-8)

In this study above secondary education means those household heads have educational levels above grade 12. The regional distribution of education is also different. For example, from the total household heads that have adult education 164(56.94%) are in Amhara region, 100 (34.27%) household heads are in Oromia region, 16 (0.05%) household heads are in SNNP region and 8 (0.027%) household heads are in Tigray region. Those household heads having primary education are concentrated in Oromia region; they are 178 in number. In Tigray region this number is much lower, at 19. From the total household heads, who have secondary education, 36 are from Oromia region, 29 are from SNNP region, and 8 from Amharha region.

Considering the household head is a decision maker in the house, his/her education is expected to have impact on any household activities. However, analysis based on the educational level of household head seems logical when only head's education is relevant in the household. In most cases others' education is also important in the household. Those households with an uneducated heads may not necessarily be less benefited from education if some other members of the household have some schooling. It means education of any other members of the household can also influence in household activities. To capture this household capital formation, the study uses average education of the household. This average education consists of only formal education of the household members. It is difficult to get the average education of the household including non-formal education because some of non-formal educations have neither specific years of accomplishment nor stepwise classified years. In rural households of Ethiopia where the survey was conducted, 3.19 years of formal schooling is available on average. It is almost equivalent to the end of the first cycle⁶ of primary education.

⁶ First cycle of primary education is 1-4

4.1.3 Off-farm wage employment income

In rural Ethiopia, households are engaged in both wage and self-employed off-farm activities. In this study off-farm activity refers to only off-farm wage employment activities. Self-employed off farm activities are not included in this paper; the reason is that those households who are engaged in self-employment activities did not have specific time (in days or hours). About 52% of the sample households reported that they participated in off-farm wage employment. The most frequently listed off-farm wage employment activities are traditional labor sharing, paid farm work, religious work, unskilled non-farm work, food for work, skilled laborer (building, Thatching), etc. In terms of location where they are employed, 88.2% were employed in their villages, 7.72% were employed in other villages and 3.22% were employed in local markets. A very small fraction of the households were employed in Addis Ababa. On average, those households who participated in off-farm wage employment earned 907.73 birr⁷ annually. The annual income from off farm wage employment ranges from 9 birr to 79952 birr.

4.1.4 Farm income

Farm income is the aggregate of income from crop production, income from animal product sales, and income from animal sale. The amount of crop produced in the “mehere” and “belge” seasons were converted into monetary value using prices as weights. In addition, the farm households have income from sales of animal products (eggs, butter, skin, milk, meat, etc). Sale of

⁷ Birr is the national currency of Ethiopia

animal is another source of income for rural households. The maximum income is obtained from crop production, in which many households are engaged.

Table 4.2: Farm income of households

Source of farm income	Mean income	Std. dev	Min.	Max.
crop production	17860.33	50012.75	0	1088320
Animal sale	840.017	1636.83	0	17600
Animal products sale	543.00	2192.615	0	55200

The farm income of the household is, therefore, the sum of the three farm incomes. The household can fetch income either from all sources, single source or combination of any two. From the total households, 559 households got farm income from all crop production, animal sale and animal product sales. There are also households who got their income from single sources; 380 households got their farm incomes only from crop production; 20 households from animal products sale and 12 households got farm income only from animal sales. The number of households who generate income from a combination of either of the two sources are many. To list some of the combined income households, 233 households got farm income from crop and animal products sale, 294 from crop and animal sale, 42 households generated farm income from animal product sale and animal sale.

When the overall farm income is analyzed, there are households who did not have any income from farm activities and a household having 1089860 birr annual farm income. On average the rural households got 19243.16 birr from farm activities.

4.1.5 Assets of the household

These represent the monetary value of all assets in the household. The household can accumulate different types of assets, some of the assets may be important for farming activities which improve and motivate the households to work on farm. There are also assets, which are important for off-farm participation. Those households having such assets may have more chances to engage in off-farm activities. In addition, the households may have assets, which improve the general wellbeing of the households. The aggregate asset values in the households range from a minimum of 3 birr to a maximum of 213978 birr. On average the households hold assets, which are valued at 2984.87 birr.

4.1.6 Livestock of the household

The number of livestock in the household is another form of asset formation. But this livestock wealth has special meaning for farm households. Livestock in the rural households is more than asset. This is because some livestock serve as capital. The values of livestock, which the households have, can determine the labor allocation of the household as well as the income of the households. Regarding labor supply, livestock has its own role but either the type of livestock or the numbers of livestock they own determine in which activities they participate. The study takes the value of livestock, which the households possess. In this regard there are households who did not have any livestock. There is also a household from Oromia region whose livestock has a value of 82700 birr.

4.1.7 Size of farm land

This is the size of the household farm in hectare. The local unit of farm area measurement was converted in to hectare using conversation factors in each peasant association. A household having large farm area is expected to supply more labor to farm activities and less to off-farm activities.

Table4.3: Total farm size by region

Region	Mean farm size (hectares)	Stand dev.	minimum	max
Tigry	0.69	.85	0.125	10.06
Amhara	3.25	17.71	0.002	362.5
Oromia	3.07	8.56	0.008	163
SNNP	1.83	8.29	0.002	162.62

The farm sizes of the households differ from household to household and from region to region. From the total households, four households have a minimum of 0.002 hectares of farmland. There are some households having very vast farm land which is more than 100 hectares. The average farmland size of all four regions is 2.57 hectares.

In Tirgay region, households have the mean farmland area of 0.69 hectare. The minimum and maximum farmland area for Tigrian household is 0.125 and 10.06 hectares, respectively. This region, relative to other three regions, has the smallest average farm size. In other three regions namely, Amhara, Oromia and SNNP, the average farm size is better than that of Tigray region.

4.1.8 Non labor income

Non-labor income reduces the motivation of households to participate in the labor market in general and labor supply to farm and off-farm activities in particular. Beyne (2008) explains that non-labor income has a positive effect on marginal value of non- work time and hence negative effect on participation of labor in off-farm activities. These show that, individuals having more non-labor income may have less participation in the labor supply of farm and off-farm activities.

The main sources of non-labor income for households are donation /aid, gift, remittance, compensation, inheritance and other transfers. From the total non-labor income that households got, donation/ aid accounted for 66.14%. The remaining are; gift (20.04%), remittance (9.73%), compensation (1.45%), inheritance (0.18%) and other transfers (1.75%). From the total sample households, 51.55% of the respondents have non-labor income. These households have, on average, 708.23 birr annual non-labor income.

4.1.9 Health status of the household

This considers the health status of the husband or wife in the household in the last twelve months using 2001E.C as base year. The paper considers these as a shock to the households. There are different shocks which affect the overall labor supply and income of the households. Among these the illness of the husband and/or wife and death of husband and/or wife is expected to have negative impact on the labor supply and income generating capacity. From the total number of sample households, 194 households faced illness of husband and 172 households faced illness of wives. There are also deaths in the households-79 husbands and 27 wives died during the period.

Table 4.4: Descriptive Statistics

Variable	Description	Mean	Std. Dev.	Min	Max
Hhsize	Number of individuals in the house	5.76634	2.59067	1	16
Ndpt	Number of dependents in the house	2.63936	1.81465	0	11
HHage	Age of the household head	52.6630	15.01216	14	120
Mhhead	Marital status of the household head, 1= married otherwise.	.651534	.4766367	0	1
Dadultedu	=1 if household head has adult literacy program	.183503	.3872028	0	1
Dprimarye	=1 if household head has primary education	.271739	.4449984	0	1
Dseconda	=1 if household head has secondary education	.046675	.2110097	0	1
Dchedu	=1 if household head has church/mosque school	.030051	.1707827	0	1
averageed	Average education of the household ⁸	3.19237	2.389651	0	13
Farminco	Income from all farm activities	19221.5	50447.07	.1	1089
wageoffa	Income from off farm wage employment participation.	909.218	3767.312	1	7995
farmlabor	Total number of days spent on farm activities	70.1687	76.24778	1	831.0
labordayw	Total number of days spent on wage employment	40.0622	51.83557	1	362
Asset	The monetary value of all asset in the house ⁹	2956.24	8728.351	3	2139

⁸ Average education of the household is only for formal education in the household.

⁹ These assets did not include the value of the house.

Valueofliv	Value of livestock in the household	7821.03	10668.32	1	8270
Nonlabou	Non labor income	1099.34	4248.391	0	5027
Totalplots	total farm size in hectares	2.57091	11.37964	.002	362.1
Dillnessof	=1 if the wife is ill	.109195	.3119838	0	1
DillnessH	=1 if husband is ill	.123488	.3291015	0	1
Dtig	=1 if region is Tigray	.093849	.2917111	0	1
Damh	=1 if region is Amhara	.266328	.4421782	0	1
Dsnp	=1 if region is SNNP	.265060	.4415053	0	1
	*Oromia region is used as a reference.				

4.2 Econometrics Estimation and Discussion

4.2.1 Determinants of labor supply

In this section, the study analyses the factors that affect the labor supply to farm and off farm wage employment, including education and other explanatory variables. The study considers education in two different ways; the first considering the household average education and its effect on the labor supply and the second is taking the household head education alone and its effect on the labor supply.

Average education of the household

When average education of the household is used as explanatory variable, it has differential impacts on the labor supply to farm and off-farm wage employment activities.

The effect of average education on farm labor supply is negative and statistically significant. Keeping other variables constant, one additional year of schooling in the household reduces their farm labor day by 6.4%. The effect of this average education on the off-farm labor supply is positive. One additional year of schooling in the household's average education increases off-farm labor supply of the family by 6.6%. This implies that as the household gets more average education, the time they spend on farm activities decrease and the time they spent on off-farm wage employment increases. Average education of the household, therefore, increases off-farm work and reduces farm work. The result for farm labor supply is presented in Table 4.5. Huffman (1980) found that increased farmers' education increases off-farm work directly.

Table 4.5: OLS Estimation of farm labor supply (in days)

lnfarmlabo~y	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Hhsize	.1408461	.0227895	6.18	0.000	.0961405	.1855518
Ndpt	-.1373599	.0289059	-4.75	0.000	-.194064	-.0806558
HHage	-.0037247	.0022631	-1.65	0.100	-.0081642	.0007148
Mhhead	.3536005	.0698342	5.06	0.000	.2166085	.4905925
averageedu	-.0648788	.0155073	-4.18	0.000	-.0952991	-.0344584
lnAsset	.118859	.0345287	3.44	0.001	.051125	.1865931
lnValueofl~k	.1145846	.0180061	6.36	0.000	.0792625	.1499067
lnTotalplo~e	.2240331	.0399314	5.61	0.000	.1457006	.3023655
lnNonlabou~e	-.006859	.0111019	-0.62	0.537	-.0286373	.0149194
DillnessofW	-.0860756	.0907156	-0.95	0.343	-.2640301	.091879
DillnessH	-.0207028	.0843633	-0.25	0.806	-.1861963	.1447907
Dtig	-1.742212	.1199189	-14.53	0.000	-1.977454	-1.50697
Damh	-.3030284	.0811021	-3.74	0.000	-.4621244	-.1439324
Dsnnp	-.0913861	.0890192	-1.03	0.305	-.2660129	.0832407
_cons	1.813731	.2487764	7.29	0.000	1.325713	2.30175

Household Head's Education

The household head is considered as a decision maker in the house. In decision making process his/her education has its own contribution in the household. So the question is that how his/her education affects the labor supply of the household. In this section the study makes analysis taking the household's head education alone. Household heads have different level of education.

Adult education of the head - Table 4.6 shows the effect of household head education on farm labor allocation of the household (the result for off farm labor supply with household head education, present at appendix A1). The result shows that the coefficient on adult education of the household head has positive sign in on farm labor supply model though it is not statistically different from zero.

Table 4.6: OLS estimation of farm labor supply with household head education

lnfarmlabo~y	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Hhsize	.1311565	.020531	6.39	0.000	.0908844	.1714285
Ndpt	-.0993983	.0252378	-3.94	0.000	-.1489027	-.049894
HHage	-.0089834	.0023312	-3.85	0.000	-.0135561	-.0044106
Mhhead	.4701339	.0698143	6.73	0.000	.3331917	.6070761
Dadultedu	.1234638	.0838223	1.47	0.141	-.0409553	.287883
Dprimaryedu	-.1079797	.0769584	-1.40	0.161	-.2589352	.0429757
Dsecondary~u	-.3698446	.1332254	-2.78	0.006	-.6311689	-.1085204
Dchedu	-.0941152	.2008027	-0.47	0.639	-.4879936	.2997633
lnAsset	.0901693	.0340966	2.64	0.008	.0232881	.1570506
lnValueofl~k	.1287511	.0164045	7.85	0.000	.0965734	.1609288
lnTotalplo~e	.1991247	.0384808	5.17	0.000	.1236439	.2746056
lnNonlabou~e	-.013322	.0110023	-1.21	0.226	-.0349031	.0082592
Dillnessofw	-.1752502	.0876056	-2.00	0.046	-.3470904	-.00341
DillnessH	-.0072247	.0859017	-0.08	0.933	-.1757226	.1612732
Dtig	-1.72981	.115784	-14.94	0.000	-1.956923	-1.502698
Damh	-.4020874	.0827045	-4.86	0.000	-.5643139	-.2398609
Dsnp	-.043563	.0881394	-0.49	0.621	-.2164501	.1293242
_cons	1.902633	.2433215	7.82	0.000	1.425353	2.379913

Primary education of the head- the effect of primary education of the household head on farm and off farm labor supply is not statistically significant. Even though it is not different from zero, the effect of primary education of the household head on labor allocation of the households to farm activities is negative and to off-farm activities is positive. A household headed by a person having primary education did not show significant difference on the labor allocation of the household than others whose head do not have primary education. This implies that primary education of the household head cannot influence the household labor supply to farm and off-farm activities.

Secondary education of the head- secondary education of the household head has statistically significant impact on labor allocation of the households. Its effect on farm labor supply is statistically significant and negative. A household whose head has secondary education applies less labor to farm activities. For all households who participated in on farm activities, the relation between the heads secondary education and number of days spent on farm is negatively related. On

the contrary, the effect of household head secondary education on off-farm wage employment labor supply is positive and statistically significant. Those households headed by a person having secondary education apply more labor day to off-farm wage employment activities than other households who do not have a head with secondary education.

Some church/mosque education of the head- The effect of some church or mosque education of household heads is insignificant in labor allocation of the household to farm and off-farm wage employment activities. Even though some church/mosque education of the household head has insignificant difference, its effect in both farm and off farm labor supply is negative.

Household characteristics and other variables, in addition to education, also have influences on farm and off farm labor supply of households. The following interpretation is made based on the average education of the household. (See Table 4.5)

Household size- family is the source of labor for farm as well as off-farm activities. Household size has a positive and statistically significant relation with farm and off-farm wage employment labor supply. A household with more family size has more labor supply in farm activities as well as off farm wage employment activities. One additional person in the household can increase the number of days on farm activities by 14.08%. For off-farm wage employment activities, one additional person in the household can increase the labor supply by 10.28%. Tassew (2000) found that household size is significant and positive in off-farm self employment activities in Tigray region. In general those households having more family size supply more labor for both farm and off farm wage employment activities.

Number of dependants- number of dependents in the household has negative relationship with the number of days spent on farm and off-farm wage employment activities. So, the number of dependants influences labor allocation of the household to farm and off farm wage employment activities negatively. One additional dependent in the household reduces the number of days spent on farm activities by 13.75%. This negative effect is higher in off-farm wage employment. One additional dependent in the household reduces off-farm wage employment days by 18.80%. As the number of dependents in the household increases, the number of days allocated to for farm activities and off-farm wage employment activities decreases.

Age of the household head- age of the household head is not statically significant in the determination of both farm and off-farm wage employment labor supply.

Marital status of the household head- there is a difference between married and not married household heads regarding labor supply of households to farm activities. Being a married head in the household increase the number of days spent on farm activities than those households whose heads are not married. Even though statistically insignificant, the effect of marital status of the household head on off-farm labor supply is positive.

Asset- the value of assets that the household owns positively affects labor allocation of the household to farm activities. A household who has higher value of assets spent higher number of days on farm activities. As the household asset value increase by one percent the labor supply of the household to the farm activities increases by 11.88%. But the effect of asset value in the off-farm wage employment is insignificant.

Value of livestock- the relationship between the value of livestock and the number of days spent on farm activities is positive and statistically significant. A one percent increase in the value of livestock that the household owns can increase the number of days spent on the farm activities by 11.45%. The value of livestock that the household owns affects off-farm labor supply negatively. A one percent increase in the value of livestock reduces the labor days to off-farm activities by 15.07%. It means when households have smaller value of livestock, they spend more of their labor on off-farm wage employment and when the value of livestock that the household owns increase the households labor days spent on farm activities increase. The reason is that some livestock are used directly for farm activities. In another words, those households who have more value of livestock give more labor to farm activities and those household who have less value of livestock give more labor to off farm wage employment activities.

Non-labor income- the effect of non-labor income is negative for farm labor supply and off-farm labor supply. Non-labor income increases the demand for leisure and reduces the labor supply. The effect of non-labor income is significantly reflected on off farm labor supply. As the household gets more non labor income the labor days they spend on off-farm wage employment activities decrease. A one percent increment of non labor income in the household causes a 6.4% reduction of labor supply to off-farm wage employment. Its effect is also negative on farm labor supply but it is statistically insignificant.

Farm size- the farm size that the household operates and farm activities that are undertaken by households is highly interrelated. Farm size also has its own effect on the labor allocation of the household. In this study, farm size and labor allocation of the household to farm activities are positively correlated. Those households having more farm area allocate more labor to farm

activities. The effect of farm size on off-farm labor allocation is negative, but it is not statistically significant.

Illness of husband or wife- these two are used to capture shocks to the household. If there is illness of the husband or wife in the household, there may be a change in the labor allocation to farm and off-farm activities. The coefficient of this factor in both labor allocation to farm activities as well as to off-farm wage employment activities is negative but it is not statistically significant.

Regional dummies – these regional dummies are used to capture the regional differences. There is significant difference between regions regarding labor allocation to on farm and off-farm activities. Using Oromia region as reference, being in Amhara and Tigray regions decreases the labor supply to farm activities. But there is no statistically significant difference in labor allocation to farm activities between Oromia and SNNP regions. When we compare off-farm labor supply of Oromia with SNNP and Tigray, being SNNP and Tigray increase the off farm labor supply. But regarding off-farm labor supply, there is no difference between Amhara and Oromia regions.

The effects of all the above variables on farm and off farm labor supply are also analyzed with using the household head education. There is no change in the signs or significance levels of the variables as the education change from average education of the household to household head education. (See Table 4.6)

4.2.2 Determinants of farm and off farm income

Education

Farm and off farm activities are determined by many factors among which education has its own role. To see whether education, along with other variables, has significant impact on farm and off farm incomes, we estimated equations (7) and (8).

Estimation of Equation (8) provides total effect of education on farm and off farm incomes. Estimation of Equation (7) provides direct effect of education on farm and off-farm incomes by conditioning on the level of household labor. Education in the farm household, in addition to determining labor allocation, has aggregate effect on improving productivity and allocation of resources. Such an effect, i.e., the total effect of education on farm and off farm wage employment is captured by Equation (8). But when we control the effect of education through labor, that is, conditioning on the household labor in the model, it gives the direct effect of education on income. When labor shifts from farm to off farm activities or vice versa due to education, it is obvious that the income also increase accordingly. This is the indirect effect of education on farm and off farm income.

The result, like the labor supply, is analyzed using the household average education and household heads education. The first analysis is the effect of average education of the household on farm and off farm income.

When we see the effect of average education on farm and off-farm income, its sign is opposite to labor supply. In both farm and off-farm income, average education of the household has a positive sign. The effect is remarkable in off-farm income than farm income. Even though the effect of

average education is positive on farm income it is statistically insignificant. On off farm wage employment income, one additional average year of schooling in the household can increase the off farm wage income by 12.55%. In the case of labor supply, as the household gets more average education they supply more days to off farm wage employment. This is also reflected in the income generation of off-farm wage employment. Average education reduces the participation of the household in on farm activities but in the overall farm income of the household it has positive effect. Education has total effects on overall efficiency of the household. If the effect of average education of the household on household efficiency outweighs the labor allocation effect, average education of the household show positive effect on the farm income though it reduces the labor supply to farm activities.

Table 4.7: OLS estimation of farm income and off farm income with average education

lnFarmincome	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
averageedu	.0095127	.0149605	0.64	0.525	-.0198349	.0388602
lnAsset	.2384418	.0415231	5.74	0.000	.1569872	.3198963
lnValueoflk	.1605849	.021669	7.41	0.000	.1180775	.2030923
lnTotalplo~e	.3422254	.0396524	8.63	0.000	.2644407	.4200101
lnNonlabou~e	-.0039303	.0117426	-0.33	0.738	-.0269653	.0191048
Dillnessofw	-.0665915	.1135549	-0.59	0.558	-.2893482	.1561652
DillnessH	.0390762	.0976367	0.40	0.689	-.1524544	.2306068
Dtig	-2.510684	.1910727	-13.14	0.000	-2.885505	-2.135863
Damh	-.5170302	.0886061	-5.84	0.000	-.6908457	-.3432147
Dsnp	-.6314126	.0860954	-7.33	0.000	-.800303	-.4625222
_cons	6.313901	.2689749	23.47	0.000	5.786262	6.84154

lnwageoff~e	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
averageedu	.1255306	.0490757	2.56	0.011	.0291889	.2218722
lnAsset	.0013874	.1263982	0.01	0.991	-.246748	.2495228
lnValueoflk	-.19305	.0469276	-4.11	0.000	-.2851746	-.1009254
lnTotalplo~e	-.1336513	.1187814	-1.13	0.261	-.3668338	.0995313
lnNonlabou~e	-.0912979	.0374803	-2.44	0.015	-.1648764	-.0177194
Dillnessofw	-.0268264	.3772063	-0.07	0.943	-.767329	.7136762
DillnessH	-.2620416	.3309312	-0.79	0.429	-.9117005	.3876172
Dtig	3.262433	.2980904	10.94	0.000	2.677244	3.847621
Damh	.0355308	.3019991	0.12	0.906	-.5573308	.6283924
Dsnp	.9827202	.3388749	2.90	0.004	.3174668	1.647974
_cons	4.822587	.8660792	5.57	0.000	3.122367	6.522808

The above tables show the effect of average education of the household on the farm and off-farm wage employment income.

In addition to the average education of the household, the study also considers the head's education on farm and off-farm wage employment income of the household. Only adult education of the head has positive and significant effect on farm income of the household. The effects of primary, secondary and some church/mosque education of the household head are not statistically significant in farm income of the household. In off-farm income of the household, only secondary education of the households head has positive and significant effect (see appendix A2 for off farm income with household head education)

Table 4.8 OLS estimation of farm income with household head education

lnFarmincome	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Dadu1tedu	.2150832	.1005661	2.14	0.033	.0178201	.4123464
Dprimaryedu	.1180959	.0789969	1.49	0.135	-.0368586	.2730504
Dsecondary~u	.1553121	.140314	1.11	0.269	-.1199176	.4305418
Dchedu	.09081	.2386726	0.38	0.704	-.3773527	.5589728
lnAsset	.2675326	.0403803	6.63	0.000	.1883255	.3467397
lnValueofl~k	.1740901	.0206574	8.43	0.000	.13357	.2146102
lnTotalplo~e	.3411063	.042597	8.01	0.000	.2575511	.4246616
lnNonlabou~e	-.0189897	.0127984	-1.48	0.138	-.0440942	.0061147
Dillnessofw	-.1372678	.1292854	-1.06	0.289	-.3908646	.1163291
DillnessH	.0690903	.0980516	0.70	0.481	-.1232405	.2614212
Dtig	-2.574089	.2025099	-12.71	0.000	-2.971318	-2.17686
Damh	-.5317413	.091975	-5.78	0.000	-.7121528	-.3513299
Dsnnp	-.52618	.0924239	-5.69	0.000	-.7074719	-.344888
_cons	5.903469	.284293	20.77	0.000	5.345821	6.461117

The above estimations using Equation (8) show the total effect of education on farm income and off-farm wage employment. To see the direct effect of education, Equation (7) is estimated, conditioning the labor supply of the household in the farm and off farm income. Labor supply is instrumented and the regression is two stage least square estimation.

The result shows that average education of the household has direct effect on farm and off farm income. When we compare the direct effect of average education of the household on farm and off-farm income, it is positive and statistically significant on farm income than off-farm wage employment income. Even though average education of the household reduces the labor supply to farm activities, its direct effect on farm income is positive. This implies that the direct effect of average education offsets the indirect effect of it in on farm income. In other words, farm income did not decrease due to higher average education of the household which reduces on farm labor; rather it increases the farm income. When we see the direct effect of average education of the household on off-farm wage employment income, it is positive but statistically insignificant.

Table 4.9 Instrumental variables (2SLS) regression of farm income with average education

Instrumental variables (2SLS) regression

lnFarmincome	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
lnfarmlabo~y	.6575413	.137371	4.79	0.000	.3880647	.9270178
averageedu	.0432547	.0169339	2.55	0.011	.010036	.0764734
lnAsset	.1262595	.0443419	2.85	0.004	.0392753	.2132438
lnValueofliv~k	.0770357	.0243915	3.16	0.002	.0291876	.1248837
lnTotalplo~e	.1867825	.0453804	4.12	0.000	.0977611	.2758038
lnNonlabou~e	.0081698	.0116209	0.70	0.482	-.0146266	.0309662
Dillnessofw	-.0285263	.1113895	-0.26	0.798	-.2470357	.1899831
DillnessH	-.0366445	.0912216	-0.40	0.688	-.2155911	.142302
Dtig	-1.361534	.3018556	-4.51	0.000	-1.953675	-.7693933
Damh	-.2976633	.0876195	-3.40	0.001	-.4695439	-.1257827
Dsnnp	-.6283825	.0860012	-7.31	0.000	-.7970885	-.4596765
_cons	5.113229	.3465473	14.75	0.000	4.433418	5.793041

Instrumented: lnfarmlaboday

Instruments: averageedu lnAsset lnValueoflivestock lnTotalplotsize
lnNonlabourincome Dillnessofw DillnessH Dtig Damh Dsnnp
Hsize Ndpt

When we consider the household heads education, the direct effect of household head education is not significant on farm income. This shows that the head education in the household has no direct effect on the farm income. However, in off farm income, secondary education of the household head has positive and statistically significant direct effect in off farm income of the household (see appendix A3)

Table 4.10 Instrumental variables (2SLS) regression of farm income with Household head education

lnFarmincome	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
lnfarmlabo~y	.8886724	.1458618	6.09	0.000	.6025596	1.174785
Dadultedu	.0022483	.1107809	0.02	0.984	-.2150521	.2195488
Dprimaryedu	-.0410498	.0850357	-0.48	0.629	-.2078502	.1257507
Dsecondary~u	.21634	.1428648	1.51	0.130	-.0638941	.496574
Dchedu	.1427071	.1701933	0.84	0.402	-.1911326	.4765469
lnAsset	.1371517	.0430698	3.18	0.001	.0526688	.2216346
lnValueofliv~k	.0453028	.0279475	1.62	0.105	-.0095171	.1001228
lnTotalplots~e	.1486293	.048318	3.08	0.002	.053852	.2434066
lnNonlabou~e	.005936	.0133026	0.45	0.655	-.0201576	.0320296
Dillnessofw	.0612775	.1286583	0.48	0.634	-.19109	.3136449
DillnessH	-.0739253	.0952765	-0.78	0.438	-.2608134	.1129628
Dtig	-1.041199	.3072916	-3.39	0.001	-1.643961	-.4384361
Damh	-.1540769	.1116033	-1.38	0.168	-.3729905	.0648366
Dsnnp	-.5724145	.0962405	-5.95	0.000	-.7611934	-.3836356
_cons	4.470933	.3627643	12.32	0.000	3.759359	5.182507

Instrumented: lnfarmlaborday
 Instruments: Dadultedu Dprimaryedu Dsecondaryedu Dchedu lnAsset
 lnValueoflivestock lnTotalplotsize lnNonlabourincome
 Dillnessofw DillnessH Dtig Damh Dsnnp Hhsize Ndpt

In addition to education, other variables also determine of farm and off-farm wage employment income. This subsection, describes how other variables affect the farm and off farm wage employment income. The interpretations of these variables are based on table 4.7.

Value of Asset- the value of assets that the household owns determines the farm income. Those households who have more asset value also have more farm income. This may be some of the assets that the households possess are useful for farm activities. One percent increase in the asset value of the household can increase the farm income of the household by 23%. This result reduces to 12% when labor is included as explanatorily variable. Though asset has positive effect on off-farm wage employment, its importance for off-farm wage employment income is not different from zero

Value of livestock- the relationship between farm income and the value of livestock is positive. Farm households having higher value of livestock also have more farm income. One percent

increase in the value of livestock in the household can increase the farm income of the household by 16%. But the value of livestock and off-farm wage employment income go in opposite direction. When the value of livestock in the house is increases, the income from off-farm wage employment reduces. A one percent increase in the value of livestock reduces off-farm wage income by 19%.

Farm size- this is the farm area in hectares. The coefficient on total farm size is positive and statistically significant in farm income model. The relationship between off-farm wage employment income and farm size is negative, but it is not different from zero. We have seen the relationship between farm size and labor days spent on the farm are positive.

Non-labor income- we have seen that the effect of non-labor income on labor supply is negative. Its effect on farm and off-farm income is also negative. Non-labor income has negative sign in on farm and off-farm wage employment income models. But it is statistically significant only on off farm wage employment income. Those households who have more non-labor income have less off-farm income.

Regional Dummies- the regional dummies entered to captures the regional differences in farm and off-farm income. There is significant difference between regions in farm and off-farm incomes. When we compare the farm income of the household with in regions, using Oromia as a reference, being in Tigray, SNNP and Amahar reduces farm income. When we compare off-farm income of Tigray and SNNP with Oromia, being in Tigray and SNNP increases off-farm income of the households. There is no significant difference between Amhara and Oromia regions in off farm income.

Chapter Five

Conclusions and Policy Implications

5.1 Conclusions

This study is an attempt to analyze the impact of education on farm and off farm income of rural households of Ethiopia.

The rural households of Ethiopia participate in farm and off-farm wage employment activities. From total households sampled, 52% participated in off-farm wage employment activities.

From 1565 household heads, 729(46.58%) are not educated. The remaining 836(53.45%) have formal or non-formal education. The educational level of those households concentrated round primary education and adult literacy program. Eighteen per cent of the household heads have adult literacy program. Those household heads who attended formal education make around 32%, but this formal education is concentrated around primary education. There are regional differences in the distribution of education among rural household heads. Most household heads from Amahara region have adult education while household heads from Oromia region have primary education. In addition to household heads the paper analyses average education of the household. On average 3.19 years of schooling is found in rural households of Ethiopia.

The result of the study shows that average education of the household can increase the number of days allocated to off wage employment and reduces the number of days spent on farm activities. As the average education of the household increase, the household allocates more time to off-farm activities than farm activities. The effect of average education of the household on off-farm wage employment income is positive and significant. The analysis also was made using the household head's education on household labor supply and income. Secondary education of the head has a

remarkable effect on the farm labor supply and off-farm labor supply. Those household heads having secondary education have considerable influence on their family labor supply. A household with secondary education head has less labor supply to farm activities than those who don't have a head with secondary education. The effect of secondary education of the household head on off farm labor supply is opposite to farm labor supply. In case of income, the effect of secondary education of the household head affects off-farm wage employment income. It has positive and significant effect on off farm wage employment income. The effects of household head's Primary education, some church and mosque education are not significant in both labor supply and income of the household. Adult education of the household head has positive and significant effect on farm income.

Education has direct and indirect effect on farm and off farm income. The joint effect of these direct and indirect effects is total effect of education on farm and off farm income. The direct effects of education in the household are improving the overall efficiency of the household in resource allocation and hence increase income. The indirect effect of education is reflected on labor allocation. Education can shift labor from farm to off-farm. As labor shifts from one activity to another activity there is also income change accordingly. Therefore, the change in income due to labor movement is the indirect effect of education. The total effect of education and direct effect of education are seen in this study. The total effect of education on farm and off-farm income is analyzed without labor supply in the model. The total effect of average education of the household is significant in off-farm wage employment income. When we consider the heads education, secondary education of the head has significant total effect on off-farm wage employment. The result shows that average education of the household has direct effect on farm income. The direct effect of average education is not reflected on off-farm wage employment. The direct effect of

head's education is not reflected in on farm income. Only secondary education of the head has direct effect on off-farm wage employment income.

In addition to education, other variables, which affect the labor supply of the household, are also analyzed. These are household characteristics, non-labor income, farm size, value of livestock and illness of the wife or husband and regional dummies. Most of the variables have the expected signs. Household size affects the labor supply of the household positively. As the household size increases the household labor supply to farm activities and off-farm wage employment activities are increases. The number of dependants in the household reduces the household labor supply to farm and off-farm activities.

Asset value of the household has positive effect on farm labor supply and farm income. As the household asset value increases, labor supply to farm activities increases. Non-labor income of the household has a negative effect on the labor allocation of the households to farm and off farm wage employment activities. As the household get, more of non-labor income, the time they allocate to farm and off farm wage employment activities reduces. Total farm size plays a decisive role in the labor allocation and income generation. Farm size and household labor allocation to farm are positively correlated.

5.2 Policy Implications

Based on the analyses, the study suggests the following:

- To see the effect of education on household labor supply and income, the paper uses the household head education and average education of the household. Average education of the household is more significant than household head education in the determination of labor supply of the household and income of the household. It implies average education of the household is more powerful than the household head education in rural Ethiopia. It is; therefore, better to provide education to all members of the household instead of educating the household head alone.
- Average education of the household and secondary education of the household head reduce the labor supply to farm activities and increase the labor supply to off-farm wage employment activities. Average education of the household and secondary education of the household head in the rural households shift labor supply from farm to off-farm. But when we see the effect of these educational measures, especially the direct effects, they positive on farm income. That is, the income does not decline due to the labor shift from farm to off-farm activities because education has direct effect on farm income. Therefore, expansion of education to all rural households increases farm income. Therefore, the government should expand education to all in rural households of Ethiopia as far as it increases the farm income regardless of labor allocation.
- From non-formal education, adult literacy of the household head has positive and significant effect on farm income. Therefore, along with the formal education, expansion of adult education is important to increase farm income.
- As the household size increases labor days to farm and off farm activities also increase. This shows that households want to work more both on farm and off-farm when they have larger family

to support. This situation may increase burden on families unless on farm and off farm job opportunities expand accordingly. Therefore, to accommodate these large numbers of worker on the farm and off farm activities, the type of activities as well as the job opportunity in these two sectors should increase accordingly.

➤ Non-labor income from different directions and in different forms reduces the labor supply of the household to off farm wage employment activities. Among the sources of non-labor incomes, donation/ aid account 66.04%. In the long run this may create feeling of dependency on donation/aid. Therefore it is better to reduce and/or control the type and amount of non-labor income, especially donation/aid.

Finally this study suggests further research on this area to make in-depth analysis of the effect of education on household welfare.

Bibliography

1. Adugna Lemi (2006) *The Dynamics of Income Diversification in Ethiopia: Evidence from Panel data*: Department of Economics University of Massachusetts Boston, unpublished
2. Arega D. Alene · V. M. Manyong (2007), *The Effects of Education on Agricultural Productivity under Traditional and Improved Technology in Northern Nigeria: an Endogenous Switching Regression Analysis*, *Empirical Economics* (2007) 32:141–159
3. Assefa Admasie and Abay Asfaw (1997), *The Impact of Education on Allocative and Technical Efficiency of Farmers: the Case of Ethiopian Small Holders*, paper presented at the Seventh Annual Conference on the Ethiopian Economy.
4. Basu, Kaushik and James E. Foster (1998), *On measuring literacy*, *The Economic Journal*, 108, 1733-1749.
5. Beyene A. (2008), *Determinants of Off-farm Participation Decision of Farm Households in Ethiopia*, *Agrekon*, Vol 47, No 1
6. Colin Cameron (2009) *Micro Econometric Using Stata*: Stata press publication.
7. Cotlear, Daniel (1990), *the Effects of Education on Farm Productivity*, in Keith Griffin and John Knight, eds., *Human Development and the International Development Strategy for the 1990s*.
8. Craig C. Wu(1977) *Education in Farm Production: The Case of Taiwan*: *American Journal of Agricultural Economics*, Vol. 59, No. 4, pp. 699-709
9. Daniel A. Sumner(1982) *The Off-Farm Labor Supply of Farmers*: *American Journal of Agricultural Economics*, Vol. 64, No. 3 , pp. 499-509

10. David Stifel (2010) *The rural non-farm economy, livelihood strategies and household welfare*: AfJARE Vol 4 No 1
11. Dean Jolliffe (2004), *The Impact of Education in Rural Ghana: Examining Household Labor Allocation and Returns On and Off the Farm*, Journal of development economics 73, p 287-314
12. Dean Jolliffe (2002) *Whose Schooling Matters in the Determination of Household Income: Evidence from a Developing Country*. Economic Development and Cultural Change 50(2): 287-312.
13. Dennis Tao Yang(1997), *Education and Off-Farm Work*, Economic Development and Cultural Change, Vol. 45, No. 3 pp. 613-632
14. Dennis Tao Yang(1997) *Education in Production: Measuring Labor Quality and Management*: American Journal of Agricultural Economics, Vol. 79, No. 3 pp. 764-772
15. Edward Taylor and Antonio Yunez-Naude(2000) *The Returns from Schooling in a Diversified Rural Economy*: American Journal of Agricultural Economics, Vol. 82, No. 2 pp. 287-297
16. Frank Ellis (2000) *The Determinants of Rural Livelihood Diversification in Developing Countries*, Journal of Agricultural Economics - Volume 51, Number 2 Pages 289-302
17. Gray S. Becker (1964) *A Theory of the Allocation of Time*, The Economic Journal, volume 75, No 299 pp 493-517.
18. Huffman, W.(1980) *Farm and Off-farm Work Decisions: The Role of Human Capital*. Review of Economics and Statistics 62, 14– 23.

19. Lopez, R., (1986), *Structural Models of the Farm Household that Allow for Interdependent Utility and Profit-Maximization Decisions*. In: Singh, I., Squire, L., Strauss, J. (Eds.) *Agricultural Household Models*. Johns Hopkins Univ. Press, Baltimore.
20. Marcel Fafchamps and Agnes R. Quisumbing (1999) *Human Capital, Productivity, and Labor Allocation in Rural Pakistan*: *The Journal of Human Resources*, Vol. 34, No. 2, pp. 369-406
21. Mark Bils and Peter J. Klenow (2000) *Does Schooling Cause Growth?* *The American economic review*, Vol. 90 no. 5
22. Marlaine E. Lockheed, T. Jamison, Lawrence J. Lau(1980) *Farmer Education and Farm Efficiency: A Survey*: *Economic Development and Cultural Change*, Vol. 29, No. 1 pp. 37-76
23. Michel Spence (1973) *Signaling in Retrospect and the Informational Structure of Market*: *American Economic Reviews* Vol 92 No.3 pp 434-459
24. Ministry of Education(1994) *Education and training policy of Ethiopia*
25. Ministry of Agriculture and Rural Development (2010) *Ethiopian's agricultural sector policy and investment framework(PIF)*
26. Reardon, T.(1997), *Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa*, *World Development* 25, 735–747
27. Schultz, T.W., (1975), *The Value of the Ability to Deal with Disequilibria*, *Journal of Economic Literature* 13, 827–846.
28. Sharada Weir (1999) *The Effects of Education on Farmer Productivity in Rural Ethiopia*, WPS99-7, Centre for the Study of African Economies Department of Economics, University of Oxford

29. Singh(1974), *Impact of Education on Farm Production*, Economic and Political Weekly, Vol. 9, No. 39 pp. A92-A96
30. Singh, Squire, Strauss, (1986), *Agricultural Household Models: Extensions, Applications, and Policy*, The Johns Hopkins Univ. Press, Baltimore and London
31. Tassew W. (2000) *Economic Analysis and Policy Implications of Farm and Off- farm Employment: a case study in the Tigray region of northern Ethiopia*, PHD thesis, Wageningen University.
32. Thomas Owen Eisemon (1989) *Schooling, Cognition and Creating Capacity for Technological Innovation in Africa*: International Review of Education Vol. 35, No. 3, pp. 329-348
33. The Federal Democratic Republic of Ethiopia (2008): Selected Issues Series, International Monetary Fund Country Report.
34. Vildan Serin, Nizamettin Bayyurt, Abdülkadir Civan(2009) *Effects of Formal Education and Training on Farmers Income*, European Journal of Social Sciences – Volume 7, No. 3

Appendices

Appendix -A1

OLS estimation of off-farm labor supply with household head education

lnlaborday~f	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
Hhsize	.1322552	.0463449	2.85	0.004	.0412815	.223229
Ndpt	-.2046312	.0569745	-3.59	0.000	-.3164705	-.0927919
HHage	.0064363	.0051899	1.24	0.215	-.0037514	.016624
Mhhead	.1415766	.1505801	0.94	0.347	-.1540078	.4371609
Dadultedu	.0578748	.1824258	0.32	0.751	-.3002218	.4159714
Dprimaryedu	.147779	.1761149	0.84	0.402	-.1979295	.4934874
Dsecondary~u	.8240309	.3668148	2.25	0.025	.103984	1.544078
Dchedu	-.2874491	.4130718	-0.70	0.487	-1.098297	.5233991
lnAsset	-.0514174	.0743416	-0.69	0.489	-.1973478	.0945129
lnValueofl~k	-.1434659	.0286797	-5.00	0.000	-.1997633	-.0871685
lnTotalplo~e	-.071092	.0745625	-0.95	0.341	-.2174561	.075272
lnNonlabou~e	-.0643211	.0224501	-2.87	0.004	-.10839	-.0202523
Dillnessofw	.0759811	.2310936	0.33	0.742	-.377649	.5296113
DillnessH	-.0452366	.2021875	-0.22	0.823	-.4421249	.3516518
Dtig	2.403685	.1884069	12.76	0.000	2.033848	2.773523
Damh	.104462	.1793873	0.58	0.561	-.2476701	.456594
Dsnp	.8085947	.209131	3.87	0.000	.3980764	1.219113
_cons	2.715287	.5342123	5.08	0.000	1.666643	3.76393

Appendix-A2 OLS estimation of off farm income with household head education

lnwageofff~e	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Dadultedu	.305814	.304063	1.01	0.315	-.2910484	.9026764
Dprimaryedu	.1938753	.2656787	0.73	0.466	-.3276403	.7153908
Dsecondary~u	1.15171	.532357	2.16	0.031	.1067163	2.196703
Dchedu	-.2726193	.6553636	-0.42	0.678	-1.559069	1.013831
lnAsset	.0616007	.1177625	0.52	0.601	-.1695619	.2927632
lnValueofl~k	-.1991273	.0466635	-4.27	0.000	-.2907257	-.1075288
lnTotalplo~e	-.1385505	.1140563	-1.21	0.225	-.362438	.085337
lnNonlabou~e	-.0846729	.0373737	-2.27	0.024	-.1580358	-.01131
Dillnessofw	.0754112	.3669927	0.21	0.837	-.6449795	.7958018
DillnessH	-.2559812	.3277168	-0.78	0.435	-.8992749	.3873124
Dtig	3.40185	.4035617	8.43	0.000	2.609676	4.194024
Damh	-.0663171	.282394	-0.23	0.814	-.6206442	.4880099
Dsnp	.9329312	.3211483	2.90	0.004	.3025312	1.563331
_cons	4.617918	.8153624	5.66	0.000	3.017398	6.218439

Appendix-A3 Instrumental variables (2SLS) regression of off-farm income with Household head education

lnwageofff~e	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
lnfarmlabo~y	1.8172	.9048215	2.01	0.045	.0410716	3.593329
Dadultedu	.0107368	.3906564	0.03	0.978	-.7561061	.7775797
Dprimaryedu	.0296938	.3173877	0.09	0.925	-.5933256	.6527132
Dsecondary~u	1.660287	.7337829	2.26	0.024	.2199005	3.100674
Dchedu	.1098054	1.079991	0.10	0.919	-2.010174	2.229785
lnAsset	-.1487362	.175362	-0.85	0.397	-.4929649	.1954924
lnValueofliv~k	-.4209646	.1294757	-3.25	0.001	-.6751203	-.166809
lnTotalplo~e	-.5670839	.2913394	-1.95	0.052	-1.138971	.0048037
lnNonlabou~e	-.0647314	.04499	-1.44	0.151	-.1530448	.0235821
DillnessofW	.7435568	.5975594	1.24	0.214	-.4294285	1.916542
DillnessH	-.3384696	.3905726	-0.87	0.386	-1.105148	.4282088
Dtig	6.847794	1.743401	3.93	0.000	3.425567	10.27002
Damh	.4384355	.4289135	1.02	0.307	-.4035045	1.280376
Dsnp	1.574955	.5060644	3.11	0.002	.5815705	2.568339
_cons	.5624205	2.245985	0.25	0.802	-3.846358	4.971199

Instrumented: lnfarmlaborday
 Instruments: Dadultedu Dprimaryedu Dsecondaryedu Dchedu lnAsset
 lnValueoflivestock lnTotalplotsize lnNonlabourincome
 DillnessofW DillnessH Dtig Damh Dsnp Hhsize Ndpt

Declaration

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

The examiners' comments have been duly incorporated.

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