FARM HOUSEHOLDS LABOR SUPPLY TO OFF FARM ACTIVITIES IN ETHIOPIA

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DECLARATION

I, the undersigned, declare that this thesis is my own original work and has not been presented, in a whole or in part, for a degree in any other university. All references used have duly been acknowledged.

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Abstract

Farm households in Ethiopia are participating in off farm activities to supplement their farm income. Despite the importance of off farm income to the farmers less attention was given to the sector. There is also little empirical evidence on the off farm labor supply behavior of farm households in Ethiopia.

Understanding the factors that affect the off farm work decisions is very important for rural development in general and farmers in particular. Therefore this paper tries to see the off farm participation decision and labor supply behavior of farm households in Ethiopia. It uses the 1999 Ethiopian rural household survey conducted by the department of economics of Addis Ababa University in collaboration with the US AID. The bivariate probit and Tobit models are used to analyze the data.

The results of the study indicated that various individual and farm characteristics affect the off farm work participation and labor supply decisions of farmers. Of the human capital variables, education of the household head does not affect the off farm work decisions of farmers. It increases the return on the farm. But average schooling of the family positively affects the off farm labor supply of males. The off farm wage rate is significantly affected by the level of schooling of the household members and is more important for female members than males. The other human capital variables included in the study, farm experience, handicraft training, and health status of the family are important factors that affect the off farm work decisions of farm households. The availability of financial sources has a significant impact on farmers' decision to engage in the sector. The negative effect with land size shows that poor and landless households will be benefited from the sector.

I. INTRODUCTION

1.1 Background

Ethiopia is a rural and agrarian society where nearly 85 percent of the population lives on agriculture and livestock for their livelihood. Despite the different measures taken by governments, the national economy still rely on the agricultural sector which is characterized by low labor productivity, a declining farm size (an average of one hectare per household) and subsistence farming, soil degradation, inadequate and variable rainfall, tenure insecurity, weak agricultural research base and extension system, lack of financial services, imperfect agricultural markets and poor infrastructure[1].

After the overthrow of Emperor Haile Sellasie, a military government known as "Derg" ruled Ethiopia. It declared Socialism and the economy was managed through central planning. The government pursued an agricultural policy committed to expanding collective and state owned farms and restricted private sector participation in the economy. Large-scale private farms were nationalized as state farms. The military government controlled labor mobility and wage rates and restricted labor hiring on private farms. Opportunities for wage employment sharply declined after 1975 because of the restrictive wage and employment policies.

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[1]Annual report on Ethiopian economy, vol.i.1999/2000.pp178.

Various public institutions like the Rural Technology Promotion Department (RTPD) of the Ministry of Agriculture, the Handicraft and Small Industries Development Agency (HASIDA) of the Ministry of Industry and the Adult Training Centers of the Ministry of Education were trying to promote the non-farm sector. These institutions, however, were not successful because of policy and institutional problems from the beginning. Each agency or organization tends to work in isolation and there is no single focal point to co-ordinate and harmonize the support of the rural non-farm sector for greater effectiveness.

The government did not formulate adequate policy measures to assist rural non-farm activities. The Socialist government directed nearly all the promotional activities towards producers' cooperatives, which were abolished following the reforms introduced in March 1990. This was an indication of their involuntary and undemocratic nature.

After the downfall of the "Derg" regime, the Ethiopian people Revolutionary Democratic Front (EPRDF) changed the centrally planned economy in to a market economy. It tries to liberalize the economy and encourage private investment. The reform process has affected the institutions set to promote the non-farm sector under the previous government. RTPD has been brought under the regional Bureaus of Agriculture. HASIDA is organized as a profit-making public establishment. Most of the Adult Training Centers of the Ministry of Education

have been inactive since 1991. In some cases, the centers have been reportedly transferred to the regional governments after decentralization.

The main objective of the agricultural policy of the present government is to ensure adequate food security through increased agricultural production and employment. The strategies or programs for the non-farm sector have not been clearly stated. Attempts to increase the productivity of agriculture and bring about rural development in Ethiopia have mostly focused on the structural sectoral problems. The development of agriculture, however, has to be seen not only as a sectoral problem but also as an intersectoral problem (Tegegne 2000).

The agricultural sector employees over 90 percent of the total rural population in Ethiopia. The main types of farming activities are crop production, livestock husbandry and mixed farming. Mixed farming is the dominant type of farming system and includes both crop production and animal husbandry. The dominant type of farm input is labor and most of the farm labor comes from the family members.

Even though the potential of the non-farm sector has not been realized, farmers allocate labor to non-farm activities. The types of off-farm activities in which farm households participate can be categorized in to wage employment and self-employment (Tassew, 2000). Off- farm wage employment includes paid development work, like soil and water conservation, manual non-farm work and

non-manual non-farm work like carpentry. Off-farm self employment includes activities like petty trade, transporting by pack animals, selling of wood and charcoal, selling of fruit, livestock trading, stone mining etc.

Farm Households in Ethiopia have continued to operate in non-farm activities. Therefore, because of the importance of off-farm income to farm households, the participation and off-farm labor supply decisions of farm families should be studied to understand the dynamics of the determinants of off farm labor supply.

1.2 Statement of the Problem

In rural areas of developing countries in general and Ethiopia in particular, labor market participation is the major source of income for many landless and small farm households. In Ethiopia during the "Derg" regime farmers were not allowed to have more than one occupation. Agricultural wage labor, except in the formal economy, was in principle not allowed. Even though enforcement was likely to be limited, data from several communities suggested that this was a serious hinderance for household income generation. From the late 1980s and reaffirmed after the Mengistu government was defeated, wage labor was again allowed. Farm households are allowed to participate in any occupation they like.

In spite of the high potential of the non-farm sector in generating employment, they are not covered by government policies and strategies. It is now becoming increasingly evident that in peasant economies farm employment alone cannot

provide an enduring solution to the problem of rural underemployment and poverty. Population pressure in Ethiopia results small farm size, soil degradation and deforestation. These contribute to the decline in agricultural productivity.

The linkage between agriculture and non-agriculture or farm and non-farm must be adequately exploited to contribute to agricultural productivity and rural progress The extent to which the benefits of rural investment strategies and technological innovations in agriculture are transmitted through the labor market to landless and poor households depends crucially on how farm households adjust their members' labor supply and their demand for family and hired labor (Singh, Squire, and Strauss, 1986). Hence farm households and the labor supply of their members are of considerable interest to policy makers in developing countries. As a long-term strategy, non-farm avenues of employment and earnings for the rural households are a must. However, there is little research effort to understand the labor supply behavior of farmers to off-farm activities in Ethiopia. Hence this paper is an attempt to address this problem with particular emphasis on the effect of human capital on the off-farm labor supply of farmers in Ethiopia.

1.3 Objectives of the Study

As the agricultural sector alone cannot solve the problem of the rural people, we need to look at the farm and non-farm linkages. Rural development policies aiming at promoting the farm non-farm linkages should consider the role of the non-farm sector. For this identifying the factors that affect the off-farm participation and labor supply decisions of farm households is necessary. Therefore, the main objective of the study is to examine the off- farm labor supply behavior of farm households in Ethiopia.

The specific objectives of the study are: -

i. To identify the determinants of off-farm labor participation decision of the farm households. .
ii. To identify the factors that affect farm households labor supply to off farm activities and to investigate the impact of those factors.
iii. To examine the impact of human capital variables on the off- farm wage rate of members of farm households.
iv. To investigate the off farm labor participation and supply of male and female members of farm households separately.

1.4. Significance of the Study

As stated by Hallberg et al (1991), strengthening the rural labor market may be the most effective means of achieving certain policy goals even those related to agriculture. For example, a more efficient and robust rural labor market could

enhance efforts to increase and stabilize farm family income, protect the family farm, maintain minimum levels of public services in rural areas, ease the transition out of farming for those who must leave, and reduce underemployment of rural people.

Ethiopian farmers are suffering from instability of income due to natural and socio economic factors. Among the major reasons for the poor performance are diminishing farm size, soil degradation, inadequate and variable rainfall, lack of credit facilities, imperfect agricultural markets and poor infrastructure, etc. To overcome such problems farmers can use working off-farm as a coping strategy. They have always combined farming enterprises with other complementary economic activities. They try to participate in non-farm activities. Some are retailers, millers, grain trades, livestock traders etc.

Ethiopia follows Agricultural Development Led Industrialization (ADLI) with the assumption that there is a linkage between farming and non-farming activities but the linkage is limited. Moreover, little empirical evidence exists on labor supply behavior of farm households in Ethiopia. Yet such information is crucial to any model of economic development formulated to serve as a useful policy-prescribing apparatus. Hence the result of the study helps the government identify the different options for intervention if there is a need to make households diversify the ways in which they gain their livelihood. It will serve policy makers

and planners to design appropriate rural development policies and strategies to improve the welfare of the farm household in Ethiopia.

1.5. Organization of the study

The remainder of the paper is organized as follows. The next section is the literature review which deals with the theoretical and empirical review of off farm work participation and labor supply to off-farm activities. Section three is the data source and methodology. In this section the source of the information, the methods used to obtain the data and the natural and socioeconomic condition of each sample site are discussed. The last part of this section explains the theoretical and econometric model specification used for analyzing the data. Section four deals with the nature of rural off-farm employment in Ethiopia. The analysis of empirical results is discussed in section five. The last section is summary and conclusion.

II. LITERATURE REVIEW

2.1. Theoretical Background

As stated by Becker (1990) Current farm-household theory (Nakajima, 1970 and 1986: Singh, Square and Strauss, 1986) is partly based on Chayanov's subjective equilibrium analysis of Russian peasant household before 1920. Chayanov shows that each rural farm household assigns labor to activities until the household's subjective evaluation of the disutility of work equals its estimate of the marginal utility of goods gained.

The neoclassical farm household model predicted that a farm household chooses to work either on the farm or off-farm depending on the marginal return from farm and off-farm labor (Singh et al, 1986). For an individual, the action for off-farm participation is based on the comparison of the market wage rate and the reservation wage. The reservation wage is the marginal value of time when none is allocated to off-farm work. An individual will participate in off farm work when the reservation wage is lower than the market wage (Benjamin and Guymand, 1994).

Sumner (1982) graphically illustrated the economics of farmers' allocation of time among farming, off farm work and non work time. It is shown that a criterion for participation in off-farm work and for optimal time allocation given participation can be developed from the value of time in each sector. In the figure below indifference curves U_0 and U_1 are drawn for the choice between income and work time. The indifference curve slopes represent the marginal value of non-work time, W_u. The relevant budget constraint consists of income from three sources

(i.e. non work income, farm income and income from off farm activities). Distance oy_0 is non-work income. The curve F represents net income from time spent on farming, and M is the earnings function from off-farm employment. The marginal value of farm work, W_f ($\partial F / \partial t_f$, i.e. the slope of F), falls as more time is devoted to farming; while the marginal wage at off-farm jobs, W_m, is a constant and shown by the slope of M. If no off-farm work is allowed, equilibrium is t_f^{**} where the marginal value of farm work just equals the slope of U_1 (the marginal rate of substitution between work and income in the utility function). If off-farm work is allowed, optimal farming time is t_f^* at the tangency between M and F (W_f=W_m). Then total work time is ($t_f^* + t_m^*$) at the tangency of M and U_0 (W_m=W_u).

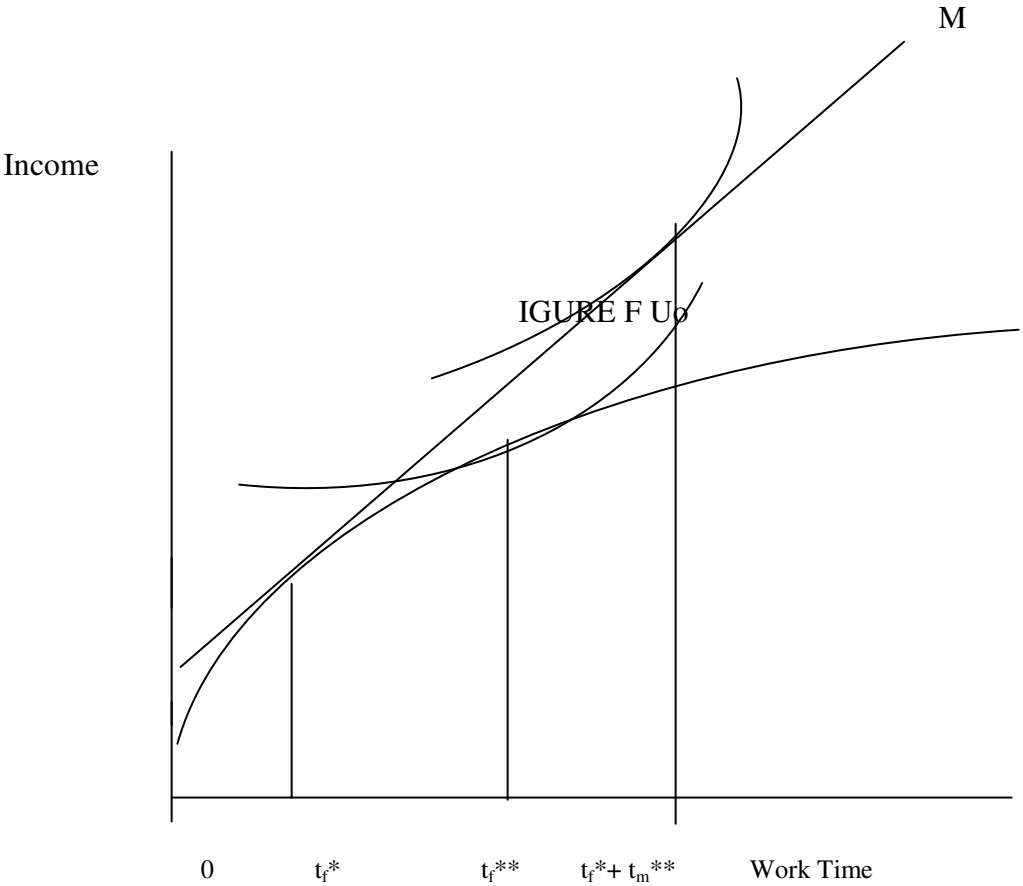

Figure 1. Allocation of time among farming, off farm work, and non work activities.

In the above illustration, off-farm participation is preferred to farming exclusively (U_0 is higher than U_1). A necessary and sufficient condition for this result is that $W_m > W_f$ at t_f^{**}, the optimum time allocation in absence of off-farm opportunities.

As stated by Lass et al, 1991, the literature dealing with estimates of off farm labor supply is quite large. The range of estimated parameters is wide. This lack of agreement is somewhat disconcerting. The differences are probably due to both the techniques employed and structural differences in supply over space and time. However, the important variables are well known and most signs, if not magnitudes, can be accurately predicted by neoclassical theory.

2.2. REVIEW OF EMPIRICAL EVIDENCES

The literature dealing with off-farm employment has focused on factors affecting participation in off-farm work and off-farm labor supply. Much has not been done in developing countries in general and Ethiopia in particular. Very few studies have considered empirically the factors that influence the decisions of rural farm households in Sub-Saharan Africa to participate in non-farm production and labor supply off farm (Reardon). Previous studies on the rural non farm economy in Africa have concentrated on the characteristics of micro enterprises in rural areas, quantifying the share of non farm in total income and employment to show the range of roles played by non farm activities in the household economy (Abdulai and Delgado, 1999). Studies that concentrate on the off-farm or non-farm work

participation decision of Ethiopian farm households are reviewed. However, since most of the studies on this area are undertaken in developed countries, some empirical evidences from these countries (North and Central parts of America and Europe) are discussed below.

2.2.1. Empirical Evidences From Developed Countries

Even though the methodologies used for analyzing the labor allocation decisions of farm households is different, much has been done on developed countries. Huffman and Lange (1989) developed theoretical and econometric models to examine joint-wage labor participation and hours decisions of a husband and wife for Iowa farm households. A bivariate probit model was used for investigating variables that explain the off-farm work participation. The results show that the probability of off-farm work for husbands is greatest at a young age and tends to decline as they become older. For wives, there is a slightly concave life-cycle pattern. Increasing the wife's age, holding husband's age constant, has a positive and significant effect on his probability of off-farm work. A husband or a wife who has more schooling has a significant greater probability of off-farm work than others. This implies that added schooling raises an individual's off-farm wage by more than it raises their reservation wage at farm and home activities. Additional wife's schooling causes a reduction (significant) in the probability that her husband works off-farm; i.e. raises his reservation wage.

Farming experience also reduces the probability of working off-farm. The presences of children (less than six years old), larger income and farm household members that are more isolated from jobs have a lower probability of off-farm work.

Sumner (1982) used data from a 1971 survey of Illinois farmers to examine the off-farm wages, labor force participation, and hours of work of farmers. The result shows that participation in off-farm work does follow a quadratic age pattern peaking at forty-three years, well below the average age of farmers. Education, by increasing the probability of working at an off farm job, indicates a stronger shift on the marginal wage at off-farm jobs than on the marginal wage of farm work or the marginal value of non-work time. The other human capital variable, health has no significant effect on off-farm work. Unlike Huffman and Lange, Sumner included dummy variables for training and experience. He found that 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, past farm experience made off-farm work much less likely. Again in contrast to Huffman and Lange, the number of children in the family, has almost no effect on off-farm work, and wives education has a small negative effect.

Lass et al (1991) provide a summary of the direct effects on the supply of off-farm labor. The off-farm wage, education, off-farm experience and children are positively related to the time spent working off-farm for men. In addition, results suggest that off-farm labor may be used as a form of diversification to reduce risk.

Capital intensity also appears to release operators to work more hours off-farm. Location near an urban area affects the supply of off-farm labor indirectly through higher wages. The availability of health benefits has been shown to be an important consideration in labor supply decisions.

The presence and number of children is one of the most important factors that reduce the supply of labor by women. The negative income effect has also been demonstrated for women. The supply of labor by women appears to be more elastic with respect to wages than their male counter parts. Both education and experience are positively related to supply. However, the effect of farm characteristics on the time spent working off-farm by women has not been adequately addressed.

Both, Sumner (1982) and Huffman and Lange (1989), tried to estimate the off-farm labor demand functions. Sumner did not separate the male and female wage functions. Included, as explanatory variables, are human capital and local labor market variables. In both cases, of the human capital variables, education and experience are the most important in determining the off-farm wage. A one-year increase in schooling causes a larger percentage and absolute increase for wives than for husbands and wives wage experience profiles are more concave than for husbands (Huffman and Lange). Health, that is represented by a dummy variable, and age (considered as a proxy for on-the-job experience) are found to have no significant effect on off-farm wage determination (Sumner, 1982).

Benjamin and Guyomard, in their study of off-farm work decisions of French agricultural households, show that the main effects on off-farm work market participation decisions of both members (husband and wife) are: -

i. Higher general education was reflected in higher off-farm labor market participation of both operators and spouses.
ii. The younger wives are the more likely they are to work off-farm.
iii. The number of children decreases the wife's participation in the off-farm labor market, i.e. increases her reservation wage, and
iv. Farm operators seem to be more responsive to farm characteristics than wives.

Several farm characteristics are inversely related to the supply of off-farm labor. The supply of labor to the off-farm markets declines with increases in gross or net farm revenues and the net worth of the farm household. Farm experience has been shown to reduce the intensity of off-farm work, as has the presence of livestock on the farm. Greater levels of non-wage income reduce the hours spent working off-farm due to the income effect on the consumption of leisure.

2.2.2. Empirical Evidences from Other Developing Countries

In this section empirical studies on the off farm work participation and labor supply decisions of farm households are reviewed from countries in North America, Latin America, Asia, and African countries.

Studies on the role of off-farm activities in rural households in Mexico shows that participation in off farm activities helps reduce poverty and contributes to greater equality in the distribution of income. It analyzes the determinants of access to off farm sources of income. Education, ethnic origin and regional availability of off farm employment are found to affect participation in off farm activities.

Multinomial estimation method (where no participation in off farm work is the choice comparison) is used to investigate the determinants of participation in off farm activities. Results show that individual characteristics affect participation in off farm activities. Spouse of a household head are less likely to participate in off farm activities as compared to the household head. Younger males (less than 35 years old) are more engaged in agricultural wage work and seasonal migration than household heads. Younger females do not have these advantages. Older females are also less engaged in all types of off-farm activities.

Education is found to be one of the most important factors that affect off farm participation decision of farmers. It analyzes the influence of schooling by classifying individuals with educational level greater than or equal to three years and less than six years, education greater or equal to six years and less than nine years and education of nine years and above. Education of less than three years is considered as a reference level. The findings indicates that compared to individuals with less than three years of schooling, those with three to nine years

of education participate more in construction work, the non-agricultural labor market, and self employment. The gains are even greater for those who went beyond secondary education (nine years and above). The role of education in women participation to off farm activities is also analyzed by contrasting its effect with men. Results show that education has no differential role across genders in agricultural wage employment and in construction work (which requires less education level). But education has a larger participation-inducement effect for women than for men in other non-agricultural wage employment and in self-employment (between men and women with nine years or more of education).In general education helps the farm households in the study area to participate in the more remunerative off-farm activities.

The household's asset position also affects individual members participation in off farm activities. For instance, greater access to land reduces participation in construction work, and an easy entry and low paying off farm activities. Location plays a role. For women, ease of access is the key to participate in remunerative non-agricultural employment, but it has no effect on men.

Similar study in Nicaragua (2001) investigated the determinants of individual participation in non-farm activities by using probit regressions. The off-farm activities are classified in to farm wage employment, non-farm wage employment, and non-farm self-employment and separate regressions were made accordingly. The results show that non household-head men gravitate toward wage

employment off farm. Women and household heads gravitate toward self-employment. Older person tends toward non-farm wage employment. The influence of education is also analyzed. Literacy, and primary, secondary, and university degrees have positive effects on participation in non-farm wage employment. The primary and secondary schooling have a negative effect on engagement in farm wage employment. However, education does not have a significant effect on self-employment in the non-farm sector may be because of the nature of products, which uses traditional technologies. Land scarcity is found to be a driving force in participation in non-farm employment. But it has a least strong effect for self-employment. Access to improved roads is important to participation in farm and non-farm wage employment, but is only a very modest determinant of non-farm self-employment.

The effect of human capital on the productivity and labor allocation of rural households was undertaken in four districts of Pakistan (1997). It tried to see the direct effect on output and incomes and indirect effect on labor allocation. Human capital variables that include experience proxied by age and age squared, education in years of schooling, innate ability, childhood nutrition measured by height, current nutritional status measured by the body mass index are considered in the analysis.

The result of the study indicate that education raises off-farm productivity and induces rural Pakistan households to shift labor resources from farm to off-farm

activities. One additional year of schooling for all adult males raises household incomes by 8.9%. One fifth of this additional income is achieved by reallocating labor away from farming and toward non-farm work. The researchers conclude that the skills acquired in school raise the productivity of adult males in rural non-farm work. The wife's education has a positive and significant effect on total income, but the effect of female human capital on productivity is not robust. The study also investigates the influence of other human capital variable, health, using height as a proxy variable. It has a positive influence on productivity and labor effort for males but no systematic and robust relationship was uncovered between female nutrition and market-oriented activities in rural Pakistan.

Employment generation is a primary objective of economic policy in a densely populated economy like Bangladesh. While agriculture continue to dominate, non-agricultural activities have steadily gained prominence, even in the rural areas of Bangladesh. These activities broadly termed as rural non-farm activities, employ over 38 percent of the rural labor force in Bangladesh. Hossain (1994), in Bakht and Shah edition, used a probit model on data from 1245 rural households to study rural non-farm employment and concluded that education has a negative impact on participation in rural non-farm activity, except in the case of trade[2]. The development of rural infrastructure does not have a positive impact on

[2]Note that he did not classify education in to different categories.

participation in rural non-farm activities. The extent of participation is higher for landless rather than land owning households and for younger heads of households.

Abdulai and Delgado (1999) estimated jointly the determinants of the decision of husbands and wives to participate in cash- income-oriented non-farm work in Northern Ghana. They tried to estimate the determinants of non-farm earnings and hours worked for participating men and women.

Non-farm labor participation decision equations, wage rate equations, and labor supply equations are estimated separately for husbands and wives. The participation decision is estimated by using a bivariate probit model. The probability of a married individual in non-farm work is affected by characteristics of the individual's spouse. The result of the analysis suggest that the variable age has a positive effect on the probability of labor supply to the non farm sector at younger ages and at older ages the probability of participating in non farm work decreases as age increases.

Human capital, as embodied in education and experience, is essential in increasing non-farm earnings and time allocation of rural families and to diversify the rural economy out of agriculture. The level of education for husband and wife is measured by years of schooling. A husband or wife who had more schooling had a significantly higher probability of engaging in non-farm activities.

Additional schooling raises an individual's off farm wage by more than it raises his or her reservation wage for farm and home activities. The marginal effect of a year of female schooling on the probability of participation was greater than that of male schooling. This suggests that a year of schooling raises the difference between a woman's reservation and market wage relatively more than is the case for males. Additional schooling of the male did significantly influence the participation of the females. For males, however, additional schooling of wives tends to decrease the probability of their participation in non-farm work.

The other variables non labor income and distance to the regional capital are found to have a negative influence on the participation decisions of farm households. Non-labor income had also a negative effect on the non-farm labor supply of both males and females.

Unlike other studies the presence of children had no significant effect on the participation decision of women in non-farm work and on the labor supply of husbands and wives. This is similar with Rosenzweig (1980) and Skoufias (1994). Jacoby (1993) also indicated that the number of children 5 years old and under does not depress women's hours worked, which includes housework, though not child care per se. But a well-developed infrastructure and population density had positive significant effects on the probability of non-farm work of both males and females. Decreases in the costs of information and transportation that stem from

improvements in infrastructure improve both the incentives and opportunities for farm- based rural labor to participate in non farm work.

The estimated wage function shows that education and experience variables were positive and significant for both males and females. Schooling has a greater effect on wives' wage than in husbands' wages. However, experience seems to more important for men than for women. This is because in the study area males engaged in non farm work are frequently involved in employment where experience may be more important than formal education, such as metal work, equipment repair, and driving.

Analysis of the labor supply functions indicated that own-wage has a positive effect on the labor supply of both males and females. Higher wages lead to substitution effects that are greater than the opposing income effects, leading to increased labor supply to non farm employment-an upward sloping labor supply, supportive of the utility maximization hypothesis. While the positive response concurs with findings by Jacoby using Peruvian data, it contrasts with Rosenzweig's findings with Indian data. Rosenzweig (1980) describe market labor supply behavior in two-person households in India by utilizing a neoclassical framework based on competitive assumptions. However, this framework is inappropriate for developing countries (Singh, et al 1986). The labor supply predictions derived from the landless and landholding household models formulated under the assumption of competitive labor markets are tested. The

market labor supply functions of males and females in landless and landholding households are estimated using ordinary least squares instrumental variables (OLS-IV) and tobit (TOBIT-IV).

The tobit estimates for landholding households indicate that the net labor supply of farm males is backward bending, with the own wage coefficient significantly less than zero at the 0.01 level. But for females the market supply curves is positively sloped. The estimated gross male wage effects on female market supply (in both landless &landholding households) are negative and significant. Indeed, female market labor supply appears quite sensitive to movements in the male wage. For instance a 10 percent rise in the wage rate of males is associated with a 20% reduction in the number of days worked off the farm by wives of landholders. This is in part due to the substitution of the wife's time for labor in farm production.

The estimated male wage effect on female labor supply was negative and significant. The cross-wage effect for females was positive, but not significant, indicating that husbands as a group do not reduce their labor supply, even when wives as a group earn more from non-farm activities. The negative effect of higher male wages on female labor supply suggests that male and female leisure are gross substitutes in terms of utility. The significance of the cross-wage effects are consistent with family utility maximization and confirm that studies that restrict such cross-wage effects to be zero may yield estimates that are subject to specification error (Skoufias 1994).

Schooling is found to have a negative influence on net labor supply on landholding households. This is because schooling of male farm managers improves managerial efficiency. The result also explained by the author as the formal education of farm wives enhances the productivity of all farm inputs, including the husband's time in farm production. Age, which is considered as an indicator of farming experience, has only a minimal productivity effect; it has a correct sign (negative) but is not statistically significant. The size of land (cropped) is also found to affect the number of days worked off the farm by heads of landholding.

The presence of children less than five years of age appears to have no significant effect on the market labor supply of women in India, suggesting that market work and child rearing are not competitive activities in rural areas of developing countries. The proximity of small-scale industry, and to a lesser extent of a factory, is associated with higher amounts of market work by females in landless as well as landholding households, suggesting that females are significantly less geographically mobile than males in rural India.

2.2.3. Empirical Evidences on Ethiopia

The available empirical literatures on the off farm work participation of farmers in Ethiopia and related studies are reviewed below.

The Ministry of Labor and Social Affairs (MOLSA) in Ethiopia, undertook a survey on the Agricultural Wage Employment and Rural Non-Farm Employment in 1997. It uses a logit regression analysis to determine the factors that influence the

participation decision of farmers in wage employment. The determinants of Participation in handicraft and related activities, in food and drink services, in Trade activities were also investigated. The variables used in the analysis of Participation in wage employment are number of cattle owned by the family, sex dummy, Region dummy (for Tigray, Afar, Amhara, Oromiya and SNNP), dummy for food and drink, dummy for trade, dummy for handicraft, distance from all weather road, dummy for fertilizer user, Education level of household head (takes a value of 1 for literate and 0 otherwise), cultivated land per person & income from agricultural activities.

The result of the study showed that all variables measuring the degree of participation in farm activities have a negative sign and all except agricultural income are significant, suggesting that wage participation is negatively correlated with farm activities. Households with more number of livestock or larger per capita holdings are less likely to participate in wage work.

Since the dependent variable in the analysis is the participation in wage employment, the study tries to look at the influence of non-farm activities. All non-farm activities are positively and significantly related to the participation of farm households in wage employment i.e. the probability of participation in wage employment increases with participation in non farm activities (in food &drink, handicrafts and trade). This may be due to the fact that wage income on its own may not be sufficient to meet subsistence needs of farm households.

The effect of human capital variables (age, age squared, experience, training in farm and non farm activities, health, education at different levels) are not analyzed in detail, even though these variables are expected to have an effect on the participation decision of farm households to off-farm activities. The researchers tried to see the impact of education by assigning a dummy variable that takes a value of 1 for literate and 0 otherwise. It has a negative coefficient showing that the probability of working for wage is lower for literate households than illiterate ones.

The reason is that casual labor is generally perceived as a low status work by the public and more so by educated people. Similarly, Tassew (2000) tried to see the impact of traditional and modern education on the supply of labor for off-farm wage employment and come out with the same result (negative sign) even though it is not significant. But the justifications given for the negative sign are different;

1) An increase in education increases the productivity of the individual on the farm or in the household more than it increases the productivity in off-farm employment or
2) Off-farm employment in the rural areas of Tigray may not require education at all and hence no special demand in the labor market for relatively educated farm households.

The study undertaken by MOLSA also tried to see the factors that influence the participation in other self-employment activities particularly on handicrafts, food and drinks and trade activities. The variables have the same sign as the participation in wage employment except that education is positively related to the probability of participation in trade activities and food and drinks but no justification is given. Also the results show that men have a greater tendency to participate in wage work than women. But the reverse is true for participation in trade, food and drinks, handicrafts and related activities.

Tassew (2000) studied the labor supply behavior of farm households in Tigray. The explanatory variables included are shadow wage of on farm family labor, market wage rate for male members and female members, non labor income, education dummy for household head and also for wife, age, age-squared, family size, number of dependants, dummy for year and location. Among these variables the first two are endogenous variables. He developed a Tobit model to analyze the influence of these variables on the on farm and off-farm labor supply decisions of farmers in Tigray.

He found that wage rate and family composition are the main determining factors in the off-farm labor supply of male members, where as female member's off-farm labor supply is influenced by the wage rate and non-labor income. The own wage elasticities of male and female members are positive and significant suggesting an upward sloping labor supply. When household heads are able to read and write,

male members supply less labor for off-farm work and female members (wife) supply more labor for off-farm work. Similarly, when household wives are able to read and write male members supply more labor for off-farm work and female members (wife) supply less labor for off-farm work. Location dummies also have a significant influence on both the male and female labor supplies. However, the age and age-squared variables do not show a significant effect on off-farm labor supply.

Mulat, Tegegne, and Delil undertook studies related to non-farm activities. The findings of each study are discussed below.

A study carried out by Tegegne in two *Woredas* of SNNP determines the factors that influence non-farm earnings. He tried to see the influence of variables like age, education, family size, proportion of farm income in total income and a dummy for *enset* by using OLS regression. He stated that farmers not participating in the non-farm activity are older than those participating. It considers age as a proxy for farm experience. Hence experienced farmers might be better of in their farming activity.

Education is found to be a significant factors that influences non-farm income positively. Family size and age are not related to non-farm income. Farmers with more farm resources are less attracted to non-farm activities. Since the non-farm sector strongly contributes to the improvement of the farm sector, rural policies

should aim at promoting the farm and non-farm linkages by strengthening non-farm activities in rural areas. Education is one of the effective instruments in promoting non-farm activities in rural areas (Tegegne, 2000).

Mulat and Teferi (1996) studied non-farm activities in North Shoa. They classify the factors that influence the participation decision of farmers in to four broad categories. These are;

(1) Personal attributes (age, sex, family size and education), (2) farm income, (3) land endowment, and (4) food balance (defined grain sales less grain purchase). The result of the study shows that the variable education has a positive influence on the share of non-farm income to farm income.[1]

In areas, which are relatively better in terms of location from the towns, education has a stronger impact. However, in the more marginal areas, it may have very little to contribute. The variable age has a negative influence in the more marginal areas. The share of non-farm income is higher for the younger age group than the older farmers. The life cycle effect that is considered as Age Square has not been included in the study. Family size is found to be non significant. Revenue from crop sales does not have a significant impact on the share of non-farm income as livestock revenue. The results also show that yield is negatively related to participation in non-farm activities. The same is true for food balance. In contrast

[1]The dependent variable is defined as the ratio of non-farm income to farm income (cash).

to other studies, land size is found to have a positive influence on non-farm employment. The larger the land owned, the greater is the level of participation in non-farm employment. The variable SEX is included in the analysis. They concluded that female-headed households are not strongly disadvantaged with respect to non-farm earnings.

Different problems constrained non-farm employment. The primary thrust of any promotional effort should focus on removing the demand constraints. Macroeconomic policies favoring the growth of rural income should be given priority. The authors also concluded that reallocation of land and labor resources in favor of livestock production could lead to a substantial increase in income. Therefore, more attention needs to be devoted to increasing the linkages between the farm and non-farm sectors.

Delil (2001) investigated the determinants of the probability of off-farm employment in Oromiya. He concluded that variables such as family size, religion (orthodox), and credit have a positive influence on the probability of off-farm employment. Variables like size of cultivated land, married household head (represented by dummy variables), own account worker head, coffee and chat producer households, fertilizer user households, number of cattle owned by household have a negative and significant influence on farm household probability of participating in off-farm work in the study area. Even though most of the variables included in his study have given the expected sign, he did not give

any emphasis on the influence of human capital variables on the probability of involvement in off-farm work except that he considered the variable age of the household head as an experience, which has a positive influence on off-farm work. Hence it is not possible to draw conclusion on the effect of human capital variables such as education and health on the probability of working off-farm.

2.2.4. Summary and Conclusion of Empirical Evidences

The above review of empirical literature on the determinants of off farm work decisions of farm households in different countries in the world show that there are many factors that affect the participation and off farm labor supply decision of farm households. So many researches have been done on developed countries. In developing countries much has not been done in this area except in India and other Latin America countries. One can find very few researches in Africa and almost none in Ethiopia. Those few studies undertaken in developing countries try to investigate the effect of the different variables like human capital variables such as education, experience (on farm and non farm), training, health, and other variables like location, household characteristics and farm characteristics. But the sign and magnitude of these variables are not the same in those research outcomes. In Africa the literature on this area are dealt with the rural non-farm employment emphasizing the importance of non-farm income or non-farm sector on the household economy and employment generation.

In Ethiopia some empirical evidences reviewed are concentrated on the importance of non-farm income for rural poverty alleviation and investigate the determinants of non-farm income on some districts of the country.

Therefore this study tries to address all the gaps indicated before. Since the impact of the different factors affecting off farm participation and labor supply decisions are not the same, this study helps to determine or examine the effect of these variables on the off farm labor supply in Ethiopian case. It is therefore necessary to pursue the analysis at the empirical level.

III. DATA SOURCE AND METHODOLOGY

3.1. Data source

The data source for this study is the 1999 Ethiopian Rural Household Survey conducted by the Department of Economics of Addis Ababa University in collaboration with the US AID. The Rural Household Survey was undertaken in four regions of the country. A total of 18 rural peasant associations were selected from four administrative regions. Namely; Tigray, Amhara, Oromiya, and SNNP. These sites were chosen in such a way that they could represent the socioeconomic and agro-ecological diversity of the rural areas. From the 18 peasant associations a total of 1681 farm households were selected randomly[1].

3.2. Description of the Study Area

After the downfall of the Derg regime (1991), the Ethiopian people's Revolutionary Democratic Front (EPRDF) divided the country in to 9 regions and 2 administrative. Namely, Tigray, Afar, Amhara, Oromiya, Somali, Benishangul-Gumuz, Southern Nations, Nationalities and peoples' region (SNNP), Gambella, Harari, Addis Ababa and Dire Dawa Administrative council. Samples were drawn from Tigray, Amhara, Oromiya and SNNP regions. These regions represent around 96.7 & 92 % of the rural & total population of the country respectively (CSA, 1999).

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[1]A summary of regions, peasant associations (sample sites) and the sample size selected are found in appendix 1.

Tigray Region

The two sites selected in the region are *Geblen* and *Haressaw*. *Geblen* has a population of 2437. The main ethnic groups are Tigre and Saho. The main crops grown in the site are barely, maize and *beles* (cactus fruit). Lentils and *teff* are also grown. The main livestock kept in the area are cattle. Lack of grazing land, feed and water are the major livestock problems.

Haressaw is found in the Eastern Zone of Tigray region with a total population of 4384. The main languages spoken in the area are Tigrigna, Afarigna, and Amharic. The main crop produced is barely. Wheat, Lentils, and beans are also grown. The main livestock kept in this area are sheep and goats.

In both sites orthodox is the dominant religion. The sites are currently a food deficit area both in crops and livestock. The community has been mobilized for participation in terracing bunding stone and other protection works to prevent soil erosion in the area.

Amhara Region

The sites selected in this region are *Debrebirhan, Dinki Ankober, Yetmen and shumshehae. Debrebirhan* and *Dinki* are found in the Northern Shoa, Amhara Region. *Debrebirhan* site is food deficit area, mainly because of the prevalence of frost, flood hail, water logging and other natural problems. The main crops grown in the area is sorghum. However, the site is a surplus area with regard to livestock

production. Cattle, sheep and goats, horses, donkeys, mules and poultry are common in both sites.

Yetmen peasant association is located in Bichena wereda in East Gojjam. The main crops grown in the area are *teff*, wheat, chickpeas, *neug*, and maize. About one third of the *teff* produced is marketed. It is therefore surplus producing area. Major animals are oxen, cows, sheep, donkeys, horse and hens.

Shumsheha is found in North Wello in Bugna wereda. The main crops grown in the area are *teff*, barely, chickpeas, maize, sorghum, linseed, cowpeas, haricot beans, lentils, wheat and *neug*. The main types of livestock are goats, donkeys, oxen, cows, mules, horses and chicken. Because of frequent droughts and rain failure, the site is a serious food deficit area, both in crops and livestock terms.

In all the sites the ethnic group is Amhara and the main language is Amharic. Almost all people are followers of orthodox.

Oromiya Region

Adele, Sirbagod, Korodegaga, Turfekechema, Eteya, Bako Tibe, and *Semedo* are the sites selected from this region.

Adele is found in Eastern Harareghe in Kersa wereda with a population of 4500 to 5000. The majority is Oromo with few Amhara. Oromiffa is the main language. The main religion in the site is Muslim. The main crops grown in the area are sorghum,

maize, soya beans, sweet potatoes and *chat*. The farmers in the area produce *chat* almost entirely for the market. The site is crop deficit area. Cattle, goats, sheep and chicken production are common in the area.

Another site in the region is *Sirbagod*. It has a total population of 883. This site is different from the previous site in that it is food surplus area. Farmers supply 30 percent of their output to the market.

Korodegaga is the other site selected in Oromiya region in Arsi zone. Crops like maize, *teff*, haricot beans, millet, barely and chickpeas are produced in the site. Livestock (cattle, sheep and goats) are also produced. But due to shortage of rains there is a problem of feed in the area. Collecting and selling firewood is a common activity to cope with hunger.

Turfekechem (Shashemene) is located in East Shoa zone in Shashemene wereda. It has a population of 2674. Most of the populations are Oromo and *oromigna* is the main language. 80% of the populations are Muslims. Both crop and livestock production takes place like other sites. Wheat, barely, maize, potatoes, *enset* and *teff* are the main crops produced in the area. It is surplus producing area. The main livestock are oxen, cows, sheep, goats, horse, donkeys and hens.

Eteya is located in the Arsi zone in Tiyo wereda. The dominant religion is Orthodox Christian. This area is characterized by adequate rainfall. Crop production is the

major economic activity. The main types of crops produced are wheat, barely, horse beans, maize and sorghum. The area is surplus cereal producer.

Bako Tibe is found in West Shoa zone. The dominant religion is Christian. Agriculture is the major economic activity. Maize, sorghum, *teff* and *nueg* are the main types of crops produced in the site. It is a surplus producing area.

Jimma-Semodo is located in Jimma zone It has almost the same characteristics with other sites. But coffee production is common in this site.

Southern Nation, Nationalities and Peoples Region (SNNP)

The SNNP region consists of diverse cultures, agro ecological zones and farming systems. The sites selected from this region are *Indibir, durame-azedebos, adado, garagodo,* and *Domma.*

Garagodo is found in Bolosso wereda with a population of 8826 to 10,300. Most of the populations are Wollayita. The main language spoken widely in the area is Wellayita. The main crops produced are *teff*, maize and haricot beans. Livestock like chicken, sheep, goat, donkeys, horses and mules are common in the site.

Adado is one of the sites selected for the study. It has a population of 1803. The people are Gedeo and the main language is Gedeo. Coffee and *enset* are the most

important crops. In addition sorghum, maize, beans, sugar cane, barely are also common. Sheep, cows, and oxen are the livestock's produced in the area.

Azedeboas (Durame) has a population of 6444. The major ethnic group is kembata. The main language is *kmbategna*. Permanent crops like coffee, enset, banana, sugarcane, orange, avocado and annual crops like maize, sorghum, teff, barely, wheat, finger millet, beans, peas, haricot beans, linseed and potatoes are produced. Since the area is food deficit area, most people buy food for consumption.

Imdibir is found in the East Shoa zone. All people are guraghe and *guragegna* is their language. The main crops produced in the area are *enset*, *chat*, coffee, cabbage, maize, and potatoes. *Chat* is mostly sold. Cow is the main livestock and there is no ox (bulls are eaten before becoming oxen). Trade is an important activity and is interpreted as a way of coping because agriculture is not sufficient for livelihood.

Domma is located in the North Omo zone with a population of 457,757. Most of the people speak a mixture of Gamo and Wolayita dialects. The area is characterized by subsistence farming. The main types of crops produced include maize, *teff*, sweet potatoes, and *enset*. Cattle are almost the only form of livestock in Dooma, although there are some goats. The people are getting income by selling animal

products in addition to income obtained from non-farm activities like wood works, local drinks and wearing.

In all these sites of the region Christianity (of different types) is the dominant religion. Most of the population can speak Amharic in addition to their native language.

3.3. MODEL SPECIFICATION

3.3.1. Theoretical Model

In analyzing the complex interactions between the labor supply and demand decisions of farm households most studies (e.g. Barnum and Squire; Rosenzweig) have relied on the empirical advantages offered by separability (Skoufias, 1994). Assuming there are perfectly competitive markets for labor and other inputs and outputs, family and hired labor are perfectly substitutable in production, and there is no disutility associated with working off the farm, the simultaneous production and consumption decisions of a farm household can be modeled as being made in two stages (Strauss; Benjamin)

First, a household decides how much total labor to use on its farm so as to maximize profits from production without any consideration of its consumption or leisure preferences. Second, based on its farm profits and the market prices and wages, it decides how much to consume and how much labor to supply.

Another alternative approach is that method which allows estimation of the labor supply of members of agricultural households under the alternative, more plausible assumption of non-separability, which might arise for several reasons. Binding hours constraints in off-farm employment may prevent complete adjustment in agricultural labor market (Benjamin, 1992). Family and hired labor may be imperfect substitutes in agricultural production (Jacoby). Also, farmers may have preferences towards working on or off the farm (Lopez). Under any of the preceding circumstances, the production and consumption decisions of farm households must be treated as non separable in the sense that their labor supply choices can not be considered independently of their labor needs on the family farm (and vice versa). In these cases it is the "Shadow wage", rather than the market wage, that determines the labor supply and demand choices of the household (Strauss, Jacoby; Benjamin).

THE MODEL

The theoretical model presented below is based on Skoufias (1994). The model assumes non separability that arises due to the imperfect substitutability of the various labor inputs in the production process. It also assumed that there is no disutility associated with working off the farm and that there are no binding constraints in off farm employment or from disutility with working off the family farm. Farm households are assumed to allocate each of their members' time endowment (T) among four main activities. Leisure (L_i), household production (N_i), market work (M_i) and farm work (F_i) where subscript i index males (m) and females (f). For expositional simplicity, the household produced commodity Z is

assumed to be perfectly substitutable with the composite agricultural commodity that is either produced by the household or purchased from the market. The price of the composite agricultural commodity is used as the numeraire. The production function for the composite agricultural commodity produced by the household is specified as $\Gamma(F_m, F_f, H_m, H_f; A)$ where Γ is a concave function. Others are defined below.

Household are assumed to maximize utility

$$Max\ U(C, L_m, L_F; B) \text{ ----------(1)}$$

Subject to:

$$C = X_m + Z \text{ ------- ----------(2)}$$

$$Z = Z(N_m, N_f; K) \text{ ----------(3)}$$

$$X_m = \Gamma(F_m, F_f, H_m, H_f; A) - W_m^H H_m - W_f^H H_f + W_m M_m + W_f M_f + V \text{ ----------(4)}$$

$$L_i + N_i + F_i + M_i = T_i \text{ - time constraint ---------- --------(5)}$$

$$M_i \geq 0 \ , i = m, f \text{ - non negativity constraint ----------(6)}$$

Where;

C is total household consumption

Z is home produced commodity

K is other fixed inputs for household production

X_m is the market purchase goods

F_m, F_f are family male and female labor.

H_m, H_f is hired male and female labor.

A is a vector of fixed factors such as land.

B is a vector of individual and household characteristics influencing preferences.

V is real non-labor income.

Substituting some of the constraints in to the utility function yields the following Lagrangean function:

$$U\,(X_m + Z\,(N_m, N_f; K), T\text{-}M_m\text{-}F_m\text{-}N_m, T\text{-}M_f\text{-}F_f\text{-}N_f; B] + \lambda[\Gamma(F_m, Ff, Hm, H_f; A) - W_m^H H_m\text{-}$$

$$W_f^H H_f + W_m M_m + W_f M_f + V\text{-}X_m] + \mu_m \mathrm{M}_m + \mu_f \mathrm{M}_f \quad \text{----------(7)}$$

Where λ and μ_i are the Lagrangean multipliers. Solving the lagrangean with respect to X_m, N_i, F_i, M_i and H_i yields the following first order conditions[1]:

$$\frac{\partial U / \partial Li}{\partial U / \partial C} = W_i^* = Wi + \mu_i / \lambda \quad \text{----------(8)}$$

$$\partial\Gamma/\partial H_i = W_i^H \quad \text{----------(9)}$$

$$\partial\Gamma/\partial F_i = W_i^* \quad \text{----------(10)}$$

$$\partial Z/\partial Ni = W_i^* \quad \text{----------(11)}$$

[1]The derivative of the first order conditions are found in appendix 2.

The equilibrium condition (8) for household utility maximization implies that household will equate the marginal rate of substitution between consumption and leisure of family labor of type i and the "Shadow wage rate" Wi* of labor type i. The shadow wage rate in turn may be inferred from the remaining condition (10) and (11) in conjunction with the complementary slackness conditions for a constrained maximum. If a person is working in the market, then his/her shadow wage rate will be equal to the respective effective wage Wi for that gender group. This comes from the complementary slackness condition that requires that $\mu_i = 0$ if a person supplies positive hours in the market ($M_i > 0$) in contrast, if a person is not working in the labor market, then the shadow wage rate W_i^* will be, in general, greater than W_i. This also follows from the complementary Slackness Condition that $\mu_i \geq 0$ if $M_i = 0$.

Thus, for a household that supplies male (female) labor off the farm the marginal rate of substitution between household consumption and male or female leisure is equal to the effective market wage rate for males or females. In addition, family male and female labor on the farm will be utilized up to the point where the marginal productivity on the farm or at home is equal to the respective effective wage.

In general, the shadow wage method is applicable irrespective of whether family members work on or off the family farm. Under the assumption of household utility maximizing behavior, the effective wage rate earned by family members working both on and off the farm must equal their marginal productivity on the family farm.

3.2.2 Econometric Model Specification

Econometric models are specified to examine the off farm participation, off-farm wages and off-farm labor supply of male and female members of farm households. In focusing on off-farm work decisions, an equation for the probability of an individual participating in off-farm work is frequently interesting. Separate labor participation models were estimated for males and females since one of the objectives of this study is to see the off farm labor supply behavior of male and female members separately.

In an agricultural household model an individual is willing to participate in off-farm work when his/her reservation wage (W^{ri}) is less than the off-farm wage (w^i) net of commuting and expected transaction costs. The reservation wage for off-farm work of i is the marginal value of his/her time when all of it is allocated to farm labor and home time.

Accordingly, the reservation and off farm wage equations can be specified as follows:

$$W^{ri} = X^{l}_{r} B_{ir} + e_{ir} \quad \text{----------(1)}$$

$$W_i = X_i^{l} B_i + e_i \quad \text{----------(2)} \qquad \text{i= female, male}$$

Where:

X^{l}_{r} and X_i^{l} represent a vector of explanatory variables.

B_{ir} and B_i are estimated coefficients, and

e_{ir} and e_i are the random disturbance terms.

The decision of male and female members of a farm household whether or not to participate in the off-farm labor market is then modeled as a binary probit model which takes in to account the simultaneity of both participation decisions. We define then a binary variable D_i which equals one if member i works off-farm, zero otherwise.

$$D_i = \begin{cases} 1 \quad \text{if } W^i > W^{ri} \\ 0 \text{ otherwise or } W^{ri} \geq W^i \end{cases} \qquad \text{----------(3)}$$

$$P(D_i=1) = P(W^i > W^{ri}) = P(W^i > X^l_r B_{ir} + e_{ir})$$

Where;

W^i is the market wage rate

W^{ri} is the reservation wage.

Therefore, the probability that the male and female members of a farm household work off-farm depends on their reservation wage (W^{ri}) relative to the market wage rate net of commuting costs (W^i). Variables that raise the reservation wage reduce the probability of off-farm work, and variables that raise the off farm wage offer increase the probability of off-farm work. For variables that raise both the reservation wage and wage offer, the net effect on the probability of off-farm work is a priori uncertain. Estimates of these participation equations provide

information about the marginal effects of exogenous variables on the probability of an individual participating in off farm work.

The next step in the empirical analysis is to estimate a Cobb-Douglas production function of male and female members of farm households from which the shadow wages or marginal products of male and female members are estimated.

The Cobb-Douglas production function is then specified as;

$$Y = AX_i^{B_i} e^{s+m} e^{u_i}$$

$$LnY = LnA + \sum B_i Ln(X_i) + s + m + \varepsilon_i \text{ ----------(4)}$$

Where :

Y denotes total value of agricultural output

B_i denotes the parameters to be estimated.

X_i denotes the quantity of inputs used by the farm household. It includes variables like female and male family and hired labor, improved and local seeds, land, and capital such as farm equipments.

s education in years of schooling of the household head.

m farm experience of the head.

Σ_i denotes the disturbance term.

In order to see the impact of management input on the level of output, education in years of schooling (s) and farm experience (m) of the household head are included as a proxy variable in the analysis.

From the above production function[2] the marginal products of male and female labor is derived using the following formula:

$$MPL_i = B_i \frac{\hat{Y}}{L_i} = \theta_i \text{ (the estimated shadow wage of labor type i)----------(5)}$$

Where:

B_i is the coefficient on Log (L_i)

$\hat{Y}$ is the predicted value of output

L_i is the male/female labor input supplied on the farm.

An efficient labor market requires that the marginal products of workers and the market wage rate to be equal. In order to test the equality of the marginal products and the market wage rate, the former is regressed on the wage rates of labor market participants as follows[3].

$$MPLi = \alpha + \beta W_i + e \qquad \text{----------(6)}$$

[2]The Cobb-Douglas production function is used because it is linear, homogeneous and it yields a reasonable estimate of the marginal productivity of family male and female farm labor. In addition it can easily be interpreted in economic terms. Therefore, it is decided to proceed with the Cobb-Douglas form despite the well-known technological restrictions it imposes.Because of the presence of zero values in some inputs, the logarithmic transformation was carried out by adding 0.1 and one.(i.e. lnXi=ln(Xi+0.1 or 1)) (Skoufias, 1994 and Jacoby, 1993 also adds 1 to some inputs).

Where:

MPL_i is the marginal product of labor.

W_i is the market wage rate

β is the estimated parameter.

e_i is the disturbance term.

Theoretically, the marginal productivity of farm labor and the off-farm wage rate received must be equal if farm households are involved in both farm and off-farm activities. Empirically, however, the estimated marginal productivity of farm labor (shadow wage rate) and off-farm wage rate may not be equal for various reasons[3] ;

• Mis-specification may arise in the production function, which may result in errors in estimating marginal productivity.

• If there is rationing and transaction cost in the labor market, the marginal productivity of farm labor and the market wage rate may be different (Skoufias, 1994).

• Due to liquidity constraints and the seasonality of agricultural production, farmers may be involved in off-farm activities in the slack season to finance farming activities during the peak season (Skoufias, 1993).

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[3] It is possible to test the equality of the marginal products and off farm wage rate. An efficient labor market requires the values of (α, β) to be (0,1). An F-test is used to test the null hypothesis that (α, β) = (0,1). However, testing is ignored because of the above mentioned reasons.

Hence the market wage rate cannot be a substitute for a shadow wage rate in the estimation of labor supply.

Before discussing the econometric specification of off-farm labor supply of male and female members of farm households, it is necessary to specify the off-farm labor demand equations from which the wage rates of male and female members of the households are predicted. Market wage rate is obtained by dividing the total off-farm wage income by the total hours supplied to off-farm wage activities. Since all members of farm households do not participate in the labor market a sample selection bias may arise. Consequently, Heckman's two-stage estimation method (Maddala, 1983) is used to solve the problem. . Inverse mills ratios are derived from the bivariate probit analysis. Then from this model the market wage rates for the non-participant are predicted.

The off-farm wage function is specified as

$$\text{Ln}W_i = \sum \ln \beta Z_i + \varepsilon_i \quad \text{----------(7)}$$

Where:

W_i is market wage rate

β is vector of estimated parameters including the constant.

Z_i is a vector of explanatory variables.

ε is random disturbance.

Since there are observations with a value of zero, using the OLS method to estimate the labor supply equation may not be appropriate.[4] Therefore, the following Tobit model is used to estimate the male and female members off-farm labor supply of farm households.

$$L_i^{S*} = f\left(\theta_m^*, \theta_f^*, W^*, \gamma, \varepsilon_i\right) \quad , \quad \varepsilon_i \sim N(0,\sigma^2)$$

$i = m$ for males; f for females

$$L_i^S = L_i^{S*} \text{ if } L_i^{S*} > 0 \quad , \quad L_i^S = 0, \text{ Other wise} \quad \text{----------(8)}$$

Where:

L_i^{S*} is a latent variable (for both males and female)

L_i^S is an observed variable

θ_m^* and θ_f^* are shadow wages for males and females respectively.

W^* is the market wage rate for male and female

γ is a vector of household characteristics such as age, family size, education etc.

ε_t is the disturbance term.

[4]Skoufias (1994) used a log linear form to estimate family male and female labor supply functions.

The off-farm labor supply for males and females are estimated by using the market wage rate and shadow wages for males and females as explanatory variables. Other explanatory variables included in the estimation are age, age squared, sex of the household head, education dummy, location dummy, dummy for health, dummy for handicraft training, dummy for presence of children, number of draft animals, distance to the nearest market, number of dependents, non labor income, amount of credit, and size of cultivated land.

IV. Off Farm Employment in Ethiopia

4.1. The Nature of off farm employment[1]

In this section the nature of off farm employment in Ethiopia is discussed based on the result of the descriptive statistics of the data.

In Ethiopia the agricultural sector absorbs almost the entire rural employment. It is estimated that over 85 percent of the total work force is employed in agriculture. There is a rural labor shortage during the peak season and high unemployment and underemployment during the slack season.

Non-farm activities have a great potential to provide employment and additional incomes during the slack season to rural households. In addition, given rising population pressure on agricultural land which results in a decline in land holding per individual, off farm activities can provide alternative employment. Despite their great potential, rural nonagricultural activities account for less than three percent of the rural labor force (CSA, 1999).

As compared to other African countries, the proportion of the rural labor force engaged in non-farm activities is too low. According to ILO/JASPA (1993), in Ghana for instance 26.7% of the rural workers were engaged in rural non-farm

[1]Off farm employment refers to employment in activities outside his/her farm. It includes employment in other farmers' farm. But non farm employment refers to employment outside farming activities.

activities, 15% in Sierra Leone and an average ranging from 10 - 20% in Sub Saharan Africa. According to this report the importance of the rural non-farm activities in Ethiopia is understated because of the narrow definition of the Central Statistical Authority, and the Ethiopian definition of urban area as towns of 2000 people or more compared to the UN definition, which uses 20,000 people as a cut off point.

Mulat and Teferi (1996) classified non-agricultural activities in the rural areas of Ethiopia in to the following categories;

a) Small-scale industrial activities such as food processing: flour milling, oil processing, soap making, cottage industries: handicrafts, spinning of cotton (yarn and wool), cloth weaving and dyeing pottery leather tanning and distilling local brews (such as *tej* and *tella*).

b) Informal sector artisan activities; blacksmithing, masonry, wood work/ carpentry, house construction, repair services and fabrication of farm tools.

c) Commercial activities; trading and transportation

d) Infrastructural development activities; special public works feeder roads and irrigation works.

e) Formal employment in rural areas including professional administrative and clerical cadres.

As stated in the background section, farmers in Ethiopia are engaged in both self-employment and wage employment[2]. About 43% of the total farm households are participated in self-employment. Among the major activities are weaving/spinning, handicraft making, making and selling farm implements, making and selling firewood, dung cakes, charcoal, collecting and/or selling straw*, shuriba sira*, trade in grain, trade in livestock, and pottery. Other activities are broker, selling *arki*, bakery, salt trade etc. About 25.2 percent of the farm households are engaged in making and selling firewood, dung cakes, and charcoal. About 27.4 percent are engaged in grain trading/general trade. Weaving/spinning (6.8%), collecting and selling straw (9%), trade in livestock/ livestock products (8.12%)are also common[3].

Farm households are also participated in wage employment. The nature of off farm wage employment is discussed below. It describes those households who are working off their land against payment in cash or in kind. About 25.3 percent of the sample households reported that they participate in wage employment. Among these households 38.8 percent participate in food for work program. The other types of wage employment, in terms of their importance, are farm worker for pay (24.0%), unskilled worker (15.5%), and laborer (skilled i.e. builder, Thatcher, etc. 9.1%). Others are domestic servant, soldier, professionals etc. The wage rate

[2]The different types of off farm activities (self and wage employment) are indicated in appendix 3.
[3]The figures do not include income obtained from renting out land, share cropped out land, and renting draft animals.

per day varies by region and by type of activity. It is relatively higher in regions such as Tigray and Oromiya than in Amhara and SNNP (MOLSA, 1997). The overall average off wage rate for male members of the family is 0.73 birr per hour, and that of female members is 0.68 birr per hour[4].

Farmers are employed in government organizations, non-governmental organizations, commercial farmers etc. The proportions of rural workers working in different employers are indicated in table 4.1.

Table 4.1. Employers of rural wage workers

Kind of employer	percent (%)
Small farmers	28.2
Commercial farmers	4.2
NGO	24.4
Government organization	30.9
Urban dwellers	3.6
Church/mosque	1.1
Individual trader	0.2
Construction worker	3.8
Private employer	0.4
Contractor	0.2
Others	2.9
Total	**100**

Source: own computation

Most of the farmers are employed in government organizations (30.9%), small farmers (28.2%), and non-governmental organizations (24.4%). Other employers

[4]The comparison between the market wage rate and the marginal products (shadow wages) is presented in Table 5.5, p.80.

of farmers include commercial farmers, urban dwellers, etc. Around 70 percent are working around their village. Hence the participation of farmers in wage employment will increase if those opportunities are available near their village.

When we look at the nature of employment, 48.9% of the farm households are engaged in wage employment on daily basis, 42.4% of the farmers are employed on a temporary or contract basis. The rest are permanent workers. From the above figure it is clear that most of the farmers are employed as a daily or temporary workers. The reason for this can be the seasonality of agriculture. Farmers may participate in off farm activities during slack seasons and they will spend most of their time on their farm during peak seasons. Hence most of the farmers cannot be employed as a permanent worker because of the nature of the agricultural production in the country.

4.2. Income from off farm activities

Farmers are participating in off-farm activities mainly to supplement their agricultural income. Around 79.3 percent of the sample farmers responded that limited agricultural income is the main reason for participating in off farm activities. Because of low production and productivity of the agricultural sector farm households' income is not sufficient even to feed their families. Therefore, rural development policies aimed at improving the lives of the rural people should consider the role of off-farm activities.

Excess labor in the family and the seasonality of agriculture are also the other factors responsible for farmers to participate in off-farm activities. Large family in the rural house holds results in declining farm size which in turn results low level of per capita production and hence less income. The seasonality of agriculture makes the farm family to have excess labor during the slack season, which induces them to engage in other non-farm activities.

Table 4.2. Reasons for participating in off farm activities

First reason	%	second reason	%
Limited agricultural Income	79.3	Large family	27.2
Large family	5.7	Seasonal nature of agricultural labor	18.2
Favorable demand for goods and services	4.5	Limited agricultural income	15.7
Availability of off farm opportunities	3.2	Favorable demand for goods and services	14.7
Seasonality nature of agricultural labor	2.5	Availability of off farm opportunities	12.8
Others	4.8	Other	11.4

Source: own computation

Note: Others include proximity to urban area, level of education, for household construction purpose, etc

On average a farm household has got 615.9 birr from off farm activities. Because of the nature of the data it is difficult to compare the total off farm income of farm households with their farm income. The mean annual income from self and wage employment are 462.6 and 723.6 birr respectively[5].

[5]It is calculated for self and/or wage participants only.

The proportion of income obtained from wage employment is 43.4% of the total off farm income. Farmers are also getting income by engaging themselves in self-employment activities like trade, weaving, selling straw, transporting by pack animals etc. Around 56.6 % of the total income from off farm activities is obtained from self-employment. Payment in these activities is both in cash and in kind. More than 85 percent of the payment in kind is done in the form of wheat.

Around 90 percent of the off farm participants respond that the income obtained from off farm activities is used for maintenance and own consumption. Very few farmers use the off farm income for investment in farm/land, to buy oxen and farm implements. Little is used for investment in non-farm activities and saving. This has an implication in that some measures have to be taken to promote the sector so that farmers will be able to get sufficient amount of income, which in turn is used, for investment in the farm.

4.3. Women's Participation in off farm activities

Since more than 85 % of the total population of Ethiopia is dependent on agriculture, the performance of the sector relies on the labor of both rural women and men. Rural women have a substantial contribution to agricultural production. In addition to farming and home activities they also participate in non-farm activities. In the survey data 22.6 % of the household heads are females. A study in North and East Shoa by Dejene indicated that different coping mechanisms are adopted by female headed households to improve their economic and social

status. These include sales of local drinks such as *tella* and *arak*i, heavy reliance on backyard farms, involvement in petty trade, active participation in the *eqqub*, reliance on remittance, and making use of traditional resource exchange arrangements such as land leasing practices and the pairing of oxen with neighboring farmers.

On average 36.6 % of the farm households have one or more female members participating in off farm activities. The difference in the off farm participation rate of females as compared to males is not significant. On the other hand 36 % of the farm households have one or more male members participating in off farm activities[6]. In general 57.3 % of the farm households are participated in off farm activities (either in wage or self or both self & wage employment). Females are participating in both wage and self-employment. Food for work is the major activities. But they are also employed as farm worker, unskilled worker and laborer. The average wage rate ranges from 0.02 to 1.68 birr per hour. In addition they are getting income by participating in self-employment. The types of off farm self employment activities are weaving/spinning, making and selling fire wood, dung cakes, charcoal, collecting and selling straw, pottery, general trade, income from share cropped out land, etc. Preparing food and local drinks such as *araki, tella, injera, and dabbo are also common*.

[6]This figure is not consistent with that of family members reporting positive hours to off farm activities. Since for some activities the reported labor supply is zero.

However, females are facing different constraints to involve in the sector. Activities like producing flour using the traditional sources, fuel and water collection, food preparation and childcare leave very little time for women to participate in income generating schemes. Moreover, despite their substantial role in rural and agricultural development[7], they are gravely disadvantaged in terms of access to opportunities, such as credit, land, appropriate technology and health services, education training, formal employment and at the decision-making level[8] (ILO/JASPA, 1990). Female farmers, a special group of rural women, have remained almost invisible to policy makers, rural development practitioners and researchers (Dejene, 1994).

Generally, as it is stated in the background section of this paper, during the previous government various socioeconomic and political factors were responsible for the rural non-farm sector not to be exploited. ILO /JASPA (1990) reported that institutional, technological, skills and training, raw materials, finance, demand for products and infrastructure are the most important constraints for the development of non farm sector in Ethiopia. For example only 3.3 percent of the sample households received training on handicraft skills. About 97 percent of the sample households do not receive any training related to handicraft skills.

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[7]In Ethiopia, women play limited roles in agricultural production as compared to their counter parts in many countries in sub Saharan countries (Dejene, 1994).

[8]MOLSA (1997) also states that lack of credit, low sales price, overlapping farm work and higher price of raw materials are the major problems in handicraft activities.

This is an indication that the sector is given less attention by the government. Moreover, unavailability of employment opportunities near their village and low wage rate are the main reasons for those farmers not interested to work for wage.

If these problems were solved, farmers would have worked more hours. For instance 44.6 % of the farm households reported that they have at least one member from their family who is interested in working more hours. It is surprising that among those members of the farm households 39.4 % are interested to work for wages all over the year (year round), 43.3% prefer to work at the end of the harvesting time, and 16.2% say between weeding and harvest. Therefore, it is possible for farmers to get additional income by participating in off farm works without affecting the farming activities.

V. ANALYSIS OF EMPIRICAL RESULTS

5.1. Description of variables used in the analysis

As stated in section 1.3 the main objective of this study is to examine the determinants of the off-farm labor force participation of farm households and to see their labor supply behavior to off-farm activities. Hence the variables used in the analysis and their theoretical expectation about the sign and magnitude of these variables on the participation decision and hours of work to off farm activities are discussed below.

Age of the household head and Age Square

Age may represent general experience that increases the marginal value of time in each activity and other forces. At younger ages the probability of working off farm will increase. At older ages the overall labor hours will decline and the demand for leisure will increase. As a net result, a humped-shaped life cycle profile is expected.

Education

This variable (refers to the household head) is further classified in to read and write, primary education and secondary education. If the effects of human capital on off-farm wages out weigh the increase in the shadow value of labor on the farm, education is expected to have a positive effect on off farm work decision of both male and female members of the household (Lass, et al 1991). The variable average years of schooling of the household members is included which will also increase the probability of working off-farm.

Farm experience

This increases the value of the marginal value of farm work relative to the marginal value of off-farm work. So the probability of participation by both male and female members of farm household is expected fall. However, the data does not have direct information about the farm work experience. The age of the household head minus years of schooling minus six years is taken as a proxy variable for farm experience. Farm training has also the same effect as farm experience but information about this variable is unavailable and it is not treated.

Non-farm training

This is treated as a dummy variable and it refers to whether any member of the farm household has undertaken any training on handicraft skills or not. This variable is expected to have a positive influence on off-farm work decisions of farmers.

Availability of children

The presence of children aged five years or less is expected to reduce the probability of working off-farm for female members of a farm household. Since females are more responsible for childcare they will supply less hours to off farm activities. The probability of working off farm for farm men might increase since the availability of children in the family requires the household to have additional income.

Health status

Here to see the effect of health condition of farm households on their decision, a dummy variable is assigned that represents whether any member from the farm

household was unable to perform farm activities in the survey year. Its expected effect on the participation decision is negative. The nature of the data does not allow using height and weight dummies as an indicator of physical strength.

Distance to the nearest market

The participation of farm family members in off-farm markets is affected not only by their willingness and ability to supply labor but also by the demand for this labor. To capture the impacts of access to and availability of employment opportunities, researchers have included various located related measures. A large distance (measured in kilometers) from the farm to the nearest market reduces the probability of working off the farm and hence hours worked.

Number of draft animals owned

The presence of donkey, mule, horse, and camel enable a farm household to participate in non-farm activities.

Number of dependants

This variable refers to those members of farm households whose age is 5 years or less and 65 years or more. A farm household with more number of dependants is less likely to participate in off farm work and may affect the off-farm labor supply negatively. On the other hand when there are more number of dependents, the household has to raise more money and the marginal value of leisure will be low. Hence they will supply more labor off farm. Therefore, the sign could not be determined a priori.

Credit received by farm households.

One of the major constraints for farmers to participate in off-farm activities is lack of capital. If members of farm households have access to credit then the probability of working off-farm is expected to increase. Accordingly, hours of off-farm work will increase.

Sex of the household head

This is represented by a dummy variable. It is assigned 1 if the household head is male, 0 otherwise. Since the male-headed households have more access to opportunities than female headed households, the probability of working off farm is expected to be positive for the former.

Farm output and size of cultivated land.

Inclusion of a measure of farm output in the participation and labor supply function can be defended on both theoretical and intuitive grounds. Intuitively, we expect farmers with larger farms to participate in the off-farm markets less frequently and to supply few hours when they do participate. Theoretically, the value of the operators labor can be derived as a shadow value (Sumner 1982). Greater farm output or sales may be assumed to indicate higher short run profits and hence increase the marginal productivity of labor on the farm. If leisure were a normal good, we would expect lower participation rates and fewer hours supplied.

Non-labor income

This variable has a positive effect on the marginal value of the non-work time and hence a negative effect on the participation and the off-farm labor supply decision of both family male and female members. If leisure is a normal good, higher non-

labor income could lead to an increase in quantity of leisure demanded at the expense of non-farm work.

Location

This may affect the marginal value of farm or off-farm time. Dummy variables for each site are assigned. The dummy variables enable us to capture the effect of location on the off-farm work and off-farm labor supply decision of members of farm households.

Shadow wage

This is an endogenous variable that is estimated from the Cobb-Douglas production function. The opportunity cost of time or shadow wages of each farm worker (male and female members in this case) is the marginal product of his or her labor in agriculture. Therefore the shadow wages for males and females are included in the off-farm labor supply functions as explanatory variables. The effect on the off farm labor supply is expected to be negative but its effect on the other members off farm labor supply could be positive or negative (cross wage effect).

Off-farm wage rate

The male and female off-farm wage rates are estimated from the wage offer equations. These are estimated in order to be able to get predicted wages for those male and female members of farm households who do not participate in the off-farm markets. Age of the household, age square, average schooling of the household members, health, distance to the nearest market, non farm training, draft animals, size of cultivated land, number of oxen, number of dependents and dummy for each sites are included as explanatory variables to predict the off- farm

wage rate of male and female members. In addition, inverse mills ratio which is derived from the bivariate probit function for off farm work participation is included as explanatory variable to account for sample selection bias. The wage rate is expected to have a positive effect on hours of off-farm work representing the substitution of off-farm for farm work.

Huffman and Lange (1989) indicated that the wage elasticity of off-farm hours could be positive, negative, or zero. For a wage-work participant and home time is a normal good, an exogenous increase in the off-farm wage has two opposing effects on the optimality condition for off-farm work. A pure substitution effect, holding utility constant, decreases home time, but the income effect increases demand for home time. Thus, these two effects pull in opposite directions on off-farm hours. An exogenous rise in the wage rate of a wage-work participant is expected to reduce his/her farm hours. For a non-participant, a rise in the off-farm wage rate increases the probability that he/she becomes an off-farm work participant.

5.2. Determinants of off-farm Labor Force Participation in Ethiopia

The result of the bivariate probit estimation[1] of the off farm participation decision of farm households is presented in table 5.2. The data definitions and the result of the descriptive analysis are found table in 5.1.

DATA CLEANING AND MANAGEMENT

In a survey data set such as the Ethiopian rural household survey a researcher should expect to encounter so many problems. The problems of multicollinearity and hetroscedasticity are very common in cross section data. The data should be cleared before it is used for the analysis purpose. Using the box plot graph and histogram identifies the outliers and the most frequent observation is assigned for each site so that observations would not be lost.

The problem of multicollinearity is detected by looking at the correlation matrix between the variables and highly correlated variables are rejected from the analysis. But when there are more than two variables in the estimation of a model, looking at the correlation matrix may not be a true indicator of the problem of multicollinearity. Hence condition index is also computed and if the value is greater or equal to 20, it is possible to expect that there could be a potential problem. The presence of hetroscedasticity is detected by using Brush Pagan test. This problem is addressed by calculating the robust standard error for the probit model. In the presence of hetroscedasticity the estimated parameters from the

[1]The econometric software stata, version 7 and spss are used to estimate the empirical models.

Tobit model are inconsistent (Maddala, 1983). Since the problem is inherent in Tobit model, a reasonable assumption has to be made than ignoring it. It is therefore assumed that the results will not be affected significantly since appropriate transformations are made.

Table 5.1. Descriptive Statistics

variable	Description	Mean	Std. Dev.	Min	Max
age	age of the household head	48.95	15.53	18	95
agesq	age square of the head	2637.4	1644.3	324	9025
sex	sex of the head	0.774	0.4184	0	1
drewr	=1if the head can read & write	0 .1493	0.3565	0	1
dprimar	=1if the head is primary	0.2070	0.4053	0	1
dsecon	=1if the head is secondary	0.0363	0.1871	0	1
avscol	average school of the family	1.65	2.089	0	12
dchild	=1if a child is present	0.473	0.4994	0	1
dhealth	1 if there is any disability in the family	0.3766	0.485	0	1
numdep	number of dependants	0.919	0.861	0	5
dhatrain	=1if any training on handicrafts	0.0333	0.18	0	1
nadrft	number of draft animals	0.716	1.191	0	9
trasfer	amount of transfer income	98.91	888.10	0	26208
land	size of cultivated land	1.07	1.046	0	8
farmexp	farming experience of the head	41.6	16.68	5	89
output	crop output of the farm household	2223.1	2999.9	0	31860
cred	amount of credit	124.99	271.52	0	5000
dist	distance from the nearest market	7.5	5.37	0	20
numoxen	number of oxen	1.06	1.153	0	5
mahrs*	male members off farm labor supply	1209.16	1358.9	5.6	8760
fehours*	Females off farm labor supply	969.61	1322.67	2.7	13824

*Indicates that it is calculated for off farm work participants only.

Note: *Mahrs* = total off farm work of male members (in hours), *fehours* = total off farm work of female members (in hours).

Table 5.2. Determinants of participation in off farm work activities

Explanatory Variables[2]	Male			Female		
	Coef.	P>|z|	marginal effects*	Coef.	P>|z|	m.effects*
age(age of hh head)	0.0322	0.069	0.0071	0.0122	0.380	0.0044
agesq (age square)	-0.0003	0.058	-0.0001	-0.0002	0.240	-0.0001
sex (Sex of the head)	0.5692	0.000	0.1044	-0.1584	0.078	-0.0615
drewr(dummy for read&write)	0.0553	0.620	0.0120	-0.1197	0.229	-0.0439
dprimary(dummy for primary)	-0.0577	0.612	-0.0124	-0.0092	0.925	-0.0036
dsecon (dummy for secondary)	-0.0671	0.775	-0.0117	-0.3092	0.192	-0.1086
avscol(average school of the family)	0.0348	0.162	0.0073	-0.0029	0.897	-0.0013
dchild (dummy for child)	0.1764	0.169	0.0379	0.2217	0.048	0.0829
nadrft(number of draft animals)	0.0611	0.402	0.0135	0.1238	0.057	0.0465
dhealth (dummy for health)	-0.1714	0.059	-0.0375	-0.0350	0.651	-0.0142
dhatrain(dummy for handicraft training)	0.3985	0.051	0.1073	0.1667	0.378	0.0637
numdep(no. of dependants)	-0.0682	0.450	-0.0157	-0.1034	0.186	-0.0394
dist (distance to the market)	0.0625	0.000	0.0137	0.0160	0.177	0.0058
lntsfer (transfer income)	0.0439	0.032	0.0097	0.0318	0.073	0.0119
lnland(size of land)	-0.0903	0.063	-0.0197	-0.1109	0.009	-0.0420
lncredt(amount of credit)	0.0390	0.013	0.0085	0.0048	0.739	0.0017
_cons	-3.079	0.000		-0.6671	0.094	

Wald test of rho=0: chi2 (1) = 12.3108 Prob > chi2 = 0.0005
Wald chi2 (64) = 466.03
Prob > chi2 = 0.0000

(*) For the dummy variables the marginal effect is the discrete change of dummy variable from 0 to 1
z and P>|z| are the test of the underlying coefficient being 0

From table 5.2 it is possible to draw conclusions about the magnitude and direction of each variable on the probability of working off farm.

[2]Site dummies are not reported for economizing the space. Dummies for the sample sites are D1 (for Haressaw), D2 (Geblen), D3 (DinkiAnkober), D4 (Debreberhan), D5 (Yetmen), D6 (Shumsha-alibela), D7 (Debrezeit-SherbaGoditi), D8 (AdeleTiqe), D9 (KoroDegaga- Sodere), D10 (Shashemene), D11 (Eteya), D12 (BakoTibe), D13 (Jimma-Somodo), D14 (Indibir), D15 (Durame-Azedebos), D16 (Adado-Dilla), D17 (GaraGodo-Areka)&D18 (Domma).

The log likelihood ratio statistic was significant at the 1% level, suggesting that the independent variables taken together influence participation decisions. The correlation between the errors (rho) is significant which implies the decisions of both members of farm households are not independent.

The result of the analysis indicated that age and age square of the household head have the expected sign. The effect of age on participation decision is statistically significant only for male members (at10%level). For female members both are not statistically significant. At young ages, the probability of off farm work participation of both members increase with age. Experience increases farm productivity and hence the reservation wage. It may also increase the off farm productivity but the effect may not be as strong as that of the farm.

The effect of education level of the household head on the participation decision of members of farm households is analyzed by classifying it as read and write[3], primary education, and secondary education. To see the effect of level of education of the family average schooling is also included as explanatory variable[4]. The result suggests that education has no significant effect on the decision of farm households to participate in off farm activities. The possible justification for this could be the nature of off farm activities in the country. As

[3]The dummy variable for read & writes refers to those who can read and write through traditional, religious or other non-formal education.
[4]The result remains the same if only average schooling is included in the participation equation(see appendix 4).]

stated in section four most of the off farm activities especially for wage employment are food for work programs that do not require any education level. Off farm activities done by the farmers themselves are also more of traditional which do not require any formal education. This is supported by Tassew (2000) and MOLSA (1997) in their study in Tigray and Ethiopian case respectively.

The participation decision of female members of farm households does not seem to be dependent on the health status of family members. The effect is negative and significant at 10 % for male members. It reduces the probability of participating in off farm activities. Training on handicraft skills has a significant positive effect on off farm participation of the male members and is insignificant for that of female members. Farmers who have got training in non farm activities are more likely to engage in either wage employment (as masonry, carpentry, etc) or self employment in activities like weaving, carpentry, pottery, blacksmithing, etc. The policy implication is that the institutions like HASIDA and The Rural Technology Centers should be strengthen and expand their activities inorder to develop the skills required for farmers to do their own activities or to be employed.

The influence of family characterstics is also analyzed. The positive coefficient of sex shows that male members in male-headed households have a greater probability of working off farm than female headed households. Female members are less likely to participate in off farm activities. This may be due to the influence of the head and cultural factors that females are naturally assigned to do home

activities. It is found that the availability of children in the family has a positive and significant impact on female members participation decision but for male members the effect is not strong. The households may require additional income and induces them to participate in off farm activities (income effect). The result is not consistent with most other studies that it reduces the probability of working off farm. The number of dependants in the family is negatively related to the participation decision of both members of a family. But the effect is found to be statistically insignificant.

The financial condition of the family members has also an impact on the decision of farm households. The result of the analysis shows that credit and transfer income have a positive effect to off farm activities. A 10% increase in the amount of credit given to the household will increase the probability of working off farm by 0.085 and that of transfer income by 0.097 for male members. For female members credit has no significant effect on the probability of working off farm, may be because the households are less interested to borrow for female members involvement in off farm activities. But the probability of working off farm increased by 0.12 for a 10% increase in transfer income.

The size of cultivated land has the expected sign and is statistically significantly different from zero. It increases the reservation wage of both male and female members of a farm household. This might also indicate that farmers involve in off farm activities for push reason i.e. because of shortage of land to support their

livelihood. This result is consistent with other studies. The number of draft animals in the household has a positive impact on the probability of working off farm. The result suggests that this variable is not a significant determinant for male members of farm households.

Theoretically, holding off farm wage and other variables constant, the probability of working off farm by the household members decreases as the market is located far away from their village. However, the result turned out to be different from what is expected in that it has a positive influence on the family members participation decision though it is not significant for female members[5].

Location dummies are also included as explanatory variables to capture the opportunities and participation decision of farm households in different sites of the country. It is found that off farm work participation is different in different sample sites. Relative to site *Yetmen* (D5), the reference site, the probability of working off farm is relatively higher in drought affected and food deficit areas like *Shumsha* and *Indibir*. The rate of participation is relatively low in areas like *Sirbana Goditi* and *Somodo* that are relatively food surplus or self-sufficient areas.

[5]When the site dummies are ignored the result was as expected.

5.3. Farm Households Off Farm Labor supply

5.3.1. Estimation of off farm wage equations

Wages represent the market value of an individual stock of human capital and can be considered fixed in the short run (Lass, et al, 1991). However, wage equations are estimated as part of the model to provide predicted wages for individuals who do not participate in the off farm markets. The Heckman two-step selection model is used to estimate the off farm wage equations. The market wage rates for male and female members of farm household were predicted from the estimated equations. The results of estimation are shown in table 5.3 and 5.4.

Table 5.3. Male members off farm wage function

	Coef.	Std. Err.	z	P>|z|
age	0.0089457	0.0131	0.68	0.496
agesq	-0.0001384	0.0001	-1.09	0.274
avscol	0.0377707	0.0164	2.29	0.022
nadrft	-0.1066511	0.0633	-1.68	0.092
dhealth	0.0539058	0.0661	0.82	0.415
dhatrain	-0.1949441	0.1448	-1.35	0.178
numdep	0.0591226	0.0431	1.37	0.171
dist	-0.0269475	0.0170	-1.58	0.113
lnland	0.0531785	0.0425	1.25	0.211
numoxen	0.021839	0.0423	0.52	0.605
mills	-0.1020462	1.101	-0.09	0.926
cons	-0.2358674	0.6143	-0.38	0.701

**Dep. Variable is log of average hourly market wage rate of male members*
**The wage rate is assumed to be independent of hours working*

Table 5.4. Female members off farm wage function[6]

Expl. Variables	Coef.	Std. Err.	z	P>|z|
age	0.0057885	0.0213	0.27	0.786
agesq	-0.0000901	0.0002	-0.42	0.677
avscol	0.0929642	0.0363	2.56	0.010
nadrft	0.055331	0.1240	0.45	0.656
dhealth	-0.1416891	0.1462	-0.97	0.332
dhatrain	-0.9504637	0.2992	-3.18	0.001
numdep	-0.0108992	0.0807	-0.14	0.893
dist	-0.0564178	0.0533	-1.06	0.290
lnland	-0.0983077	0.0935	-1.05	0.293
numoxen	0.0550851	0.0901	0.61	0.541
mills	-1.830477	1.390	-1.32	0.188
cons	0.0427731	1.367	0.03	0.975

Note: Dep.var is log of hourly wage rate of female members (lnfewage); the explanatory variables are *age*-age of the head, *avscol* is average school of the household members, *nadrft* is the number of draft animals,*dhealth* is dummy for health,*dhatrain* dummy for handicraft training, *dist* is distance from the nearest market, *lnland* is log of cultivated land, *numoxen* is the number of oxen,

The inverse mills ratios are insignificant in both the male and female wage functions indicating that sample selection bias would not have been a problem if the equations were estimated by simple OLS[7].

The explanatory variables included in the wage offer equations are age and age square (a proxy for farm experience), average schooling of the household

[6]Site dummies are not reported for the sake of economizing space

[7]preliminary estimation of the wage equations by using OLS shows that the results are more or less similar.

members, number of draft animals, dummy for health, dummy for handicraft training, number of dependants, distance to the nearest market, size of land and number of oxen. The number of oxen is included to solve the problem of identification. In addition the inverse mills ratio are included.

The result of the estimation shows that of the human capital variables schooling of the household members is found to be an important determinant of the off farm wage rate of both males and females. Additional years of schooling of the family members seem to be more important for female than males. If the level of schooling increases by one, the wage rate of male members increases by 3.8% and that of females by 9.3%. This result, though the magnitude is not the same, is consistent with findings of Delgado (1999) and Huffman and Lange (1989). The other human capital variables farm experience, health, handicraft training do not have a significant impact for both members except that handicraft training has a negative impact on female members wage rate. This may be due to the nature of activities done by females. They are more inclined to do home activities and limited farm activities than looking for wage employment.

The number of draft animals has a negative and significant effect (at 10% level) for males wage rate but does not have a significant effect on female members wage rate. The coefficient of land size is positive for males and negative for females but not significant in both cases. The number of oxen and distance to the nearest market are also statistically not significant.

5.3.2. Estimation of the agricultural production function (Shadow wages)

The estimation of shadow wages is carried out because it is considered as measures of the opportunity cost of time irrespective of whether households work off the farm or not (Skoufias, 1994).

The agricultural production function from which the shadow wages are derived is specified in section three. The translog production function was estimated but negative marginal products of male and female labor were found[8]. The estimated results of the Cobb Douglas production function are indicated in table 5.5.

Table 5.5. Estimation of production function

Exp.var	Coef.	Std. Err.	t	P>|t|
cons	2.111039	.1893782	11.15	0.000
lnland	0.39676	.0536635	7.39	0.000
lnmahr	0.619188	.0266768	23.21	0.000
lnfehr	0.092841	.0201085	4.62	0.000
lnexiput	0.103783	.0211078	4.92	0.000
farmexp	0.004463	.0023377	1.91	0.056
edcta	0.065512	.014471	4.53	0.000

Dep.variable: log of output No.Obs. = 1681 Prob > F = 0.0000
Ln =natural logarithm Adj R^2 = 0.68

Note: lnland=log of land, lnmahr =log of male labor hour, lnfehr =log of female labor hour, lnexiput=log of Expenditure on inputs including the depreciation value of oxen owned, farmexp=farming experience of the head, edcta=years of schooling of the head.

[8]Jacoby dropped the negative male and female marginal products derived from the translog production function. But this may lead to biased estimates of the parameters.

Statistically the value of crop output is significantly affected by the area of land cultivated, on farm labor supply of male and female members, and expenditure on farm inputs[9]. The impact of management on the production of crops is analyzed by considering farm experience and education level (years of schooling) of the household head as a proxy variable. They are found to be significant at 10% and 1% level respectively. These variables (human capital variables) show that farm production and productivity are affected by the experience and educational level of the household head. An additional year of schooling of the household head increases the farm production by 6.5% and that of experience by 0.4 (%). The return from schooling is relatively high may be because the educated farmer is more likely to use modern inputs and be able to accept the advice of the extension agents. Therefore it is possible that off farm labor supply may not be significantly affected by the human capital variables since these variables are expected to increase the return from the farm.

The mean of the marginal products of the male and female members of the family is compared with the off farm wage rate in table 5.6.

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[9]When the site dummies were included in the production function the effect of female labor hours becomes insignificant.

Table 5.6. Descriptive statistics of the marginal products and the wage rate

Variable	Mean	Std. Dev.	Min	Max
mahrs*	1209.16	1358.9	5.6	8760
fehours*	969.61	1322.67	2.7	13824
fwagehr*	0.6846	.3644	0.02	1.68
mwagehr*	0.7332	.4133	0.01	1.71
mpml	1.787	.90368	.13	9.68
mpfeco**	1.2824	1.0661	.01	4.53
Mpfl (predicted)	1.2357	1.6684	.04	15.5
Male on farm Labor supply	868.18	1807.88	0	32613.07
Female on farm Labor supply	670.26	3099.81	0	40079.18

Source: own computation

* Shows that it is calculated only for off farm participants.

**Shows that the marginal product is for those females supplying on farm labor.

Note: mahrs is the total male members off farm labor supply in hours, fehours is female members off farm labor supply in hours, fwagehr is the off farm wage rate per hour of female members, mwagehr is the off farm wage rate per hour of male mebers, mpml is the marginal product of male members, mpfeco and mpfl are the marginal products of female members.

On average males supply 868.2 hour on the farm in the year. But the average on farm labor supply by female members in the year is around 670.3 hours. There should be a significant difference on the on farm labor supply between the two sexes because females are working limited farm activities and hence supply less labor. However, the males are responsible for doing the main farming activities. The mean of the marginal product of male members is 1.79 birr. That means an increase in the males labor supply by one hour increases the total value of crop output by 1.79 birr. On the other hand the mean marginal product of female labor is 1.28 birr per hour. The averages off farm wage rate received by both male and female members of farm households are less than their respective marginal products (shadow wages).

5.3.3. Male and Female Off farm labor supply

The off farm labor supply of male and female members of farm households were estimated by equation (8) in chapter III, section 3.2.2 using the Tobit model. The effect of household and farm characteristics has been analyzed. The market wage rate of both male and female members (that are predicted from the off farm wage equations of male and female members of farm households) and the marginal products (shadow wage rates derived from the agricultural production function) are also included in the analysis. The suspected endogenous variables, the marginal products of male and females, are tested using the Smith-Blundell test of exogeneity.

The test involves specifying that the exogeneity of one or more explanatory variables is under suspicion. Under the null hypothesis, the models are appropriately specified with all explanatory variables as exogenous. The alternative hypothesis is the suspected endogenous variables are expressed as linear projections of a set of instruments, and the residuals from those first-stage regressions are added to the model.

The tobexog test statistic, under the null, is distributed as F (m, N-k), where m is the number of explanatory variables specified as endogenous in the model. A rejection indicates that the standard Tobit estimator should not be employed.

The Smith-Blundell test of exogeneity for the marginal products of male and female members of farm households shows that both are not endogenous to the model (the P-value is 0.3014) and hence the off farm labor supply equations are estimated by the standard tobit model[10]. The estimated male and female off farm labor supply functions are presented in table 5.7 and 5.8.

[10]The instruments used were: dummy for the presence of ox, dummy whether the farm household was using any modern agricultural inputs or not and other explanatory variables in the labor supply equations. Other instruments were included but the result remains the same.

Table 5.7. Male members off farm labor supply estimates

Exp. Variables	Coef.	P>|t|	marginal effects
lnmpml (male marginal product)	-299.89	0.165	-50.31
lnmpfl (female marginal product)	-190.54	0.127	-31.97
lnmwage (male wage rate)	-27854.2	0.001	-4672.76
lnfwage (female wage rate)	5053.04	0.021	847.68
age (age of the hh head)	330.71	0.000	55.48
agesq (age square)	-4.50	0.000	-0.7560
sex (sex of the head)	1175.40	0.000	197.18
drewr (dummy for read & write)	47.82	0.844	8.02
dprima (dummy for primary)	25.15	0.921	4.22
dsecon (dummy for secondary)	-101.44	0.855	-17.02
avscol (average school of the family)	697.40	0.001	116.99
dchild (dummy for child)	706.26	0.028	118.48
nadrft (number of draft animals)	-2858.92	0.002	-479.60
dhealth(dummy for health)	1590.99	0.014	266.90
dhatra(dummy for handicraft training)	526.32	0.733	88.29
numdep(number of dependants)	1512.26	0.004	253.69
dist (distance to the market)	198.49	0.000	33.29
lntsfer(transfer income)	69.01	0.146	11.58
lnland (size of land cultivated)	1857.67	0.003	311.64
lncredt(amount of credit)	77.52	0.039	13.01
Cons	-12910.08	0.000	
_se 2201.35 106.76 (Ancillary parameter)			

Dep.Variables=mahours (total male off farm labor suppy in hours)

Ln = natural logarithm

Number of obs = 1681 LR chi2 (36) = 217.54

Prob > chi2 = 0.0000

Log likelihood = -2950.1615 Pseudo R2 = 0.0356

Table 5.8. Female members off farm labor supply*

Exp.variables	Coef.	P>|t|	marginal effects**
lnmpml (male marginal product)	157.37	0.245	57.58
lnmpfl(female marginal product)	50.77	0.507	18.58
lnmwage(male wage rate)	-5625.15	0.252	-2057.98
lnfwage(female wage rate)	2319.65	0.085	848.65
age(age of head)	79.88	0.107	29.23
agesq(age square)	-1.055	0.126	-0.386
sex (sex of head)	103.44	0.514	37.84
drewr(dummy for read and write)	-289.062	0.070	-105.75
dprimary(dummy for primary)	-102.46	0.516	-37.49
dsecon(dummy for secondary)	-576.08	0.106	-210.76
avscol (average school)	-2.486	0.984	-0.909
dchild(dummy for child)	443.97	0.026	162.43
nadrft(number of draft animals)	-555.43	0.303	-203.21
dhealth(dummy for health)	433.22	0.270	158.49
dhatrain(dummy for handicraft training)	1963.35	0.038	718.30
numdep(number of dependents)	180.78	0.568	66.14
dist(distance to the market)	28.16	0.289	10.30
lntsfer(transfer income)	40.13	0.179	14.68
lnland(size of cultivated land)	317.40	0.402	116.12
lncredt(amount of credit)	41.11	0.079	15.04
_cons |	-2514.92	0.05	
_se | 1729.224 53.85895 (Ancillary parameter)			

Dependent var.=fehours (total off farm labor supply of female members in hours)
Log likelihood = -5941.78 Prob > chi2 = 0.0000
LR chi2 (36) = 238.92 Pseudo R2 = 0.0197

* The marginal effects for the dummy variables is the discrete change of the dummy variable from 0 to1.
** The site dummies are not reported to economize space. There are 18 sites selected for the survey.

The results show that the market wage rate affects the off farm hours worked by both male and female members of the farm household. Both the own and cross wage effects are reported in the table 5.5 and 5.6. The own wage effect for males is negative suggesting that male labor supply curve is backward bending. This is in contrast to most other studies. But as Huffman and Lange (1989) indicated if home time is a normal good an increase in the wage rate will decrease the hours worked for wage participants because of the income effect. Even though this analysis does not separate participants in to wage and self employed it is possible that total off farm work hours could decrease due to a rise in off farm wage rates. Lass et al (1991) also show that if leisure is a normal good the effect of off farm wage rate on the off farm labor supply is ambiguous (it could be positive, negative or zero). Rosenzweig (1980) found that the labor supply of Indian farm males is backward bending. The possible justification for the negative sign of males own wage effect on their labor supply is that farmers have target income and work off farm specially during the slack season. Once they achieved their target income they will turn back to their farm even if the wage rate is increased.

The own wage effect for females is positive and significant at 10 % level. The female labor supply is an upward sloping curve, supportive of the utility maximization hypothesis (Delgado, 1999). The estimated elasticities for some variables are indicated in the following table.

Table 5.7. Elasticity estimates of male and female members

	Males	Females
Mwage (male wage rate)	-3.86	-2.12
Fwage (female wage rate)	0.701	0.875
Mpml (marginal product of males)	-0.042	0.059
Mpfl (marginal product of females)	-0.026	0.019
Avscol (average school of the family)	0.16	-0.0015

Source: own computation

A one percent increases in the wage rate of male members decreases the total males off farm hours of work by 3.8 percent. This figure is exaggerated as compared to other similar studies probably due to the problem of the data. On the other hand a one % increases in the average wage rate of female members increases their total off farm labor supply by around 0.88 %. According to Sumner (1982) this labor supply may come from an increase in total hours worked, but the major effect is likely to be a reduction in farm work. In Ethiopian case since most of the farmers are not utilizing their time fully (because of the seasonality of farming and excess family) this labor supply may come from their family or those already working may increase their working hours with out decreasing the farm production and productivity. A rise in the wage rate of male members has a negative effect on female members off farm labor supply but it is found to be statistically insignificant.

The shadow wage rates (marginal products) were also included in the labor supply analysis. It is used as measure of the opportunity cost of time. The negative effect of marginal products of female labor on the male members off farm hours suggests that, at least in terms of utility, male and female leisure are gross substitutes. The significance of such cross wage effect is consistent with family utility maximization and it suggests that studies that restrict such cross wage effect to be zero may yield estimates that are subject to specification error (Skoufias, 1994).

The effects of human capital variables on the supply of labor to off farm activities are analyzed. The level of schooling of the household head is classified as read and write (through non formal education), primary and secondary education. But the education level of the household head is found to have no effect on the off farm labor supply of both male and female members of farm households. The impact of education level of the household head on the labor supply of family members can therefore be indirect through farm productivity. Education may increase farm managerial ability and hence farm productivity. On the other hand the average schooling level of the household members increases the hours worked by male members but has no significant effect on female members. The male members are relatively more advantageous to be employed in administrative and other wage works that requires education.

As indicated in the previous section, in Ethiopia most of the off farm activities do not require education particularly formal education. Those farmers engaged in self-employment are doing activities that can be done by experience and by traditional technologies. For example among the main types are weaving, making pottery, trading livestock and grains, making and selling fire wood, collecting and/or selling straw, handicraft, making and selling farm implements, preparing local drinks (like *araki* and *tella*) etc. Most of the off farm wage employments are food for work as indicated in section four which do not require education at all. The other types of off farm wage employment are farm worker for pay, laborer, unskilled worker, domestic servant, guard, flourmill operator etc. Again most of these activities do not require any formal education except that there are few farmers employed as professionals but it is less likely to influence the labor supply behavior of farm households.

The result is consistent with most other studies in that disability in any member of the family negatively affects their participation decision. But it has a positive effect on the off farm labor supply of male members and statistically not significant for female members.

Training on handicraft skills increases the off farm labor supply of farm households and is significant for female members but not for male members. Farm experience as proxied by age and age square has the expected sign and is significant for male and insignificant for female members of the farm household. Both members

increase their labor supply to off farm activities as their age increases, but at a decreasing rate.

The impacts of household and farm characteristics are also analyzed. Being male-headed household enable family members to supply more hours to off farm activities than a female-headed household. The presence of children has a positive and significant impact on both the male and female members labor supply. It may have an income effect in that availability of children in the family will force them to engage in off farm activities and work more hours to get additional income.

The effect of financial constraints is investigated by including the amount of credit received by the farm household in the survey year. The result shows that it is an important determinant of the family members to work more hours in off farm activities. This is one indication that farmers have financial constraints to engage in the sector. The current policy of the government to expand the micro finance institutions in the rural areas will have a good contribution to promote the sector in addition to the farming activities.

Transfer income is found to have a positive impact on off farm hours worked. But it is statistically insignificant. This may be due to the fact that a non-labor income may enable the farm household to increase their consumption of leisure. Hence it may not have any incentive for farmers to work more hours in off farm activities.

VI. Summary and Conclusions

6.1. Summary

Because of the natural and socioeconomic problems, Ethiopian farmers are suffering from instability of income. Agriculture is the backbone of the economy and the performance of the sector directly or indirectly affects the lives of so many people. More than 85 percent of the labor force is engaged in agriculture. Low productivity of the sector is the major cause of unemployment and underemployment in the rural areas. Hence rural off farm activities can play an important role to improve the well being of the rural population.

We have observed that 57.3% of the farm households have one or more members participating in off farm activities. The types of off farm activities are self employment (43%)such as weaving/spinning, grain and livestock trading, making pottery, collecting and selling charcoal, collecting and selling straw etc., and wage employment (25.3%)such as employment in food for work program, as a farm worker for pay, unskilled worker etc. In all these activities both male and female members are participating. Therefore because of the importance of the sector to the farm households (and rural development) the factors or determinants of off farm work decisions are analyzed by using econometric models.

This study has tried to investigate the impacts of personal, household, and locational characteristics on the off farm participation and labor supply decisions of male and female members of farm households in Ethiopia.

The participation decisions of male and female members are shown to be dependent. The empirical analysis shows that of the human capital variables, education of the household head has no effect on the off farm participation and labor supply decision of both male and female members of farm households. The effect of this variable may be indirect through increasing farm production and productivity since education may improve the managerial efficiency of the head. As a result he/she may not have any incentive to make the other household members engage in off farm activities. The level of schooling (as measured by average years schooling) of the household members has a positive effect but it is found to be insignificant. This may be due to the nature of off farm activities done by the farmers. They are more of traditional in that most of them do not require any formal education. But for male members of the family the schooling level of the household members will make them to supply more hours once they participate.

The Heckman two- step regression analysis of the off farm wage equations shows that average schooling of the household members is the main determinant for the off farm wage rate of both male and female members of the family. An added year of schooling increases the off farm wage rate of male and female members by 3.8

and 9.3% respectively. Investments in education are more important for females than males. Hence it enables rural females to improve their economic status. The other main findings of the study is the effect of wage on the off farm labor supply of farm households. The cross wage effect also shows that increase in market wage rate of male members reduces the hours worked by female members (but not significant). However, an increase in female wage rate increases the male members off farm labor supply.

The marginal products that are derived from the agricultural production function are included in the analysis. It increases the reservation wage of male members of the farm household and hence reduces hours supplied to off farm activities. Even though its effect in females off farm hours worked is positive it is not statistically significant.

The other human capital variable farm experience, that is proxied by age and age square, shows that at early ages the participation decision of both male and female members increases but at older ages the probability of participating in off farm activities decreases as age increases.

The effect of health status of the family is investigated by considering the self reported health condition of the family. The empirical analysis shows that disability of any member of the family reduces the probability of working off farm for both members of farm households. Training on handicraft skills has a positive

and statistically significant impact on male members participation but not for female members. Once both members participate then it has a strong effect on the off farm work hours of female members of the family than males.

The presence of children has a positive effect on the off farm work decisions of family members. It has an income effect in that households require more money for their children. The number of dependents negatively influences the participation decision (but not significant). However, once they do participate it has a positive effect on the off farm labor supply decision.

The size of land increases the reservation wage of the family members and hence it has a negative and significant effect on the off farm work decisions. But it affects labor supply decisions of both members positively.

The financial condition of the family is found to affect the participation and off farm labor supply decision of both family members. For male members of the family it is found that credit is an important factor. For females the effect is not strong. The participation decision is positively and significantly affected by the amount of transfer income even though its effect on the hours worked is statistically insignificant (but positive).

The off farm participation behavior of farmers is found to be different in different sites of the country. It is higher in those areas affected by drought, but lower in relatively self-sufficient areas.

6.2. Conclusion

This study has shown the importance of the off farm sector to the rural people. A considerable proportion of farm households are engaged in off farm activities to supplement their limited agricultural income. Farmers are participating in both self and wage employment activities. Therefore, determinants of the off farm work decisions of farmers should be identified inorder to interfere and promote the sector.

Of the human capital variables, education of the household head has no effect on the off farm work decisions. But it increases the return on the farm. Average schooling of the family increases the male members off farm labor supply. However, the effect on female members is indirect through higher wages. An added year of schooling level of the family will increase the off farm wage rate of female members by 9.3%. This indicates that investment in education in the rural areas has a significant contribution for the improvement of the economic status of the rural women. The other human capital variable, health condition of the family, is obviously an important factor in that it affects the time allocation decision of the family.

The effect of off farm wage rate on the off farm labor supply is analyzed by including both male and female wage rates. The own wage elasticity for male members shows that the labor supply curve is backward bending. Farmers have target income in that once they achieved this target income they will turn back to their farming activities. However, the females labor supply curve is an upward sloping. The cross wage effect is positive for males and negative for females (but not significant). A rise in the females wage rate increases the off farm labor supply of members of farm households.

Even though trainings on non farm activities have not been given due attention, their importance in the off farm work decisions of farm households are supported by the analysis. Therefore, giving emphasis on the role of non farm training by governmental and non-governmental organizations dealing with rural development will enable the farmers diversify their sources of income.

Farmers have financial constraints to involve in off farm activities. The availability of financial sources will increase the rural people participation and labor supply off farm. This implies that development of rural micro finance institutions serving the rural people will contribute to the promotion of the non-farm sector. The current policy of the government to expand the micro finance institutions in the rural areas will enable the farmers to diversify their sources of income and will contribute significantly to the overall poverty reduction in the country.

The effect of farm characteristics (farm size) also shows that farmers are participating in off farm activities for push reason. The small farm size forces them to look for other sources of income. Ethiopian farmers have small farm size due to the increase in population. Therefore, poor and landless households may be benefited from the sector.

Finally, policies that aims to increase the off farm labor supply of family members should take in to consideration the difference in response to the various factors that affect the off farm work decisions of the male and female members of farm households.

Further research is required that tries to see the off farm work decisions of farm households in wage and self employment activities separately. Moreover, studies that consider the demand side of the labor market together with the supply side will enable to understand the full functioning of the rural labor market.

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APPENDICES

Appendix 1 Regions, peasant associations and sample size.

Region	wereda	No.obs.	Percentage
Tigray	Haressaw	84	5
	Geblen	66	3.9
Region Total		**150**	**8.9**
Amhara	Dinkiankober	86	5.1
	Debrebirhan	175	10.4
	Yetmen	61	3.6
	Shumsha-Lalibela	144	8.6
Region Total		**466**	**27.7**
Oromiya	Debrezeit-Sherba Goditi	95	5.7
	Adele tiqe	95	5.7
	koro degaga-Sodere	109	6.5
	Shashemene	97	5.8
	Eteya	69	4.1
	Bako tibe	80	4.8
	Jimma-Somodo	80	4.7
Region Total		**625**	**37.2**
SNNP	Indibir	65	3.9
	Durame-Azedebos	74	4.4
	Adado-Dilla	134	8
	Gara Gado-Areka	96	5.7
	Domma	71	4.2
Region total		**440**	**26.2**
Total		**1681**	**100**

Appendix 2

The first order condition are derived from the utility function:

$$MaxU(C, L_m, L_f; B)$$

Subject to:

$$C = X_m + Z \quad \text{---- ----------(1)}$$

$$Z = Z(N_m, N_f; K) \quad \text{----------(2)}$$

$$X_m = \Gamma(F_m, F_f, H_m, H_f; A) - W_m{}^H H_m - W_f{}^H H_f + W_m M_m + W_f M_f + V \quad \text{---(3)}$$

$$L_i + N_i + F_i + M_i = T \quad \text{----------(4)}$$

$$M_i \geq 0 \quad \text{----------(5)}$$

Where

C *is total household consumption*

Z *home produced commodities*

X_m*is market purchased goods*

F_i *is family male and female labor*

H_i *is hired male and female labor*

A *is a vector of fixed factors*

B *is a vector of individual and household characteristics*

V *is real non labor income*

The Lagrangean function is as follows;

$$L = U(C, L_m, L_f; B) + \lambda\left[\Gamma(F_m, F_f, H_m, H_f; A) - W_m{}^H H_m - W_f{}^H H_f + W_m M_m + W_f M_f + V - X_m\right] + \mu_i M_i$$

By substituting the value of C in to the utility function and the value of Z in to the consumption function

$$L = U(X_m + Z(N_m, N_f; K), L_m, L_f; B) + \lambda\left[\Gamma(F_m, F_f, H_m, H_f; A) - W_i^H H_i + W_i M_i + V - X_m\right] + \mu_i M_i$$

Taking the derivative of L with respect to X_m, N_i, F_i, M_i and H_i , we get:

$$\frac{\partial L}{\partial X_m} = \frac{\partial U}{\partial C} \cdot \frac{\partial C}{\partial X_m} + \frac{\partial U}{\partial L_i} \cdot \frac{\partial L_i}{\partial X_m} - \lambda = 0$$

$$\frac{\partial U}{\partial C} \cdot \frac{\partial C}{\partial X_m} = \lambda \qquad \Rightarrow \frac{\partial U}{\partial C} = \lambda \quad \text{----------(6)}$$

$$\frac{\partial L}{\partial M_i} = \frac{\partial U}{\partial C}.\frac{\partial C}{\partial M_i} + \frac{\partial U}{\partial L_i}.\frac{\partial L_i}{\partial M_i} + \lambda\left[\frac{\partial \Gamma}{\partial M_i} + W_i\right] + \mu_i = 0$$

$$\Rightarrow \frac{\partial U}{\partial L_i}.\frac{\partial L_i}{\partial M_i} + \lambda W_i + \mu_i = 0$$

$$\frac{\partial U}{\partial L_i} = \mu_i + \lambda W_i \ ,(since\ \frac{\partial L_i}{\partial M_i} = -1\ )\text{----------(7)}$$

Dividing (7) by (6),

$$\frac{\partial U/\partial L_i}{\partial U/\partial C} = \frac{\mu_i + \lambda W_i}{\lambda} = W_i + \frac{\mu_i}{\lambda}\text{----------(8)}$$

$$\frac{\partial L}{\partial H_i} = \frac{\partial U}{\partial H_i} + \lambda\left[\frac{\partial \Gamma}{\partial H_i} - W_i^H\right] = 0$$

$$\frac{\partial \Gamma}{\partial H_i} - W_i^H = 0 \ , \ \text{since}\left(\frac{\partial U}{\partial H_i} = 0\right) \quad \Rightarrow \frac{\partial \Gamma}{\partial H_i} = W_i^H\text{----------(9)}$$

$$\frac{\partial L}{\partial F_i} = \frac{\partial U}{\partial F_i} + \lambda\frac{\partial \Gamma}{\partial F_i} = 0 \qquad \Rightarrow \frac{\partial U}{\partial L_i}.\frac{\partial L_i}{\partial F_i} + \lambda\frac{\partial \Gamma}{\partial F_i} = 0\text{-----}$$

$$\Rightarrow -\frac{\partial U}{\partial L_i} = -\lambda\frac{\partial \Gamma}{\partial F_i} \qquad \Rightarrow \frac{\partial \Gamma}{\partial F_i} = \frac{\partial U/\partial L_i}{\lambda} \ , \ \text{since}\ \lambda = \frac{\partial U}{\partial C}\ , \text{from (6)}$$

$$\frac{\partial \Gamma}{\partial F_i} = \frac{\partial U/\partial L_i}{\partial U/\partial C} = W_i^* \ , \text{----------}\text{----------(10)}$$

$$\frac{\partial L}{\partial N_i} = \frac{\partial U}{\partial C}.\frac{\partial C}{\partial N_i} + \frac{\partial U}{\partial L_i}.\frac{\partial L_i}{\partial N_i} = 0$$

$$\frac{\partial U}{\partial C}.\frac{\partial Z}{\partial N_i} + \frac{\partial U}{\partial L_i}.\frac{\partial L_i}{\partial N_i} = 0 \ , \qquad \frac{\partial U}{\partial C}.\frac{\partial Z}{\partial N_i} = \frac{\partial U}{\partial L_i} \ , \quad \text{since} \quad \frac{\partial L_i}{\partial N_i} = -1$$

$$\Rightarrow \frac{\partial Z}{\partial N_i} = \frac{\partial U/\partial L_i}{\partial U/\partial C} = W_i^* \quad \text{----------(11)}$$

Appendix 3

Type of activities in self employment

Activity	**Percent(%)**
Weaving/spinning	6.8
Milling	0.81
Tailoring	0.81
Handicraft, making & selling farm implements	1.95
Tannery	1.14
Making & selling firewood, dung cakes, charcoal	25.2
Collecting and/or selling straw	9.0
Shuruba sira (traditional hair dresser)	6.3
Salt trade	0.33
Trade in grain/general trade	27.4
Trade in livestock/livestock prod.	8.12
Traditional healer/religious teacher	0.98
Transport (by pack animal)	1.8
Basketry	0.81
Pottery	4.1
Shoe shinning	0.65
Butcher	0.33
Carving & selling of stone	1.14
Broker	0.33
Barber	0.16
Selling Araki	0.49
Hair dresser (Shruba)	0.33
Sale of land	0.16
Making and selling malt	0.16
Trading of bile gold (Hamot woirk)	0.16
Spinning	0.16
Making mattress	0.16
Bakery	0.16
Total	**100.0**

Type of wage employment

Type of wage employment	Percent (%)
Farm worker(for pay)	24.0
professional	2.5
Laborer	9.1
Soldier	0.4
Driver/mechanic	1.1
Unskilled worker	15.5
Domestic servant	2.1
Food for work	38.9
Religious worker	0.2
Guard	3.2
Brocker	0.2
Flour mill operator	0.2
others	2.8
Total	100

Appendix 4

Determinants of off farm work participation (Including only average school of the household members)

Male					Female			
	Robust				Rubust			
	coeff.	Std. Err.	z	P>|z|	Coef	Std. Err.	z	P>|z|
age	0.0342	.01740	1.96	0.050	0.0121359	.0136758	0.89	0.375
agesq	-0.00034	.00017	-1.99	0.046	-0.001527	.0001331	-1.15	0.251
sex	0.5674	.12258	4.63	0.000	-0.725966	.0890251	-1.94	0.053
avscol	0.0303	.02317	1.31	0.191	-0.0119588	.0208513	-0.57	0.566
dchild	0.1737	.12867	1.35	0.177	0.2268562	.1121626	2.02	0.043
nadrftq	0.0599	.07260	0.83	0.409	0.1206889	.064774	1.86	0.062
dhealth	-0.1704	.09101	-1.87	0.061	-0.0354804	.0773972	-0.46	0.647
dhatrain	0.4053	.20454	1.98	0.048	0.1481632	.1889232	0.78	0.433
numdep	-0.0686	.0903	-0.76	0.448	-0.1136742	.0777317	-1.46	0.144
dist	0.0622	.01562	3.98	0.000	0.0157934	.0117918	1.34	0.180
lntsferq	0.0440	.02047	2.15	0.031	0.0317526	.0177434	1.79	0.074
lnland	-0.0893	.04837	-1.85	0.065	-0.1112173	.0421884	-2.64	0.008
lncredt	0.0384	.01556	2.47	0.014	0.0051356	.0137257	0.37	0.708
cons	-3.1202	.50887	-6.13	0.000	-0.6710537	.3872846	-1.73	0.083

No significant difference was found when only the education level of the household head are included in the off farm work participation equation.

Appendix 5.

Estimation of the marginal product of female members

Exp.var	Coef.	Std. Err.	z	P>|z|
lnland	0.3222938	0.0347	9.27	0.000
lnmahr	0.3887348	0.0153	25.40	0.000
lnfehr	-0.5593921	0.0120	-46.41	0.000
lnexiput	0.0681093	0.0105	6.46	0.000
edcta	0.0474361	0.0060	7.82	0.000
farmexp	0.003391	0.0010	3.11	0.002
dninputs	-0.1142706	0.0458	-2.49	0.013
mills	0.2999502	0.2548	1.18	0.239
_cons	-0.5149548	0.1655	-3.11	0.002

Dep.variables ln(marginal product of females)
Number of obs = 1681 Wald chi2 (41) = 7477.11 Prob > chi2 = 0.0000