The Dynamics of Income Diversification in Ethiopia: Evidence from Panel data

Adugna Lemi
Department of Economics
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125
Email: adugna.lemi@umb.edu

April 2006

Abstract

Block and Webb (2001) in food policy address the issue of the dynamics of livelihood diversification in Ethiopia. Their study uses the ratio of per capita income derived from crops to the sum of all other incomes as an indicator of livelihood diversification for the years 1989 and 1994. Their study focuses only on drought-prone areas during the survey years. The aim of the present study is to explore further the demographic and economic determinants of the dynamics of income diversification using survey data. The data used in this study cover larger and more representative sample and was colleted from rural Ethiopia during 1994 and 1997 harvest years. This study investigates not only the determinants of participation and intensity of off-farm activities, but also factors that affect the dynamics between 1994 and 1997. The results of this study attempt to answer the question: to what extent initial conditions (for instance, asset holdings, production, and crop income) prompt households to diversify to off-farm activities overtime. The results show that participation in off-farm activities is mainly driven by demographic factors, whereas land and other asset ownership as well as crop production and income affect intensity of off-farm activities. The dynamic model results show that farm families who have initially diversified to more off-farm activities subsequently realized less income diversification. Families with more initial crop production from slack harvest season subsequently realized greater income from off-farm activities in 1997. The study also confirms that it is only during slack harvest season that off-farm and on-farm activities are complement each other.

JEL Classification: D1, J2
Key Words: Dynamic Livelihood, Off-farm Income, Diversification, Ethiopia

I. Introduction

Diversification of income sources, assets, and occupations is the norm for individuals or households in different economies, but for different reasons. Households in Sub-Saharan Africa whose livelihood heavily depend on agriculture and related activities are no exceptions to this phenomenon. In Africa, the significance and implications of off-farm activities on income diversification are well documented (Barrett, Reardon, and Webb 2001). For instance, a study in Tanzania indicates that off-farm activities offer an important route out of poverty (Lanjouw, Quizon, and Sparrow 2001). Income diversification is also associated with higher incomes and food consumptions, more stable income and consumption over years (Reardon, Delgado, and Matlon 1992). Other studies dealt with the issue of income diversification as it relates to poverty, employment, and income distribution (Ellis 1998, and 2000).

Nevertheless, despite the increasing significance of these activities for households and its increased importance as income source, most previous studies address the problem and significance only from a static point of view. The dynamics in intensity and participation in off-farm activities in Africa in general, and in Ethiopia in particular, have not given due attention, especially when the underlying determinants change from time to time. These changes may be due to government policy, economic growth, and more recently liberalization (specifically, changes in farm input and output market situations). In the case of Ethiopia, recent years have witnessed some changes in policy that promote the role of the market, even in the rural setting where increased market participation just began to have impacts.

The purpose of this study is, therefore, to examine the determinants of participation and intensity in the off-farm activities as well as to investigate what initial conditions promote households to engage in and earn more income from such activities over-time. Household survey data from rural Ethiopia during 1994 and 1997 harvest years are used for the purpose of the analysis. These two survey years (1994 and 1997) can be described as the periods when the country underwent significant changes in economic policy reforms that open up the market both domestically and globally. With the launching of reform measures in 1994, one can reasonably expect responses from farm households in 1997. Hence, with respect to farmers' livelihood, one should be able to see changes in 1997 due to reforms not only in the output markets but also in the input markets. These changes are expected to have an effect on farmers' labor allocation and diversification decisions as well. For instance, it has been indicated that the implementation of Structural Adjustment Program (SAP) and economic liberalization throughout sub-Saharan Africa during the last fifteen years have been coincided with rapid expansion of rural income diversification (Bryceson 1999). During these reform periods, synergy between farm and non-farm activities in Africa have been documented in de Janvry, 1994; Delgado and Siamwalla 1999; Reardon, Crawford, and Kelly 1994.

The remaining sections of the paper are organized as follows. Section II presents brief review of literature and previous works on Ethiopia. Section III provides details on data and descriptive statistics of the survey data. Section IV discusses estimation and model variables. Results of the estimation are presented in section V. Attempt is made to link

poverty profile of regions to the degree of participation in off-farm activities in section VI. The last section provides concluding remarks.

II. Literature Review

Despite the traditional believe that view rural off-farm sector as a low-productivity sector, recent years have witnessed a shift away from this position towards recognition of its roles. The contributions of rural off-farm activities to economic growth, rural employment, and poverty reduction (Lanjouw and Lanjouw 2001); as well as its role in promoting growth and welfare by slowing rural-urban migration (Lanjouw and Lanjouw 1999) are well documented. The significance of this sub-sector is also manifested through the importance of non-farm wage labor (as compared to self-employment), non-farm sector earnings (as compared to farm sector wage earnings), and of local non-farm earnings (as compared to migration earnings) (Reardon 1997). Studies in Latin America also confirm the significance of the sub-sector. For instance, in Colombia, off-farm employment contributes a significant share (45%) to household income, but the importance of off-farm income and returns to household labor vary over the income distribution (Deininger and Olinto 2001). In Peruvian rural areas, 51% of the net income of rural households comes from these off-farm activities (Escobal 2001). In Honduras, income from non-farm wage and self-employment represents 16-25% of farm household income and is especially important for middle and higher income strata (Ruben and van den Berg 2001). Related studies in Latin America also demonstrate similar results (Lanjouw 2000; Reardon, Berdegue, and Escobar 2001, Yunez-Naude and Taylor 2001).

Although scholars seem to agree on the significance and importance of off-farm activities in rural Africa, there seems to be no consensus regarding the most important factors that drive participation and intensity of off-farm activities (Ellis, 2000)[1]. One of the hypotheses is that households engage in off-farm activities either for necessity or for choice (necessity vs. choice). Proponents of necessity hypothesis argue that households engage in off-farm activities for survival out of need to secure based needs during times of distress. Whereas, proponents of choice argue that the decision to engage in off-farm activities is determined by return to labor in the labor market, as most household models predict. Given the rural settings in Africa, where there are constant changes in farming income determinants, farmers switch between necessity and choice as their main determinants for participation. Others argue that farmers simply respond to underlying trends and processes when they make decision to engage in off-farm activities as opposed to decision process that looks into not only short-term objectives but also long-term plan for the family. From these contentions, it is not simple to come up with list of major determinants that influence the decision process. To this effect, Ellis (2000) argues that household models and some of the above contention does not reflect capture inter-

[1] Just as in the key determining factors of off-farm activities, there is no agreement on the terminologies used to refer to such activities. The same activities are refereed to as off-farm or non-farm. Ellis (2000) defines the former as 'wage or exchange labor on other farms, including payments in kind and cash' and the later as 'non-agricultural income sources that includes non-farm rural wage or salary employment, non-farm self-employment income and remittances. In this paper, no distinction is made between non-farm and off-farm income and the term off-farm is used to refer to income sources included in both off-farm and non-farm. The exception is that remittances are not included here since it is not an income from supply of resources.

temporal dimensions of livelihood strategies, and not describe circumstances of survival under stress.

According to Ellis (2000), the following key factors should be taken into account as causes for diversification: seasonality, risk strategies, coping strategies, as well as labor and credit market conditions. Seasonality refers to the heavy reliance of farming on weather conditions and/or fluctuations in prices as a response to changes in demand and supply conditions. Seasonality in crop production and income result in some slack seasons during which farmers may have time to engage in off-farm activities. It is also possible that households diversify activities to ameliorate the threat to its overall welfare from failure due to concentration in a single activity. Coping strategies argument resembles that of the necessity reasoning, which states that household's diversification is survival response to crisis or disaster. Market conditions, which in the case of rural Africa refers to market failures, leaves households to engage in activities to compensate for market failures, especially credit, and labor markets[2]. The absence of such markets requires households to take advantage of the demographic composition of households to use its resources effectively and to respond to market failures. Lack of functioning markets coupled with inter-temporal decision-making, and survival decision under stress call for the aforementioned factors, which often are not included in the standard household models. In addition to these key factors, other factors outside of the control of households, including regional and local features, environmental factors, social and governmental factors, should also be considered in addressing the question of rural households to understand their decision process.

Studies in Africa and other developing economies also provide support for the significance of the above factors. For instance, access to public assets such as roads and private assets such as education and credit are also pointed out as factors that influence participation and intensity (Escobal 2001; Lanjouw, Quizon, and Sparrow 2001)). These studies conclude that under the precarious conditions that characterize rural survival in many low-income countries, diversification has positive attributes for livelihood security that outweigh negative connotations it may possess. A study in Burkina Faso and Guinea shows that harvest shortfalls and terms of trade are found to drive diversification towards off-farm activities (Reardon, Delgado, and Matlon 1992). Other studies indicate that relative lack of capital (Abdulai and CroleRees 2001), entry barriers, lack of liquidity, market access, and skill constraints (Barrett, Bezuneh, and Aboud 2001) are some of the impediments to diversify and to break the poverty trap in rural Africa.

Previous works on Ethiopia

Only a few studies specifically deal with the significance of off-farm activities in Ethiopia. The available studies are either regional (Woldenhanna and Oskam 2001; Carswell 2002; Holden, Shiferaw and Pender 2004) or focus on drought periods (Dercon and Krishnan 1996, Block and Webb 2001). The later two studies used similar nation-

[2] In the case of Ethiopia, there is also lack of land market. This also requires households to find means to allocate other resources, mainly labor, to compensate for absence of such markets.

wide household survey data as the one employed in this study, but limited their analysis to very few sample households from the survey.

Using data from the southern part of the country, Carswell (2002) shows the role that women play in diversification and the particular importance of the contribution of diversification activities to cash incomes for poorer households. Dercon and Krishnan (1996) analyze the different income portfolios of households using survey data from rural Ethiopia and rural Tanzania. The results of their study contend that the different portfolios held by households cannot be explained by their behavior towards risk; it is better explained by differences in ability, location, and in access to credit (Dercon and Krishnan, 1996). Their result, with respect to the risk, is contrary to the theoretical explanations (Ellis, 2001) and empirical findings (Block and Webb, 2001). Using survey data from the northern part of the country, Woldenhanna and Oskam (2001) argue that farm incomes and off-farm incomes are substitutes. They divided the off-farm employment into off-farm wage employment and off-farm self employment and arrive at the finding that farm households diversify their income sources into off-farm wage employment motivated by low farm income and availability of surplus family labor, whereas they enter into off-farm self employment to earn an attractive return (Woldenhanna and Oskam 2001).

The study that is close to this study, in approach and methodology, is the one by Block and Webb (2001). Their work employed 300 households from the drought-prone sites of the survey during the harvest years of 1989 and 1994. Their study attempts to answer the question that which households increased their share of income from non-cropping activities the most during the inter-survey years. They find that wealthier households tend to have more diversified income streams; households with a greater concentration of assets were more likely to fall in their relative outcome ranking (as were female-headed households); and, initially less diversified households subsequently realized greater gains in income diversification. Contrary to Dercon and Krishinan's work, they also find suggestive evidence that personal perceptions of risk factors guided subsequent diversification decisions.

The present study follows the procedure adopted by Block and Webb (2001) to answer the question of what initial conditions influence households' decision to diversify income to or away from off-farm activities. This study is different from previous studies in three aspects. First, the survey sites covered are representative of the regions and the different cropping systems of the country (except pastoralist areas). Second, the survey years used in this study are 1994 and 1997; these years were the periods in which government undertook economic policy reforms, to which significant response is expected from farm households, as opposed to between 1989 and 1994. Third, this study addresses not only determinants of intensity but also determinants of participation in off-farm activities during the two survey years.

III. Data and Survey Sites

The Department of Economics at Addis Ababa University in collaboration with various institutions (University of Oxford, UK and International Food Policy Institute (IFPRI), USA) have collected socio-economic data from 1500 representative farm households in Ethiopia since 1989[3]. The information gathered from the same households is in its sixth round (although not on a regular interval). The core modules that appear on the questionnaire are information on demographics, asset, farm inputs, farm outputs, livestock, and health. The survey covers six regions (regions 1, 3, 4, 7, 8, and 9) and fifteen survey sites representing the different ecology of the highland farming systems in the country with the exception of pastoral system. Table A.8 in the appendix displays survey sites, the main harvest months and the time of interview for the first four rounds.

This study uses the first and the fourth rounds (conducted in 1994 and 1997, respectively) of the survey data to determine factors behind the dynamics of off-farm activities. The selection of these two rounds is to allow enough time between the survey years to see real effects of the changes undertaken during the economic reform periods in the country and to determine if there is a significant change in income sources and participation by the sample households. The first three rounds were conducted not that much far apart to expect significant changes in income and participation in off-farm activities.

During both survey years, households were asked questions specific to their participation in the off-farm activities ranging from the location of the activities to the reasons why other family members were not seeking off-farm employment. Information on the income earned from these activities both in cash and in kind was collected from households. Compared to participation rate in 1994 (34.9%) survey year, in 1997 participation in off-farm activities decreased to 23.6% (see Table A.1); with significant variation across regions. For instance, in region 1 (Tigray region) participation rate dropped from almost 71% to 19%. The difficulty of access to off-farm activities outside of farmers residential locality were manifested through the fact that, during both survey years, over 74% of households reported that they had participated in off-farm activities only in their villages (Table A.2).

Pervious work done in the southern part of the country shows that the single most important activity was trading and laboring for others was also found to be significant (Carswell, 2002). In line with this finding, the major activities into which farm households engaged during the 1994 and 1997 harvest years were farm work (on others' farm), labor sharing activities, laborers (skilled builder, Thatcher) and other unskilled work activities. Compared to year 1994, in 1997 there was an increase in participation in skilled labor and unskilled labor activities; and there was a decrease in participation in food-for-work and labor sharing activities (Table A.3). This trend is expected, as the size of per capita land holding gets smaller and smaller, family members have to engage in off-farm activities with limited entry barriers. The decline in food-for-work may be due to the low-level food crop harvest in 1994 compared to 1997.

[3] The 1989 survey covered only six (drought-prone sites) of the fifteen sites covered during the other survey years. The next four surveys were conducted in 1994, 1995, 1996 and 1997.

Farmers were also asked the reasons why other members of the household were not seeking off-farm jobs in 1994 and 1997 harvest years. Two reasons stand out as major impediments: lack of employment opportunities (which reflects weak backward and forward linkage with other sectors and limited purchasing power of farm households to demand more off-farm labor and products), and competition over labor for farm and off-farm activities (see Table A.4). For female income earning activities, in addition to the above two reasons, distance from the location of job was also cited both survey years as an additional constraint (Table A.5).

Farm households were also asked why they participate in off-farm activities, and specifically why family members participate in female income earning activities during 1997 harvest season. One of the main reasons for participating in off-farm activities (for those activities traditionally undertaken by male family members) was limited agricultural income, which accounts for over 68% of the responses. This supports the view that farm and off-farm incomes are complements during the time when the farm income is not adequate to support the family. For female income earning activities (the response for this question relates to activities traditionally undertaken by women), on the other hand, the main reasons to engage in these activities were availability of off-farm activities (24.5%), having large family (20.7%), and favorable demand for outputs from such activities (16.3%). For female off-farm activities, limited agricultural income as a reason for participation accounts only for 11.4% (see Table A.6). One can argue that the entry-barrier or cost for female income earning activities is not as large as entry-barriers on some activities traditionally undertaken by male. There are some regional variations in terms of the reasons for participating and for not participating in off-farm activities. Tigray region (region 1) can be singled out of the pack for its unique response. In this region, one of the reasons for not participating in such activities is that these activities were considered as taboo.

Households were also asked about the income earned from different sources. In a rural setting, income sources can be broadly divided into three: crop income, off-farm income, and livestock income. Table 1 presents the descriptive statistics for the different sources for 1994 and 1997 harvest years. For the three sources of income, mean, median, and inter-quartile ranges are reported for total and share of each income source. During the 1997 harvest year, when weather condition was suitable for farming, share of off-farm activities significantly dropped from over 18% in 1994 to only 7% in 1997. In absolute terms, the average income received from off-farm activities was also lower in 1997 (birr[4] 97) compared to year 1994 (birr 107) (Table 1). There were regional variations in terms of average off-farm income during the two harvest years. In 1994, region 7 had the highest average off-farm income (birr 168) followed by region 4 (birr 128). However, during the same year the share of off-farm income in total income was the highest for region 1 (0.62) followed by region 7 (0.26). In 1997, for all regions the share of off-farm income declined from its 1994 level. Nevertheless, absolute value of off-farm income had increased for almost all regions.

[4] Birr is the Ethiopian currency. The exchange rate as of October 2005 was $1= 8.6 birr.

The off-farm income is highly skewed in 1997 compared to that of 1994. The median values of total off-farm and per capita off-farm incomes are zero in 1997. Median values of total livestock and per capita incomes are also zero in both years. The fact that the median values of are zero and the inter-quartile ranges are positive suggests that income is skewed upward and households in the top ladder receive from these other sources (off-farm and livestock) while others receive only crop income.

Table 1. Mean, Median, and Inter-Quartile Range (IQR) of total and per capita incomes from different source[5]

	1994			1997			Total		
Income Source	*Mean*	*Median*	*IQR*	*Mean*	*Median*	*IQR*	*Mean*	*Median*	*IQR*
LIVESTOCK, TOTAL	52.47	0.00	15.00	65.81	0.00	10.00	59.12	0.00	12.00
CROP, TOTAL	1394.70	573.37	1645.90	3383.25	1203.55	2225	2386.61	875.5	2005.4
OFF-FARM, TOTAL	107.19	25.00	124.15	96.61	0.00	42.00	101.91	0.00	96.00
PER CAPITA CROP	233.92	106.54	286.78	443.79	180.93	309.6	337.01	146.8	304.5
PER CAPITA LIVESTOCK	9.74	0.00	2.71	10.41	0.00	1.33	10.07	0.00	2.22
PER CAPITA OFF-FARM	20.44	4.32	22.11	15.78	0.00	5.71	18.15	0.00	16.00
SHARE OF CROP	0.71	0.87	0.43	0.83	0.96	0.20	0.77	0.93	0.32
SHARE OF LIVESTOCK	0.06	0.00	0.03	0.05	0.00	0.01	0.05	0.00	0.02
SHARE OF OFF-FARM	0.18	0.03	0.21	0.07	0.00	0.03	0.13	0.00	0.11

Off-farm income= total off-farm income (both in cash and in kind earnings), share of Off-farm = total off-farm income divided by total income from all sources, share of crop income = total crop income divided by total income from all sources, Per capita income = total income divided by family size, Per capita livestock = total value of livestock divided by family size, Per capita land = total land holdings divided by family size. IQR = inter-quartile range = 75^{th} percentile – 25^{th} percentile

In terms of asset holdings, sizes of livestock and land owned re the key indicators. Livestock ownership, measured by value of livestock owned, has decreased in per capita terms. Per capita land holding was also declined from 0.37 hectare[6] in 1994 to 0.26 hectare in 1997 per family. As one would expect, due to population growth over and above the growth of livestock and fixed land, per capita asset ownership has declined overtime.

One has to note here that both off-farm and crop income sources are mostly dependent on weather condition (rainfall conditions) since almost all agricultural activities (crop and livestock) depend on the weather conditions. Hence, it is not appropriate to attribute all the variability and dynamics of income sources over time only to the rational/irrational behavior of farmers. Having this in mind, the harvest year 1994 was considered as relatively low production year due to not so suitable weather condition compared to that of 1997 harvest year. During a good weather year (like the one in 1997), resource scarce farmers are expected to spend more time and resource on crop production on their farm to have enough food production for the season not only for consumption but also as a source of cash income. For such resource poor farmers, more labor time and resource spent on own farm lowers their participation in off-farm activities. This descriptive statistics seem to support the belief that in countries like Ethiopia off-farm activities are survival

[5] Values are in Ethiopian currency (birr). The exchange rate was about $1=5.42 birr in 1994 and $1= 6.1 birr in 1997.

[6] Hectare is a metric measurement unit for area; 0.4 hectare = 1 acre.

mechanisms but not viewed as an opportunity that farmers engage in as a choice. However, there may be resource rich farmers, especially labor and livestock, who can engage in off-farm activities as a choice since they can engage in both activities simultaneously. Nevertheless, the types of activities that these farm households – resource poor and resource rich – engage in may differ. Resource rich farmers may engaged in lucrative activities since they participate in these activities by choice not for subsistence. This study attempts to show if there is in fact such difference among farmers both at static and dynamic settings.

VI. Model Variables and Estimation

4.1. Model Variables

As implied above, the key determinants that believed to drive diversification of income sources in rural settings can be grouped into demographic, asset, risk indicators, and seasonality/income factors. Hence, it is important to identify variables that capture these key factors in the estimation models. Since household models or the aforementioned eclectic approaches do not distinguish between factors affects participation and intensity, this study uses the key factors identified above for both participation and intensity models.

This study performs three different estimations in relation to the factors that affect participation in and intensity of off-farm activities. For the participation model, the dichotomy dependent variable is constructed from the response of farmers to the question as to how many people household member participated in off-farm activities during the harvest years 1994 and 1997. Households included in this estimation may include those who participated but not necessarily earned income from participation. In terms of participation, there was more participation rate during 1994 compared to 1997 survey years (see Table A.1). Once the determinants of participation are identified from the above estimations, intensity models are estimated both in static and dynamic settings. The static setting estimates intensity equations using share of off-farm income as dependent variable for the years 1994 and 1997 separately, and the dynamic models are estimated using the change in off-farm income share between 1994 and 1997 harvest years.

First, share of off-farm income to total income is calculated for each year (1994 and 1997). Off-farm income includes those incomes received both in cash and in kind by working on others' farms and other non-farm activities. The earnings received in kind are converted to cash value using prices of the products from market survey conducted during the survey periods. Other income sources are crop income, and livestock income. Ratio of off-farm income to total income (sum of all the three income sources) is used in the intensity and dynamic models. Table 1 above presents descriptive statistics of income from different sources for 1994 and 1997.

As indicated earlier in the descriptive statistics of the variables, during periods of suitable weather conditions (i.e. year 1997), share of income from crop production was higher than in 1994, and share of off-farm income was lower. As a result, share of income in

1997 would be lower since we divided small off-farm income by larger total income. This may be a concern since share of off-farm is lower not only because of lower off-farm income in absolute terms but also because of the higher total income in 1997. One way to go around this is to try an alternative way of calculating share of off-farm income to total income to see robustness of estimation results. The alternative way used here is to use year 1994 as a base year to calculate the share of off-farm income for both years. Hence, for the intensity and the dynamic models, dependent variables that use both years as base year are created and then regressed on the explanatory variables from year 1994 and 1997 to see if the result may differ.

For the dynamic model, the following changes in the share of off-farm income are used:

1. Change in share of off-farm income A (CHOFFSH1994) = share of off-farm income in 1997b – share of off-farm income in 1994.

2. Change in share of off-farm income B (CHOFFSH1997) = share of off-farm income in 1997a – share of off-farm income in 1994.

Block and Web (2001) used only equation similar to that of equation 1 for their analysis of the dynamics of off-farm income and its determinants. In this paper, both options (equations 1 and 2) are used to see if there is any difference in using same base year to analyze the dynamics of off-farm income[7].

Coming back to the selection of variables that captures the factors identified above, one should take into account demographic composition, asset ownership (including tools and land holding), risk indicators, and seasonality/income as they play a significant role in affecting farm household decisions. The role of livestock is even more that often thought. That is because livestock is used not only as farm input but also as saving as a substitute for credit market. Land holding is also one of the major farm inputs and is expected to play a significant role. Not only land holding size but also land quality influences the decision of farm households to engage in activity diversification. In the context of Ethiopia where farm households do not have ownership right – but only use right and in some cases rent right- farmers may use their own allocated land and also rental land from other farm households. To this effect, status of ownership – allocated or rent- matters in decision-making. In addition, farm households have different degree of risk perception depending on their asset ownership and the degree of variability in weather condition. Farmers may respond to risk by diversifying farming activities or types of crops and/or by diversifying to other income generating activities, for instance, off-farm. Finally, seasonality also plays a role in farm and off-farm activities. In Ethiopia, most surveyed areas have two crop seasons (*meher* and *belg*). Farmers earn income during these two seasons and the amount of income they earn during each season may affect their decision of off-farm activities.

As stated above, the explanatory variables are divided into four main groups: demographics, asset holding, risk indicators, and seasonality/income as well as village

[7] It turns out that the results are not that different when using the two different ways of calculating off-farm income share. Hence, to save space, only results that use both 1994 and 1997 as base years are reported.

dummies[8] (to capture regional and local effects that might affect decision-making). The demographic/social variables include age of household head (AGEHHH), age squared (AGE2), dummy for female headed households (FEHHH), dependency ratio (DEPR)[9], family size in adult equivalent (AEQU), number of female household members (NUFEHH), number of male adult household members (NUMAHH), and religion (RELIG)[10]. Under asset, the variables included are total land holdings (TOTLAND), proportion of rented land to total land (LRENTR), and, value of agricultural tools (VTOOL), and value of livestock owned (TOVLIV). Investment on education is also considered as part of asset since households send family members for future income. Hence, to capture this human capital investment, two different education indicators are used; number of family members who have completed primary education (EDMEM) for 1994 and number of students in a household (NUSTU) for 1997. The reason for the difference in the education variables for 1997 and 1994 is the way the data was collected during each year. Households Risk is captured using two variables. One of the signs for farmers to perceive risk is the quality of their land. The lower the quality of land the higher the possibility that farmers may experience crop failures. This is captured by the weighted average quality of land under cultivation (LQUALITY)[11]. The other risk indicator used here is the number of crops farmers harvest each year. Farmers often diversify their crop production by planting different crops at the same time as a mechanism to avoid the risk of a particular crop failure. Hence, the total number of crops cultivated (TNCR) is used in the estimation as one of the risk indicator. The seasonality/income indicators are values of crops produced during the two production seasons in a year: *meher* (main harvest season) (VMCROPS) and *belg* (slack season) (VBCROPS). Having crop production alone may not be enough; amount of cash income from production also matters. For this, dummy variables are created for those households who sold part of their crop during *meher* (SPOM) and *belg* (SPOB). Interaction terms between crop income and these dummy variables are also included in the model to see the effect of the amount of cash flow on off-farm decisions. In addition to the explanatory variables indicated above, off-farm diversification index[12] is also included in the model to see the effect of previous year's diversification on subsequent year's level of diversification.

In the dynamic model, since the purpose here is to see the role of initial conditions, in addition to some of the key factors that affects intensity, factors from 1994 are also incorporated in the dynamic model as initial conditions.

[8] Village dummies are used in all the estimations. There are a total of 19 villages and hence 18 dummies. The coefficients for the dummies are not reported here to save space.
[9] Dependency ratio is defined as ratio of family members below age 15 and above age 60 to total family size.
[10] Dummy variable is used for religion, where "1" represents Christian of all denominations and "0" all other religions.
[11] Quality of land variables indicates degree of fertility of the land. Three values are used 1 for best quality, 2 for medium quality and 3 for poor quality.
[12] This is calculated as one minus concentration (Herfindahl) index. Herfindhal index is calculated as the sum of the squared values of the share of labor allocation in each off-farm activities.

4.2. Estimation

As stated above, three separate equations are estimated: participation, intensity, and dynamics. For the participation equation, since the dependent variable is the dichotomy yes or no response, Probit estimation technique is employed to estimate the model. For each year, two different specifications are estimated to see robustness of the results. For 1997, in addition to the key determinant variables indicated above, diversification index of 1994 is also added in the model to see the response of households given their previous participation rate. Results of the participation equation for 1994 and 1997 are reported in Table 2.

For the intensity and the dynamic models, quartile regression technique is used. Quantile regression is different from the standard OLS model in that the later is based on the mean and deviations from the mean to calculate the sum of squared errors. Quantile regression is based on median (and other percentiles too) to calculate squared deviations and seems appropriate for such survey data[13]. The other reason for the choice of quantile regression is that, unlike the case in OLS, there is no need to impose the normality assumption of error term (Koenker, and Hallock, 2001). For these reasons, quantile regression is used for the estimation of both the intensity and the dynamic models.

In survey data where there are outliers that tend to distort value of the mean, such technique may result in biased coefficients and standard errors. For instance, Table 1 shows that there is wide gap between the mean and median for the off-farm income in both years. For year 1997, the median off-farm income was zero, which makes convergence difficult even with median regression. Hence, since median (50th percentile) off-farm income was zero in 1997, estimation is made for 75th percentile for 1997[14]. Upper quantile estimations give more weight to the upper values, which in this case deviation is computed in reference to the 75th percentile off-farm income share.

There is also another issue involving the many zeros in the dependent variables. As we have seen in Table 1, zero median implies that more than half households have not participated in off-farm activities. This raises the question of how to treat the zeros. There are two ways to treat the zeros, one way is to just assume that zero imply that households have no opportunities to participate in the off-farm activities and that is why they reported zero off-farm income. The other way is to assume that this zero is decision variable that reflects households had the chance and the opportunity to engage in the off-farm income but decided not to engage in the off-farm activities by choice. The later way calls for an appropriate estimation technique to the zeros as a decision variable - Tobit

---

[13] Quantile regression is given as

$r_i = y_i - \sum_j \beta_j \chi_{ij}$, for each observation i, let r_i be ther residual and h_i be the multiplier

$h_i = \begin{cases} 2q \text{ if } r_i > 0 \\ 2(1-q) \text{ otherwise} \end{cases}$ where q may be any precentile values

β_j is obtained by minimizing $\sum_i |r_i| h_i$

[14] For 1997 intensity estimation with median (50th percentile) did not converge.

estimation technique. Hence, for the intensity models, in addition to the quantile regression, Tobit estimation results are also reported. Results are reported in Table 3.

For the dynamic models, the Tobit estimation method is not appropriate since change in the off-farm income share between 1994 and 1997 is used, there might be negative values in the dependent variable. In this case, it is not appropriate to lump the zeros and the negative values, as is the case if we use Tobit estimation method. Only quantile regression results are reported for the dynamic models in Table 4.

Both Probit and Tobit estimation methods are non-linear estimation techniques, which makes it difficult to interpret the raw coefficients of the estimation results. To make interpretation easier, marginal effects are reported where Probit and Tobit estimation are employed.

V. Results

Estimation results for the determinants of participation are presented in Table 1. The results reveal that participation in off-farm activities in 1994 is mainly influenced by demographic factors and not by asset holdings or seasonality/income factors. Specifically, households with more dependents (DEPR), and female-headed (FEHHH), tend to participate less in off-farm activities. One can safely say that these variables characterize most of the poor farm households in rural highland Ethiopia, which implies that poor farm households participate less in off-farm activities. Age has positive but declining effects on participation since the linear term (AGEHHH) has positive and the quadratic term has negative and significant coefficients, which implies that farmers participate in off-farm activities at a decreasing rate as they age. The only other demographic variable that positively influences participation of farmers in off-farm activities is number of female family members (NUFEHH). The fact that demographic factors – especially composition- remain to be the only decision variable for farmers to engage in off-farm activities imply that family labor is the most disposable and available resource for rural households to allocate in ways they want to maximize family income and at the same time secure subsistence consumption.

One of the risk indicators – land quality (LQUALITY) – has negative influence on the off-farm participation. This result confirms that households with poor land quality engage less in the off-farm activities. Households with such poor land quality need to spend more time on farm to secure food for subsistence. This result is contrary to the findings of Dercon and Krishnan (1996) that report no influence from risk n participation decision.

Only single variable is significant for the 1997 participation equation. Income from slack season –VBCROP- seems to promote participation in off-farm activities. None of the demographic factors influences participation in 1997. There seems to be other underlying conditions that drive participation in 1997. Though statistically insignificant, some of the demographic variables changes signs in 1997 compared to 1994.

Table 2. Determinants of Participation in off-farm activities: 1994 and 1997

Participation	1994				1997			
	Raw	Marginal	Raw	Marginal	Raw	Marginal	Raw	Marginal
DIV944					-0.022	-0.007	-0.021	-0.007
					(-0.115)	(-0.115)	(-0.111)	(-0.111)
Demographics								
AGEHHH	0.041*	0.016*	0.037*	0.015*	0.017	0.006	0.015	0.005
	(2.301)	(2.298)	(2.098)	(2.095)	(1.093)	(1.093)	(0.957)	(0.958)
AGE2	-0.052**	-0.020**	-0.047**	-0.018**	-0.024	-0.008	-0.022	-0.007
	(-2.941)	(-2.936)	(-2.649)	(-2.645)	(-1.492)	(-1.493)	(-1.342)	(-1.342)
FEHHH (D)	-0.368**	-0.146**	-0.386**	-0.153**	0.082	0.029	0.082	0.029
	(-3.035)	(-3.050)	(-3.119)	(-3.136)	(0.772)	(0.763)	(0.757)	(0.748)
DEPR	-0.581**	-0.229**	-0.670**	-0.264**	0.091	0.031	0.018	0.006
	(-2.624)	(-2.624)	(-2.743)	(-2.744)	(0.402)	(0.402)	(0.071)	(0.071)
AEQU	-0.031	-0.012	-0.008	-0.003	-0.01	-0.003	-0.014	-0.005
	(-1.161)	(-1.161)	(-0.267)	(-0.267)	(-0.433)	(-0.433)	(-0.462)	(-0.462)
NUFEHH	0.206***	0.081***	0.215***	0.085***	0.062	0.021	0.067	0.023
	(3.726)	(3.727)	(3.741)	(3.742)	(1.33)	(1.33)	(1.408)	(1.408)
NUMAHH			-0.048	-0.019			-0.006	-0.002
			(-0.784)	(-0.784)			(-0.111)	(-0.111)
RELIG (D)			-0.251	-0.099			0.036	0.012
			(-1.374)	(-1.375)			(0.252)	(0.251)
Asset								
EDMEM/NUSTU17			-0.074	-0.029			0.069	0.024
			(-1.759)	(-1.759)			(0.964)	(0.965)
VTOOL	0.00	0.00	0.00	0.00	-0.001	0.00	-0.001	0.00
	(-0.354)	(-0.354)	(-0.397)	(-0.397)	(-1.425)	(-1.427)	(-1.415)	(-1.417)
TOVLIV	-0.01	-0.004	-0.01	-0.004	0.008	0.003	0.008	0.003
	(-1.860)	(-1.861)	(-1.880)	(-1.881)	(1.667)	(1.668)	(1.683)	(1.684)
TOTLAND	0.042	0.016	0.046	0.018	-0.029	-0.01	-0.029	-0.01
	(0.958)	(0.961)	(1.024)	(1.027)	(-1.689)	(-1.694)	(-1.668)	(-1.672)
LRENTR	0.255	0.1	0.277	0.109	-0.027	-0.009	-0.031	-0.011
	(1.386)	(1.386)	(1.452)	(1.452)	(-0.146)	(-0.146)	(-0.166)	(-0.166)
Risk								
LQUALITY	-0.143*	-0.056*	-0.150*	-0.059*	-0.023	-0.008	-0.024	-0.008
	(-2.281)	(-2.282)	(-2.384)	(-2.385)	(-0.436)	(-0.436)	(-0.451)	(-0.451)
TNCR	0.018	0.007	0.019	0.007	0.015	0.005	0.014	0.005
	(0.92)	(0.919)	(0.969)	(0.968)	(1.11)	(1.11)	(1.042)	(1.043)
Seasonality/income								
VMCROP	0.002	0.001	0.002	0.001	0.00	0.00	0.00	0.00
	(0.706)	(0.706)	(0.767)	(0.767)	(0.504)	(0.504)	(0.493)	(0.493)
VBCROP	-0.002	-0.001	-0.002	-0.001	0.007*	0.002*	0.007*	0.002*
	(-0.801)	(-0.802)	(-0.692)	(-0.692)	(2.192)	(2.189)	(2.181)	(2.177)
SPOM (D)	-0.098	-0.039	-0.083	-0.033	-0.131	-0.046	-0.128	-0.044
	(-0.859)	(-0.860)	(-0.725)	(-0.725)	(-1.202)	(-1.191)	(-1.169)	(-1.159)
SPOB (D)	-0.057	-0.023	-0.058	-0.023	0.08	0.028	0.079	0.028
	(-0.453)	(-0.452)	(-0.452)	(-0.451)	(0.657)	(0.65)	(0.65)	(0.643)
N	1218	1218	1218	1218	1107	1107	1107	1107
Psuedo R2	0.30		0.30		0.09		0.09	
CHI2	495.3***	495.3***	502.9***	502.9***	121.9***	1219***	122.9***	122.9***

(d) Marginals for discrete change of dummy variable from 0 to 1, * p<0.05, ** p<0.01, *** p<0.001, values in parentheses are t-values.

The columns labeled as marginal report the response of households for marginal changes in the explanatory variables – that is predicted probabilities. Marginal responses for dummy explanatory variables (with (D) in front of them shows the marginal effects as the dummy variables change from 0 to 1.some binary(dummy) explanatory variables, predicted probabilities are also computed to see the role of these variables in affecting the probability of participation. Four dummy variables- female headedness, religion (Christianity), households who sold crop during *meher* and *belg* seasons- are reported in the results. The values show, for instance that being in a female headed household (compared to male headed) decreases probability of participation by over 15%. Increasing female family members marginally increase the probability of participation by 8% in 1994. Increasing the number of dependents marginally decreases the rate of participation by over 22%. Land quality is the only non-demographic variable that influences participation. If the quality of the land is downgraded to the low fertility level, the probability of participation in off-farm declines by about 5%. This implies that no matter what the quality of land, farmers need to make sure that they have some subsistence level output before venturing to engage in off-farm activities.

Unlike the results for the determinants of participation in off-farm activities, results for intensity show that not only demographic factors but also asset holdings, seasonality/income influence the level of intensity in off-farm activities even more so than the demographic effect. Again, this result is strong in 1994. In 1997, even though the intensity model seems to be better explained by the key variables identified, it still shows lower significance level and explanatory power compared to intensity model of 1994. The results for the intensity are presented in Table 3. As stated above, both qunatile and Tobit estimation results are reported. The quantile and Tobit results are qualitatively the similar results. The signs of the coefficients are the same for almost all coefficients in both estimations, though there are variations in significant levels across the two estimation techniques. Given decision-making under stress and the belief that diversification is mostly driven by survival more than choice, especially for the case farm households in Ethiopia, more focus is given to the quantile regression results.

As in the participation model, demographic factors also affect intensity decision but not as significantly as in the case of participation model. In 1994, of the demographic factors, only the number of female members promotes intensity just like its effect in the participation model. Household age square and number of male adults in a household turn out to be significant in only the Tobit model but both have same signs in both models in 1994. No other demographic factors have statistically significant impacts on off-farm intensity in 1994 and 1997. What makes the intensity model clearly different from the participation models is the significance of non-demographic factors that drive only intensity in both years. Once farmers decide to engage in off-farm activities, intensity is driven by asset ownership, farm income, and cash flow.

Of Asset holding factors, education, and value of agricultural tools in 1997, and value of livestock owned, total size of land owned as well as proportion of rented land in 1994 significantly affect intensity. In 1994, having more land (owned or rented) helps farmers to increase intensity in off-farm activities, where as having more livestock lower farm households' off-farm intensity. It sounds counter intuitive because farmers with more

land supposed to stay on farm since they have the resources. However, one should also look into the expected return (crop production or income) from farm to spend all disposable resources on farm. Therefore, just having enough land may not guarantee enough food, especially during times of bad weather. That seems the reason why households increase their intensity on off-farm or shift their focus on livestock rearing in cases where bad weather affects only crop production. In 1997, another set of asset indicators matters – education and agricultural tools. Farm households with more educated members or more number of students increase off-farm intensity. Is education starts to pay-off in 1997? This remains to be seen. Nevertheless, farmers with more agricultural tools (specific resource) stay on farm and lower off-farm intensity in 1997.

Seasonality/income factors also have significant effects on intensity in both years. In 1994, almost all crop income variables lower off-farm intensity. This supports the view that off-farm and on-farm activities compete over the limited household resources. It also implies that those households who expect secured agricultural income stay on farm and lower off-farm intensity. However, the two interaction terms – combining crop production with cash income -affect intensity positively. Those households who sold part their crop production and more crop production tend to intensify off-farm activities during both harvest seasons. More crop production and cash flow have to come together to increase off-farm intensity in rural farm household in Ethiopia.

In 1997, though the coefficients are only weekly significant, results show some seasonality effects. As opposed to the case in 1994, more crop production during the main harvest season increase off-farm intensity. It seems that in 1997 off-farm and on-farm activities are complementary. This result has to be interpreted with caution since the estimation in 1997 is based on the 75^{th} percentile as opposed to the 50^{th} percentile, which is the case for 1994. In 1997, giving more weight for those at the upper percentile, off-farm activities complement on-farm activities. The other effects from crop productions and interaction terms are similar to the results in 1994. Degree of off-farm diversification in 1994 has no significant bearing on the intensity of 0ff-farm activities in 1997.

Table 3. Determinants of Off-farm Intensity: 1994 and 1997

Intensity	1994		1997[15]	
	Quantile	Tobit/Marginal	Quantile	Tobit/Marginal
DIV944			0.032	7.555
			(0.08)	(1.102)
AGEHHH	0.031	0.675	0.013	0.338
	(0.781)	(1.719)	(0.451)	(0.577)
AGE2	-0.047	-0.843*	-0.017	-0.503
	(-1.278)	(-2.186)	(-0.570)	(-0.862)
FEHHH (D)	-0.545	-5.039	0.047	0.17
	(-1.533)	(-1.715)	-0.213	-0.044
DEPR	-0.988	-6.368	-0.497	-2.18
	(-1.385)	(-1.054)	(-0.944)	(-0.236)
AEQU	-0.025	-0.086	-0.057	-0.959
	(-0.278)	(-0.111)	(-0.964)	(-0.895)
NUFEHH	0.431**	3.083*	-0.026	0.376
	(2.606)	(2.286)	(-0.258)	(0.217)
NUMAHH	0.13	3.158*	-0.029	1.22
	(0.713)	(2.09)	(-0.269)	(0.653)
EDMEM/NUSTU17	-0.05	-0.943	0.985***	3.345
	(-0.412)	(-0.928)	(6.682)	(1.327)
VTOOL	0.00	-0.005	-0.002*	-0.052
	(0.339)	(-0.405)	(-2.502)	(-1.446)
TOVLIV	-0.035*	-0.504***	0.001	-0.07
	(-2.188)	(-3.305)	(0.078)	(-0.380)
TOTLAND	0.101***	0.087	-0.004	-1.289
	(7.224)	(0.645)	(-0.567)	(-1.799)
LRENTR	1.327**	2.862	-0.411	-4.751
	(2.764)	(0.755)	(-1.086)	(-0.739)
LQUALITY	-0.107	-0.358	0.024	-0.058
	(-0.565)	(-0.230)	-0.218	(-0.030)
TNCR	-0.071	-0.809	-0.013	0.346
	(-1.360)	(-1.868)	(-0.455)	(0.681)
VMCROP	-0.156***	-0.987***	0.001*	0.023
	(-7.588)	(-4.151)	(2.068)	(1.745)
VBCROP	-0.279***	-0.555	-0.084*	-1.464
	(-3.634)	(-0.915)	(-2.230)	(-1.685)
SPOM (D)	-3.684***	-18.175***	-0.293	-15.250***
	(-9.379)	(-5.475)	(-1.237)	(-3.723)
SPOB (D)	-0.521	-3.332	0.288	-3.35
	(-1.253)	(-0.978)	-1.102	(-0.744)
SPMCROP	0.155***	0.941***	-0.001	-0.025
	(7.228)	(3.992)	(-1.929)	(-1.511)
SPBCROP	0.267***	0.532	0.082*	1.514
	(3.469)	(0.875)	(2.16)	(1.735)
N	1185	1185	1094	1094
PSEUDO R2	0.24	0.067	0.06	0.023
CHI2	-	510.325***	-	93.759***

(d) Marginals for discrete change of dummy variable from 0 to 1, * p<0.05, ** p<0.01, *** p<0.001.
Values in parentheses are t-values.

[15] 75th percentile estimation result as opposed to median (50th percentile) for year 1994.

Results from the dynamic model are reported in Table 4. The dependent variable for all four specifications is change in off-farm share between 1994 and 1997 computed as [(off-farm income in 1997)/ (total income in 1997) – (off-farm income in 1994)/ (total income in 1994)]. The alternative way is to take 1994 as base year. Since the results are qualitatively similar in both cases, results from the later are not reported here to save space. As in intensity specification for year 1997, prior level of diversification is also included in the dynamic estimation models. In addition to prior level of diversification, asset, crop income, and cash flow from 1994 are also included in the dynamic estimation models to investigate the role of initial conditions on off-farm intensity overtime. Four different specifications are estimated (labeled as A, B, C).

The results reveal that in all specifications, households with higher initial diversification within off-farm activities subsequently realize less diversification to off-farm activities. The other two initial conditions that affect degree of subsequent diversification in income sources are size of land and crop production during slack (*belg*) season. Farmers with large land holding in 1994 tend to engage less in off-farm activities in 1997. This result is contrary to the static model where more land means larger share of off-farm income in 1994. This implies that, compared to 1994, in 1997 return from land or staying on farm provides secured and adequate output for consumption and income source to keep farmers on farm. The negative coefficient on land holding may also be explained by the strict residency and use requirement to claim user right over the state owned land. The negative significant coefficient on *belg* crop harvest supports the idea that better off farmers – who harvest during both seasons – in 1994 tend to engage more in off-farm in 1997.

The static model in 1994 implies that there is competition (and substitution) between off-farm and on-farm activities during any crop production season of a year; where as the dynamic model reveals that, at least during slack crop production season, there is complementarities between on-farm and off-farm activities. The finding that households with higher initial crop income (from *belg* harvest season) diversify more in subsequent years is consistent with the results of Block and Webb (2001). This confirms the widely held view in the rural Ethiopia that there is labor shortage, at least during the main harvest season of a year. The competition between farm and off-farm activities during the main harvest season, not during slack season, leads farmers to focus less on off-farm activities than more on farm activities. The later relatively guarantees food security from own farm production.

In estimation B, in addition to the initial conditions, contemporary seasonality/income factors are incorporated. The results further confirm the competition between farm and off-farm activities during the main harvest season and complementarities during the slack seasons. The last specification, which includes interaction variables for crop production and sale of part of production, reveals that what really matters is cash income and not just crop production. Households who produced more and sold part of it during main season cut off-farm intensity, where as those with more crop production and sold part of it during the slack season engage more in off-farm activities.

Table 4. Determinants of the Dynamics of Off-farm Intensity between 1994 and 1997

Dynamics	A	B	C
Initial Conditions			
DIV944	-42.188***	-42.587***	-42.273***
	(-276.121)	(-151.896)	(-103.212)
EDMEM1	-0.007	-0.013	-0.019
	(-0.292)	(-0.296)	(-0.295)
VTOOL	0.00	0.00	0.00
	(-0.095)	(-0.152)	(-0.119)
TOTLAND	-0.024***	-0.018**	-0.024*
	(-5.844)	(-2.666)	(-2.348)
LRENTR	0.081	0.079	-0.06
	(0.74)	(0.41)	(-0.215)
TOVLIV	0.003	0.006	0.011
	(0.87)	(0.996)	(1.268)
VMCROP	-0.001	0.003	-0.002
	(-0.386)	(0.359)	(-0.187)
VBCROP	0.051**	0.094**	0.100*
	(3.032)	(3.14)	(2.275)
SPOM	0.124	0.414**	0.342
	(1.447)	(2.609)	(1.519)
SPOB	-0.001	-0.049	0.087
	(-0.010)	(-0.287)	-0.347
SPMCROP	0.003	-0.001	0.005
	(0.749)	(-0.171)	(0.543)
SPBCROP	-0.026	-0.070*	-0.074
	(-1.533)	(-2.335)	(-1.701)
LQUALITY	0.065	0.167*	0.155
	(1.545)	(2.133)	(1.357)
TNCR	-0.016	-0.022	-0.032
	(-1.385)	(-1.052)	(-1.065)
Factors in 1997			
LRENTR7		-0.486*	-0.387
		(-2.032)	(-1.120)
VMCROP7		-0.000***	0.001
		(-3.484)	(1.606)
VBCROP7		0.014***	-0.05
		(4.561)	(-1.775)
SPOM7			0.278
			(1.335)
SPOB7			-0.412
			(-1.817)
SPMCROP7			-0.012***
			(-24.526)
SPBCROP7			0.088**
			(3.134)
N	1167	1030	1030
PSEUDO R2	0.20	0.21	0.21

(d) Marginals for discrete change of dummy variable from 0 to 1, * p<0.05, ** p<0.01, *** p<0.001. Values in parentheses are t-values.

One of the initial conditions considered by Block and Webb (2001) as risk variables is small farm size (TOTLAND). The argument states that the smaller farm size, which indicates risk, farmers engage more in off-farm activities. As stated above, this is confirmed consistently in all specification in the dynamic model.

The result that households who initially diversify more to off-farm activities in 1994 tend to diversify less to off-farm activities in 1997 is line with Block and Web's finding. This supports the view that farmers just switch away from off-farm activities when the farm activity is promising; and hence, this supports the necessity argument as opposed to the choice argument. Farmers consider off-farm activities as a last resort income source if crop production fails.

VI. Poverty Profile and Off-farm Participation

In a rural setting, the role that poverty plays in family decision process is obvious. Does it also relate to the decision to participate in off-farm activities? To address this question, households are grouped into those who participated in off-farm activities and those who did not. Households are also grouped into those who earned income from off-farm activities and those who did not earn income from off-farm during 1994 and 1997 survey years. Then, poverty indices are computed for each group for each harvest year to investigate if there is difference across groups as well as overtime. Foster, Greer, and Thorbecke (1984) – (FGT (a) hereafter) - poverty indices[16] are used to compute poverty indices. FGT (0) (labeled as P0, when *a* is zero in the function) is the headcount ratio (the proportion poor); FGT (1) (labeled as P1) is the average normalized poverty gap; FGT (2) (labeled as P2) is the average squared normalized poverty gap. The poverty line is computed as half of the median income. Alternative poverty lines provided by the World Bank are also used in computing the indices. In all the cases, internally computed poverty lines are lower than those provided by the World Bank. The results below use poverty lines from the World Bank, which are birr 161 (about $30) for 1994 and birr 200 (about $32.8) for 1997. The results are presented in Table 5.

Region 1 had the highest poverty rate followed by region 9 in 1994. In 1997, region 1 and region 9 exchanged the top two highest poverty positions. Region 8 had the lowest poverty rate during both survey years. Ranking in terms of poverty gap also follow that of the poverty rate (headcount ratio) ranking. In almost all the regions, poverty gap, and squared poverty gap declined in 1997 compared to that of 1994. Is this the fruit of policy reform, better weather conditions, and/or farmers' active engagement in off-farm activities? In this table below, we can only investigate the role that off-farm participation plays in changing the poverty dynamics.

[16] For poverty line Z, FGT (a) poverty index is computed as

$$FGT(a) = \sum_{i=1}^{n} (f_i).(I_i).[(z - y_i)/z]^a$$

$$where I_i = 1 if\ y_i < z\ and\ I_i = 0\ \text{otherwise}$$

Table 5: Poverty profile by region and off-farm participation during the 1994 and 1997 survey years

Regions	1994			1997			Population share
	P0	**P1**	**P2**	**P0**	**P1**	**P2**	
1	0.97	0.77	0.65	0.63	0.38	0.28	0.10
3	0.35	0.20	0.14	0.36	0.23	0.18	0.33
4	0.34	0.21	0.16	0.16	0.10	0.08	0.27
7	0.57	0.34	0.25	0.45	0.23	0.16	0.10
8	0.31	0.13	0.08	0.13	0.06	0.04	0.09
9	0.79	0.53	0.41	0.73	0.44	0.33	0.15
Participation	**P0**	**P1**	**P2**	**P0**	**P1**	**P2**	
Off-farm participants	0.45	0.25	0.17	0.37	0.21	0.19	0.44
Off-farm non-participants	0.50	0.35	0.28	0.36	0.23	0.18	0.56
Earned off-farm income	0.48	0.28	0.20	0.30	0.14	0.08	0.54 (0.28)*
Not earned off-farm income	0.48	0.33	0.27	0.39	0.25	0.20	0.46 (0.72)*
Overall	0.48	0.31	0.23	0.36	0.22	0.16	

* Numbers in bracket refer to the share of population during the 1997 survey year. There was no change in the share of population under the other categories in the table.

In 1994, there was high poverty rate among off-farm non-participants compared to off-farm participants. This ranking had not changed even in 1997 but the rate had dropped, especially for non-participants, from a high of 50% to 36%. The same trend can be observed for households grouped based on whether they earn off-farm income or not. The rate of poverty dropped during 1997 compared to that of 1994. Headcount poverty ratio of those who earned off-farm income in 1994 and 1997 has declined from 48% in 1994 to 30% in 1997. Poverty gap, and squared poverty gap were also declined across the board, but more so for off-farm income earners. This confirms that participation in off-farm activities has poverty reduction effects; however, off-farm also is not responsible for the changes. It seems that there are also other underlying changes that lower poverty across the board in rural Ethiopia.

VII. Conclusions

The purpose of this study is to examine the determinants of participation in and the intensity of off-farm activities in rural Ethiopia. The study looks into not only the static determinants but also the determinants at a dynamic setting using survey data from Ethiopia during 1994 and 1997 harvest years. Probit, quantile, and Tobit estimation techniques are employed to estimate the models. Attempt is made to take into account demographic, asset holding, risk indicators, and seasonality/income variables to explain diversification to off-farm activities. Poverty profiles of the households surveyed are also linked to off-farm participation and income to investigate possible effects of off-farm on poverty.

The results show that participation rate in 1994 is mainly influenced by demographic factors, including age of household head, gender of the head of the households, dependency ratio, and number of female household members. On the other hand,

intensity is affected not only by demographic factors but also by the size of land holdings, value of livestock owned and crop production as well as cash income from crop production. In 1997, similar, but weak results are observed. In a dynamic setting, initial degree of diversification, size of land, and slack season crop production have statistically significance influence on off-farm intensity in 1997. Households with large initial land holding subsequently realize less off-farm intensity, whereas households with more crop production and cash income from *belg* season tend to diversify more into off-farm activities.

Nevertheless, land remains to be key factor both for the static and dynamic intensity models. In 1994 – the year when crop production was not promising – farmers with larger size of land holding tend to engage more in off-farm activities. In the dynamic setting, larger initial land holding promote households to engage less in off-farm activities. The dynamic setting implies that compared to year 1994, in 1997 more initial land keeps farmers on farm. Since 1997 is considered as better weather condition for crop production, farmers stay on farm as that guarantee secured and adequate crop production and income. This result should be qualified with the seasonal effects. As opposed to main harvest seasons, more crop production and income during the slack season promotes farmers to engage more in off-farm activities. This result is confirms both in the static and the dynamic intensity models. This supports the view that there is competition between off-farm and on-farm activities during the main harvest season but during the slack season, off-farm and on-farm activities are complements.

The study also found that participation in off-farm activities has poverty reduction effects. Although poverty rate declined across the board for all farmers, those who earned off-farm income saw their poverty rate decline by higher proportion. The poverty profiles of those households engaged in off-farm activities show that those participated tend to have a lower poverty rate in 1997 compared to 1994. It is important for policy-makers to give due focus on the role that off-farm activities and other underlying changes that play a significant role to lower poverty in rural Ethiopia.

It may be that resource-poor and resource-rich farmers engage in different off-farm activities. However, given the data, it is not possible to see the specific activities undertaken by the well-off farmers and resource-poor farmers to determine its actual return. It is, therefore, relevant for policy-makers to look into the resource composition of households to make sure farmers have the opportunities to use their family resource in activities that provide the highest possible return.

References

Abdulai, Awudu, and Anna CroleRees. 2001. Determinants of Income Diversification amongst Rural Households in Southern Mali. *Food Policy* 26, no. 4:437-52.

Barrett, Christopher B., Mesfin Bezuneh, and Abdillahi Aboud. 2001. Income Diversification, Poverty Traps and Policy Shocks in Cote d'Ivoire and Kenya. *Food Policy* 26, no. 4:367-84.

Barrett, Christopher B., Tom Reardon, and Patrick Webb. 2001. Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications. *Food Policy* 26, no. 4:315-31.

Bevan, Phillipa and Alula Pankhurst, eds. (1996) Ethiopia Village Sociological Survey Reports (Oxford: Centre for the Study of African Economies).

Block, S., and Patrick Webb. 2001. The Dynamics of Livelihood Diversification in Post-famine Ethiopia. *Food Policy* 26, no. 4:333-50.

Bryceson, Deborah F. 1999. African Rural Labour, Income Diversification and Livelihood Approaches: A Long-Term Development Perspective. *Review of African Political Economy* 26, no. 80:171-89.

Carswell, Grace. 2002. Livelihood Diversification: Increasing in Importance or Increasingly Recognized? Evidence from Southern Ethiopia. *Journal of International Development* 14, no. 6:789-804.

de Janvry, Alain. 1994. Farm-Nonfarm Synergies in Africa: Discussion. *American Journal of Agricultural Economics* 76, no. 5:1183-85.

Deininger, Klaus, and Pedro Olinto. 2001. Rural Nonfarm Employment and Income Diversification in Colombia. *World Development* 29, no. 3:455-65.

Delgado, Christopher L., and Ammar Siamwalla. 1999. Rural Economy and Farm Income Diversification in Developing Countries. *Food security, diversification and resource management: Refocusing the role of agriculture? Proceedings of the Twenty-third International Conference of Agricultural Economists held at Sacramento, California, 10-16 August 1997*126-43.

Dercon, Stefan, and Pramila Krishnan. 1996. Income Portfolios in Rural Ethiopia and Tanzania: Choices and Constraints. *Journal of Development Studies* 32, no. 6:850-75.

Ellis, Frank. 1998. Household Strategies and Rural Livelihood Diversification, *the Journal of Development Studies*, Vol. 35, No. 1, pp. 1-38

Ellis, Frank. 2000. Rural Livelihoods and Diversity in Developing Countries, Oxford University Press, New York.

Escobal, Javier. 2001. The Determinants of Nonfarm Income Diversification in Rural Peru. *World Development* 29, no. 3:497-508.

Foster, J.E., Greer, J., and Thorbecke, E. 1984. A class of decomposable poverty indices, *Econometrica*, 52, 761-766.

Holden, Stein, Shiferaw, Bekele and Pender, John. 2004. Non-farm income, household welfare, and sustainable land management in a less-favored area in the Ethiopian Highlands. *Food Policy*, 29, 369-392.

Koenker, R. and K. Hallock, 2001. Quantile Regression, *Journal of Economic Perspectives*, 15, 143-156.

Lanjouw, Jean O., and Peter Lanjouw. 2001. The Rural Non-farm Sector: Issues and Evidence from Developing Countries. *Agricultural Economics* 26, no. 1:1-23.

Lanjouw, Peter. 2000. Rural Non-agricultural Employment and Poverty in Latin America: Evidence from Ecuador and El Salvador. *Rural poverty in Latin America*, 99-119.

Lanjouw, Peter, and Lanjouw, Jean O. 1999. *Rural Nonfarm Employment: A Survey*. The World Bank, Policy Research Working Paper Series: 1463.

Lanjouw, Peter, Jaime Quizon, and Robert Sparrow. 2001. Non-agricultural Earnings in Peri-urban Areas of Tanzania: Evidence from Household Survey Data. *Food Policy* 26, no. 4:385-403.

Reardon, Thomas. 1997. Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa. *World Development* 25, no. 5:735-47.

Reardon, Thomas, Julio A. Berdegue, and German Escobar. 2001. Rural Nonfarm Employment and Incomes in Latin America: Overview and Policy Implications. *World Development* 29, no. 3:395-409.

Reardon, Thomas, Eric Crawford, and Valerie Kelly. 1994. Links between Nonfarm Income and Farm Investment in African Households: Adding the Capital Market Perspective. *American Journal of Agricultural Economics* 76, no. 5:1172-76.

Reardon, Thomas, Christopher Delgado, and Peter Matlon. 1992. Determinants and Effects of Income Diversification amongst Farm Households in Burkina Faso. *Journal of Development Studies* 28, no. 2:264-96.

Ruben, Ruerd, and Marrit van den Berg. 2001. Nonfarm Employment and Poverty Alleviation of Rural Farm Households in Honduras. *World Development* 29, no. 3:549-60.

Woldenhanna, T., and Arie Oskam. 2001. Income Diversification and Entry Barriers: Evidence from the Tigray Region of Northern Ethiopia. *Food Policy* 26, no. 4:351-65.

Yunez-Naude, Antonio, and J. E. Taylor. 2001. The Determinants of Nonfarm Activities and Incomes of Rural Households in Mexico, with Emphasis on Education. *World Development* 29, no. 3:561-72.

Appendix

Table A.1: Worked on someone else's land or other employment?

YEAR			1994	1997
Off-farm?	Yes	Count	515	344
		% share	34.90%	23.60%
	No	Count	962	1114
		% share	65.10%	76.40%
	Total	Count	1477	1458

Table A.2: Location of employment by region

Location		1994	1997
This Village	Count	518	344
	% share	74.70%	78.70%
Other village in PA	Count	92	49
	% share	13.30%	11.20%
This province	Count	41	29
	% share	5.90%	6.60%
The neighboring province	Count	27	8
	% share	3.90%	1.80%
Total	Count	693	437

Table A.3: Kind of work by region

Kind of work		1994	1997
Farm worker	Count	126	100
	% share	18.00%	22.70%
labor sharing	Count	255	131
	% share	36.40%	29.70%
Professional	Count	9	16
	% share	1.30%	3.60%
Laborer	Count	34	44
	% share	4.90%	10.00%
Trader	Count	9	12
	% share	1.30%	2.70%
Soldier	Count	2	2
	% share	0.30%	0.50%
Driver/Mechanic	Count	2	2
	% share	0.30%	0.50%
Unskilled	Count	50	80
	% share	7.10%	18.10%
Domestic servant	Count	11	12
	% share	1.60%	2.70%
Food-for-work	Count	180	31
	% share	25.70%	7.00%
Total	Count	700	441

"Professional" refers to teacher, government worker, health worker, etc
"Laborer" refers to skilled builder, thatcher, etc

Table A.4: Why did no other member seek other off-farm job?

Why not looking for off-farm work?		1994	1997
No employment opportunities	Count	712	315
	% share	54.40%	38.90%
Needed on farm	Count	346	326
	% share	26.50%	40.30%
Job too far away	Count	31	25
	% share	2.40%	3.10%
Wages too low for kind of work	Count	22	13
	% share	1.70%	1.60%
Other	Count	24	42
	% share	1.80%	5.20%
Taboo	Count	84	NA
	% share	6.40%	NA
Old Age, Poor health	Count	29	73
	% share	2.20%	9.00%
Total	Count	1308	809

Table A.5: Why did no other member seek female income earning employment?

Why not looking for female off-farm activity?		1994	1997
No employment opportunities	Count	39	35
	% share	10.50%	15.10%
Needed on farm	Count	89	78
	% share	24.00%	33.60%
Job too far away	Count	112	49
	% share	30.20%	21.10%
Wages too low for kind of work	Count	32	20
	% share	8.60%	8.60%
Other	Count	10	21
	% share	2.70%	9.10%
Taboo	Count	45	NA
	% share	12.10%	NA
Old Age, Poor health	Count	6	11
	% share	1.60%	4.70%
Total	Count	371	232

Table A.6: If member participated in any off-farm activity in 1997, why?

Reasons		Why Participate any off-farm?	Why participate in female off-farm activity?
Limited Agricultural Income	Count	220	21
	% share	68.10%	11.40%
Large family	Count	19	38
	% share	5.90%	20.70%
Favorable demand for goods	Count	19	30
	% share	5.90%	16.30%
Proximity to urban areas	Count	4	10
	% share	1.20%	5.40%
Seasonal nature of agricultural Labor	Count	12	25
	% share	3.70%	13.60%
Level of education required.	Count	12	10
	% share	3.70%	5.40%
Availability of off-farm opportunity	Count	28	45
	% share	8.70%	24.50%
Landless	Count	2	1
	% share	0.60%	0.50%
to help himself	Count	-	1
	% share	-	0.50%
Total	Count	323	184

Table A.7: Descriptive Statistics of the variables used in estimation by year

Year		1994		1997	
Variable	Description	N	Mean	N	Mean
AGEHHH	Age of household head	1476	46.41599	1469	44.87703
FEHHH	Female headed dummy	1476	0.224255	1469	0.229408
DEPR	Dependency ratio	1476	0.339822	1425	0.3925
AEQU	Adult equivalent	1476	4.769146	1469	5.577461
NUFEHH	Number of female members	1476	1.644309	1469	1.928523
NUMAHH	Number of male adults	1476	1.54607	1469	1.767189
EDMEM	Primary education	1476	0.656504	1469	0.014295
RELIG	Religion of household head dummy	1476	0.375339	1469	0.335603
NUSTU	Number of students in the family	1317	0.309	1317	0.269
VTOOL	Value of agricultural tools	1476	30.90385	1469	36.88676
TOTLAND	Area of total land owned	1476	1.9521	1469	1.634003
LRENTR	Ratio of area of land rented in	1346	0.09232	1281	0.063823
TOVLIVE	Value of livestock	1476	960.3498	1469	1033.511
VMCROPS	Value of *meher* crops	1476	1113.198	1469	2926.601
VBCROPS	Value of *belg* crops	1476	281.4988	1469	456.6528
LQUALITY	Quality of land	1476	1.383313	1469	0.918012
TNCR	Number of crops harvested	1476	5.210705	1469	6.023826

FEHHH – dummy for female-headed households, 1 if female headed and 0 otherwise
RELIG – dummy for religion of household head, 1 for orthodox Christians and 0 otherwise

Table A.8: Timing of activities and of the surveys

Region	Survey site	Location	Main Harvest	Survey Round : Time of Interview				
				1989	Round1 1994	Round 2 1994-95	Round 3 1995	Round 4 1997
1	Haresaw	Tigray	October-November		June-July	January	March	June
1	Geblen	Tigray	October-November		June-July	January	March	June
3	Dinki	N. Shoa	December	March April	March-April	November	January	October, November
3	Debre Berhan	N.Shoa	November-December	March-April	March-April	October	March	June - August
3	Yetmen	Gojjam	November-December		March-April	October	March	September, October
3	Shumsha	S.Wollo	October-December		June-July	December-January	May	October, November
4	Sirbana Godeti	Shoa	November-December		March-April	November	March	June, July
4	Adele Keke	Hararghe	November-December	November-December	May-June	October	April	October, November
4	Koro-degaga	Arssi	October-November	November-December	May-June	November-December	May- June	June, July
4	Turfe Kechemane	S.Shoa	December		March-April	September-October	March- April	September, October
7	Imdibir	Shoa (Gurage)	October-December		March-April	October	March	June, July
7	Aze Deboa	Shoa (Kembata)	October-November		March-April	September-October	March	September, October
8	Addado	Sidamo (Dilla)	December-January		March-April	January	March	June, July
9	Gara Godo	Sidamo (Wolayta)	August-December	March	March-May	October	March	June, July
9	Doma	Gama Gofa	September-December	May-June	April-May	December-January	May-June	November

Source: Bevan and Pankhurst (1996).