

Determinants of Rural Households' Participation in Income Generating Activities in Central Region, Eritrea

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Abstract

This study aims to identify and analyze the determinants of rural households' participation in income generating activities in the Central region, Eritrea. Households' level survey data was collected through a standardized, formal questionnaire from 202 randomly selected households in four villages. Five income generating activities and several independent variables are identified and the probability that a given household participates in these income generating activities is estimated using probit technique. The result of the econometric analysis shows that the probability of participation in wage employment is related positively to age of head of household (HoH), risk, and average education of household (HH) members; while, rain-fed area owned, age of HoH squared have a negative effects. When we consider non-agricultural wage employment; sex of HOH, adult members in the HH and risk are related positively in contrast to the negative effects of distance to the nearest tarmac road and social capital index. Non-agricultural self-employment is another major source of income which is positively related to rain-fed area owned, age of HoH, dependency ratio, and distance to nearest tarmac road; and negatively to sex of HoH, possession of livestock, age of HoH squared and risk. Combining both non-agricultural wage and self-employments is categorized as off-farm and has a positive relationship with age of HoH, years of schooling of HoH, adult members in the HH, risk, average education of HH members and access to credit, while the effect of sex of HoH and age of HoH squared is negative. Finally, the probability of participation in agricultural self-employment (livestock production) has negative relationship with age of HoH squared, years of schooling of HOH and average education of HH members. Based on the results of the econometric analysis, some policy recommendations are drawn with respect to activity diversification and rural development which can be helpful in rural poverty reduction.

Keywords: activity diversification, rural households, non-farm, off-farm, central-zone, Eritrea

1. Introduction

The economy of rural areas is predominantly based on agriculture and other activities related to the agricultural sector. Hence an overwhelming majority of rural population is mainly depending on agricultural sector both for its employment and livelihood (Mehta, 2002). Despite this narrow view, there is growing evidence in developing regions that the rural sector is much more than just farming. Various non-agricultural activities are also playing an important role in providing opportunities of employment and income to the labour force belonging to both farming and non-farming households.

The prevalence of non-agricultural activities in rural areas dates back in the literature as far as the 19th century, however, studies over the past 15 years have highlighted the increasing importance of non-agricultural sources of income to rural dwellers. The focus on livelihood diversification necessarily implies a process - a broadening of income and livelihood strategies away from purely crop and livestock production towards both farm and non-farm activities that are undertaken to generate additional income via the production of other agricultural and non-agricultural goods and services, the sale of waged labour or self-employment in small enterprises and remittance from urban areas and from abroad (Smith *et al.*, 2001). Thus, diversification is a norm. Very few people collect all their income from any one source, hold all their wealth in the form of any single asset, or use their assets in just one activity. There are several reasons for this: risk reduction, realization of economies of scope, diminishing returns to factor use in any given application, response to crisis, liquidity constraints, etc. At the more aggregate level of households or communities or regions, scarcity of productive resources and specialization according to comparative advantage accorded by superior technologies or skills or by greater endowments leads to considerable inter-individual diversity in activities and incomes. So no matter the unit of analysis, diversification is ubiquitous (Barrett and Reardon, 2000).

In Eritrea where the majority of the rural households are poor and productivity of the agricultural sector is very low, it is natural for rural households to depend on additional source of income for their survival. To-date, in Eritrea, little has been done to analyze and identify the various income generating activities as well as participation of rural households in activities supplementary to their agricultural production and the reasons for this diversification of livelihoods. Diversification and its implications for development and policy are now

drawing considerable attention from scholars, policymakers and donors, because of the relevance of the theme to policy and development action.

2. Livelihood Diversification

During the last few decades, many authors have put agricultural development at the central place as an engine of prosperity, while discussing early stages of development of a nation. The economies of most developing nations are predominantly agrarian in nature and agriculture is the backbone of those economies because most of the people live in villages and earn their living from farming and trades related to farming (Dutta, 2004). This widespread view persisted until the late 1970s and early 1980s, that rural households undertook little activity off their farm, except when they left rural areas to migrate (Reardon, 1997). However, there are relatively few households for which agriculture is the exclusive source of income. Men, women and children in rural areas also undertake a variety of other activities besides farming. Some of these non-farm activities flow directly from agriculture or are closely related to it. Others are distinct, ranging from full-time but temporary, wage-employment in industry or construction to regular but part-time self-employment in home-based handicrafts, and trading or other services (ILO, 1983).

The literature on livelihood diversification, which crosses several related fields and disciplinary approaches, is characterised by many terms and definitions. For the purposes of this study, the definition of livelihood diversification developed by Frank Ellis is used:

Rural livelihood diversification is defined as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living (Ellis, 2000a).

3. Conceptual Approaches Linking Assets with Activity Choice and Incomes

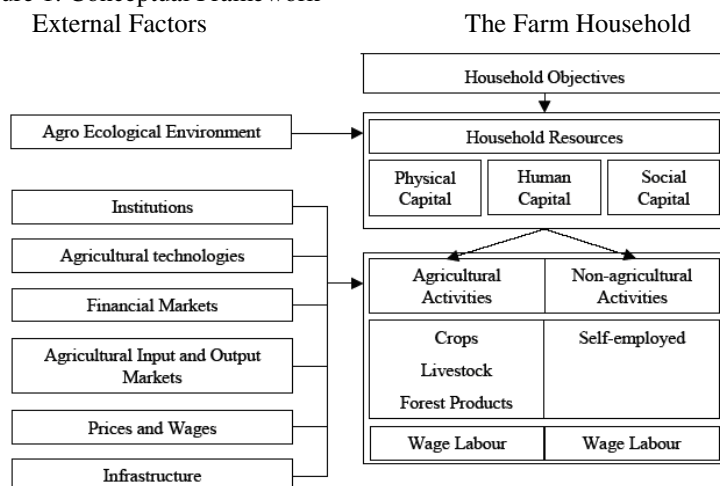
In the last two decades, two approaches emerged in the literature linking assets, income and activities: the livelihood approach and the assets-activities-incomes approach. The livelihood approach developed by Ellis (2000a) defined a livelihood as consisting of “the *assets* (natural, physical, human, financial and social capital), the *activities*, and the *access* to these (mediated by institutions and social relations) that together determine the living gained by the individual or household”. The livelihood approach emphasizes the role of the household’s resources as determinants of activities and highlights the link among assets, activities and incomes. Moreover, it stresses the multiplicity of activities rural households are engaged in.

Barrett and Reardon (2000) developed another approach linking *assets, activities and incomes*. They argued that it is useful to have an image of a production function in mind when analyzing the components of diversification behaviour: (1) *assets* are the factors of production, representing the capacity of the household to diversify; (2) *activities* are the *ex-ante* production flows of asset services; (3) *incomes* are the *ex-post* flows of activities, and it is crucial to note that the goods and services produced by activities need to be valued by prices, formed by markets at meso and macro levels, in order to be the measured outcomes called *incomes*.

The conceptual framework used in this study depends on the features of these two approaches linking assets, activities, and incomes for reasons of its simplicity and it stresses the multiplicity of activities rural households are engaged in and the importance of assets in determining the capacity to undertake the activities. Furthermore, similar approaches have been used in many studies on livelihood diversifications in Africa and Latin America.

According to Schwarze (2004) the household which is taken as a single decision making body is assumed to maximize its utility which is a function of the consumption of goods and services as well as leisure subject to various constraints. According to its objective, the household allocates its resources to activities subject to factors which are external and internal to the household. These activities generate outcomes which will meet the objectives. Determinants of the allocation decision, which are external to the household, are illustrated on the left hand side of the conceptual framework. They condition, or mediate the use of the household’s resources. The household’s assets are shown on the right hand side, which also stylizes the decision making process of the household.

Figure 1: Conceptual Framework



Adopted from Schwarze (2004)

4. Definitional and Conceptual Issues

Before embarking on a review of rural off/non-farm activities, it is necessary to specify what is meant by “rural”. As emphasized in many literatures, the concepts and definitions of “rural,” vary dramatically. According to CARE, WFP& ERREC (2003), rural areas in the Eritrean context are defined as areas other than cities or towns with populations less than 5,000.

4.1. Assets

According to Barrett and Reardon (2000) assets are stocks of directly or indirectly productive factors that produce a stream of cash or in-kind returns. Portfolio theory, on which much of the diversification literature depends, emphasizes assets as the subject of agent choice when trying to maximize expected income, minimize income variability, or some combination of the two. In the literature various classifications of assets can be found. For example, according to Reardon and Vosti (1995) households and villages have the following assets: natural resources composed of water, biodiversity, soil/land; human resource endowments composed of education, health, nutritional status, skills, and number of people; on-farm resources comprising livestock, farmland, pastures, reservoirs, buildings, equipment; off-farm resources such as local off-farm enterprise capital and migration activity capital; community-owned resources such as roads, dams, and social institutions. Ellis (2000a) distinguishes between natural, physical, human, social, and financial capital. Barrett and Reardon (2000) propose to distinguish productive and non-productive assets. Individuals own assets, some of which (non-productive assets, such as household valuables) generate “unearned” income directly and others (of which productive assets, such as human capital, land, livestock) generate “earned” income only indirectly through their allocation to activities such as farming, weaving or commerce. Therefore, the asset classification adopted for the study is taken by mixing the propositions made by Reardon and Vosti (1995), Barrett and Reardon (2000) and Ellis (2000a) accordingly, assets are classified as physical capital (land, livestock, and other assets owned), human capital (labour, education, gender, and age), social capital (access to social networks and institutions) and financial capital which further can be classified into productive and non-productive assets.

4.2 Activities and their Classifications

Activities are the particular uses to which productive assets are put, so activities are *ex-ante* flows of asset services that map the stock concept of assets into the *ex-post* flows of income. Activities use productive assets, often a combination of multiple complementary assets, to generate incomes (Barrett and Reardon, 2000).

In the literature, there has been a wide range of systems in classifying sources of income. Terms like off-farm and non-farm income are used, in seemingly synonymous way, but with slightly different definitions. Ellis (1998 and 2000a) for example define off-farm income as referring to wage or exchange labour on other farms (i.e. within agriculture). It includes labour payments in kind, such as the harvest share systems and other non-wage labour contracts that remain prevalent in many parts of the developing world, whereas Barrett *et al.* (2001) refer to off-farm income as all returns of activities away from the farmer’s own property, regardless of sectoral or functional classification. Non-farm income is usually deployed to mean incomes arising from outside agriculture.

Therefore, here the classification proposed by Barrett *et al.*(2001) is adopted and Table 1 depicts the components of rural household income using a three-way classification of earned income (i.e. income from productive assets) by sector (e.g. farm vs non-farm), function (wage vs self-employment), and space (local vs migratory) and unearned income (remittance, pension, etc).

Table 1: Three ways classification of Activities: Sectoral, Functional and Spatial *

Type of Employment	Primary				Secondary Manufacturing		Tertiary Services	
	Agriculture		Mining/ Other Extraction		Local	Migratory	Local	Migratory
Wage	Local	Migratory	Local	Migratory	Local	Migratory	Local	Migratory
Self	Local	Migratory	Local	Migratory	Local	Migratory	Local	Migratory

Source: Barrett and Reardon (2000:40)

* *Non-farm* = all activities outside the agricultural sector, regardless of location (on-or off-farm, that is, at-home or away-from-home) (shaded columns). *On-farm or at-home* = all activities on one's own property, regardless of sectoral or functional classification. *Off-farm or away-from-home* = all activities away from one's own property, regardless of sectoral or functional classification.

4.2.1 Sectoral Composition

The most basic classification of activities follows the sectoral distinctions of national accounting systems: primary¹, secondary² (manufacturing), and tertiary³ (services) sectors. Primary sectors refer to agriculture, mining and other extractive activities. Agriculture or farm activities are a subset of primary activities (Start, 2001). This leads directly to the distinction between "agricultural" or "farm" activities and "non-agricultural" or "non-farm" activities. "Non-farm" or "non-agricultural" activities are sectoral definitions and include all economic activity other than crop and livestock production, encompassing services, construction, mining, commerce, manufacturing, processing, transport or trading of unprocessed products regardless of location: on-or off-farm, that is, at-home or away-from-home- (Haggblade *et al.*, 1989; Start, 2001).

4.2.2 Functional Classification

The nearest distinction, depicted as separate rows in Table 1, concerns functional classifications. Here, there exists a continuum from "clearly wage-employment" (i.e. involving a wage or salary contract), through a grey area where an activity could be classified as either wage-or self-employment, to "clearly self-employment" (e.g. entrepreneurial activity). The distinction is between wage and self-employment (Barrett *et al.*, 2001; Davis and Bezemer, 2004).

Activities which are "clearly wage-employment" involve (at least an implicit) employment contract where the employer can give orders to the employee. Activities which are "clearly self-employment" involve the ownership of a firm that produces goods or services, the buyers of which cannot give orders to the firm, and take the product as sold. A non-ambiguous example is the charcoal producer who collects wood, processes it, and sells bags of charcoal by the roadside (Reardon, 1997).

4.2.3 Spatial Composition

Finally, given the sectoral and functional categorization of activities, spatial classification is divided into two broad categories with some important subcategories. First, an activity can be "local", with two sub-categories: (a) at-home (or the more ambiguous term "on-farm"); and (b) local, away-from-home, with subcategories of (i) countryside or strictly rural, (ii) nearby rural town, and (iii) intermediate city. Second, an activity can be "distant, away-from-home" (or the simpler but sometimes ambiguous term, "migratory"), with subcategories: (a) domestic rural (e.g. inter-zone migration), (b) domestic urban (such as to a distant metropolitan area), and (c) foreign (Barrett *et al.*, 2001).

¹ The primary sector activities are production processes that produce raw agricultural food products with one of the production factors being natural resources (land, rivers/lakes/ocean, air). The process can involve "growing" (cropping, aquiculture, livestock husbandry, woodlot production) or "gathering" (hunting, fishing, forestry).

² The secondary sector activities are production processes that use raw physical intermediate inputs (such as maize, milk, iron, wood) and process them into manufactured goods (such as maize flour, cheese, pails, furniture).

³ The tertiary sector activities are production processes that produce services (transport, commerce, banking, and so on) using physical capital and labour.

5. Study Areas and Methodology of the study

The areas selected for the study are four villages from three Sub Zones in Central Zone, one of the six Zones that comprise the country. The choice of the Zone was purposive; because the research design took into account the time and finance constraints. The unit of observation (unit of analysis) is a rural household. According to Ellis (1992) a household is a social unit defined by the sharing of the same abode or hearth. As such it is eventually a sub set of the family, through the extent to which families may be split up among separate households again varies across different societies.

In order to develop an unbiased and representative sampling frame for this scope, the survey design used a multi-stage sampling procedure at different levels of sampling to capture the advantages of these designs, and also because a sampling frame at the household level did not exist for the study areas. A list of 81 villages and other additional information for the three Sub Zones was available from the Administration of Central Zone. The Sub Zones were used as first stage sampling units.

In a second stage, the four villages were selected randomly from the three Sub Zones selected earlier. All the villages had administrative records of households, but their accuracy varied greatly as they were prepared for different purposes. Therefore, rather than using the existing administrative records, the preparation of a fresh list was considered essential. In the third stage, a list of all households in a selected village was generated by visiting all residential places. This was done by the enumerators through a Household Listing Schedule developed for this purpose and the total number of households listed was 5,253. To ensure that households from the entire list can be drawn, sampling interval and a random start was calculated. Following this procedure, 202 households were randomly selected out of the four villages.

5.1 Dependent and Independent variables

The dependent variables measure participation. The independent variables show individual, household and location characteristics. Each empirical variable is linked to the categories of variables described in the conceptual framework.

5.1.1 Measurement of Dependent variables

The dependent variables on participation are categorized as: agricultural self-employment (crop production and livestock production), agricultural wage-employment, non-agricultural self-employment, non-agricultural wage-employment and off-farm activities. All of these variables measure the probability that a given household participates in an activity (a dummy variable) which take the value one if the household participates in the activity and zero if the household does not participate in that activity.

5.1.2 Measurement of the Independent variables

The study considers a set of explanatory variables that corresponds to the conceptual framework. In the econometric models various proxies for the capital endowment as well as for the external factors are utilized. We follow the differentiation in internal and external factors.

5.1.2.1 Internal factors

Following the conceptual framework, internal factors includes physical, human and social capital. Physical capital is composed of land, livestock, and other physical assets which are owned by the household. The categories land and livestock include productive assets. Landholding is measured as the total area of land owned by the household, in tsmidi (local measurement, where one tsmidi = 0.25 hectare) and it includes rain-fed and irrigated lands. As households own different types of animals it is necessary to use a conversion factor to calculate a single indicator for livestock ownership¹.

In order to analyze the determinants of household's participation in various income generating activities, a set of variables at the individual (head of household) level and household level are considered under the category human capital. These include: age of head of household, level of education of head of household, average education of household members, dependency ratio, number of dependents and adult members. The variable age of head of household is modelled quadratically to show the marginal rate of return of having additional years of age and how it affects activity participations. The variable sex of head of household describes whether the

¹ Using FAO (1984) livestock conversion factors: One tropical livestock unit (TLU) is equal to a standard Zebu Bovine of 250Kg live weight.

household is male headed or not (dummy). The years in school of head of household and average education of household members are calculated based on the level of schooling of the individual household members. The dependency ratio is the number of household members below 15 and above 65 years old divided by the number of adult household members. Lastly, the number of adults in the household takes into account all adult individuals in the household 15-65 years old who are considered to be part of the economically active population.

Social capital index of a household was calculated by multiplying the number of memberships in organizations by the so-called decision making index. The number of memberships measures the density of membership and includes all kinds of groupings and memberships of all household members. Respondents were asked to evaluate subjectively whether they were “very active”, “somewhat active” or “not very active” in the decision making process of the group. The response was scaled from 2 (“very active”) to 0 (“not very active”), respectively, and averaged across the number of organizations regarded as important by the household. Multiplying it by 50, this figure was re-scaled from 0 to 100 to form the decision making index. Moreover, they were asked to name up to two most important associations they were members of (Grootaert, 1999).

5.1.2.2 External factors

In the questionnaire the households were asked detailed questions about the different types of accesses to formal and informal credits. Participation in formal credit is measured by a dummy variable which takes the value of one for participants and zero for non participants.

The distance to the nearest tarmac road is used as a proxy for access to the market. Each respondent was asked to estimate how many hours he/she needs to get to the nearest tarmac road on foot.

The number of crop failures in the last five years for a particular household was used as a proxy measure for low agricultural productivity (risk) the household may have possibly suffered.

6. Participation in income activities

Participation in an income activity is measured by a binary variable which takes the value of zero if the household does not participate in an activity and one if the household participates in an activity (i.e., if the household earns income from that activity). The interest is how the vector of explanatory variables X_i influences the possibility that the binary dependent variable Y takes on the value 1. The binary response probit model can be written as:

$$P_i = P(Y=1|x) = F(\beta X)$$

where $P(Y=1|x)$, is the probability that an event occurs given the values of the explanatory variables, $F(\beta X)$ is the standard normal density distribution and β the vector of coefficients, which is estimated by Maximum Likelihood Estimation (MLE).

Interpretations of the coefficient values β_i is complicated by the fact that estimated coefficients from a binary (probit) model cannot be interpreted as the marginal effect on the dependent variable (QMS, 2005). When estimating probit models it is important to have a sufficient mix of ones and zeros on your dependent variable. In general, there has to be at least K of each value, where K is the number of independent variables (Schwarze, 2004). As this requirement is not fulfilled for the variable measuring participation in agricultural self-employment (crop production), it was dropped from the analysis of activity participation.

6.1 Empirical Result (Participation in income activities)

In the analysis of participation in income activities, five different income sources are identified: participations in (agricultural wage-employment, non-agricultural wage-employment, non-agricultural self-employment, both self and wage-employment (off-farm) and agricultural self-employment (livestock production)) which are important for rural households in the research area. Five different binary probit models are estimated by Maximum Likelihood Estimation (MLE) using SATA 9 statistical package. The percentage of correctly predicted observations is on average 79.80. This value ranges from 74.75% correctly predicted observations in the non-agricultural wage-employment and livestock production models to 83.66% in the wage and self-employment (off-farm) activities. Table 2 presents the regression results, and coefficients with a significance level greater than 90% in bold. As discussed above the coefficients of probit estimation results cannot be interpreted as the marginal effect of explanatory variables. Therefore, the marginal effects that represent estimated percentage

point change in participation probabilities associated with an infinitesimal change in each independent, continuous variable and the discrete change in the probability for dummy variables is presented in Table 3.

Looking at the overall level of significance of the model, all the regressors have a significant impact on the decision to participate in activity incomes, Wald-test, the equivalent of F-test in linear regression is used. The null hypothesis is: all slope coefficients are simultaneously equal to zero ($H_0: \beta_i=0$). The decision rule is: if the p value of Wald statistic is smaller than the chosen level of significance, say at 5%, the null hypothesis is rejected. In this study, the null hypothesis of all equations is rejected at 5%.

Theoretically, the possession of land has positive influence on participation of crop production. But the estimation of participation in crop production is not done here, because of less variability of the dependent variable. But an additional tsmdi of rain-fed land decreases the probability of participation in agricultural wage-employment by 7.95% and increases the probability of participation in non-agricultural self-employment and off-farm by 7.90% and 3.49% respectively where the former relationship is statistically significant but not the later. This suggests that non-agricultural self-employment is perceived as a complementary to cultivation (large agricultural land owners are more likely to engage in non-agricultural self-employment than the small agricultural land owners).

The possession of livestock positively influences participation in livestock production. However, the overall effect is insignificant. An additional livestock unit owned increases the likelihood of participation by only 0.62%. However, an additional livestock unit decreases the probability of participation in non-agricultural self-employment by 4.9% which is statistically significant.

Turning to household characteristics, sex of HoH (Male=1), age of HoH, Age of HoH squared (HoH^2), year of schooling of HoH, adult members, dependency ratio, number of dependents, average education of HH members are considered for analysis. Sex of head of the household encourages participation in non-agricultural wage-employment and the probability of participation is 32.31% higher for male headed households which is statistically significant, and it also increases the probability of participation in livestock production but it is statistically insignificant. The effect of sex of head of household in the probability of participation in non-agricultural self-employment and off-farm is negative and the probabilities of participation decreases by 22.54% and 8.04% for male headed households respectively which are statistically significant; whereas the effect of sex of head of household on participation in agricultural wage-employment is negative and statistically insignificant.

The effect of age of head of household on probability of participation in all the activities is positive and statistically significant except for participations in non-agricultural wage-employment and livestock production. The quadratic variable of age of head of household (Age of HoH^2) shows the marginal rate of return of household head's age on the dependent variables. The quadratic life cycle effect on probability of participation in the activities is as expected: at young ages, the level of participation increase with age but it decreases as age increase further. The result of the econometric findings shows that the age of HoH has an inverted U-shaped effect which is statistically significant in agricultural wage-employment, non-agricultural self-employment, off-farm and livestock production.

Table 2: Probit estimation of Activity participation

Variables	Agricultural wage employment		Non-agricultural wage employment		Non-agricultural self-employment		Both wage and self employment (off-farm)		Agricultural self employment (Livestock)	
	Coefficient	Z-Statistic	Coefficient	Z-Statistic	Coefficient	Z-Statistic	Coefficient	Z-Statistic	Coefficient	Z-Statistic
Constant	-7.483841	-3.63	-4.776346	-2.89	-8.197935	-3.63	-9.047523	-3.73	1.393572	0.87
Rain-fed area owned	-0.284034	-2.76**	0.089375	0.98	0.348278	3.54**	0.179011	1.55	-0.081729	-0.87
Irrigated area owned	-0.237069	-0.49	0.078166	0.17	-0.585488	-1.10	-0.8044	-1.35	-0.421393	-1.00
Possession of Livestock	0.04574	0.56	-0.069512	-0.84	-0.215715	-2.33**	-0.107253	-1.20	0.039527	0.41
Sex of HoH	-0.408973	-1.42	0.96582	3.31**	-0.847829	-2.96**	-0.458817	-1.47	0.468687	1.36
Age of HoH	0.225339	2.88**	0.077025	1.22	0.126968	1.59	0.19475	2.52**	0.10113	1.60
Age of HoH ²	-0.00238	-3.20	-0.00058	-1.01	-0.001287	-1.68*	-0.001676	-2.43**	-0.001118	-1.91*
Year of schooling HoH	-0.050259	-1.24	0.062203	1.51	0.012799	0.30	0.097188	1.48	-0.098472	-2.05**
Average education of HH members	0.187876	2.01**	0.0033	0.04	0.108004	1.08	0.232962	2.09**	-0.242353	-2.42**
Adult members	0.00159	0.01	0.230676	1.80**	0.182741	1.55	0.263009	1.71*	-0.111826	-0.94
Risk	0.421925	4.07**	0.551204	5.70**	-0.159653	-1.74*	0.853654	5.58**	0.033239	0.39
Number of dependents	0.059553	0.43	-0.060571	-0.5	0.037465	0.32	0.239391	1.39	-0.065028	-0.57
Dependency ratio	0.388601	1.28	-0.111472	-0.45	0.500106	2.06**	0.311381	0.85	-0.163515	-0.84
Distance to the market	0.008467	0.63	-0.025636	-2.46**	0.028929	2.46**	-0.002477	-0.17	-0.010083	-0.82
Social capital index	0.001339	0.76	-0.00349	-2.11**	0.00215	1.20	-0.001258	-0.63	0.001045	0.55
Access to formal credit	-0.024757	-0.09	0.047032	0.17	0.291391	0.99	1.062875	3.20**	-0.362973	-1.01
Access to electricity					3.070481	4.52**	-0.713684	-0.83		
Dummy for the village of Hazega	-0.423318	-0.31	1.555392	1.44	-3.869718	-3.13**	-0.062267	-0.04	1.096759	0.88
Dummy for the village of Zigib	-0.615654	-1.50	-0.032319	-0.09	1.684815	2.55**	-1.11418	-1.28	0.130174	0.30
Dummy for the village of Adi-Tsenaf	0.353655	0.35	0.860096	1.00	0.476828	0.48	-0.396542	-0.28	0.247827	0.26
Wald chi2(18)	50.92		67.95		45.76		61.97		32.49	
Prob > chi2	0.0001		0.00		0.0005		0.00		0.0192	
R ²	0.316		0.3213		0.289		0.5244		0.1735	
Log likelihood	-85.751257		-92.836083		-77.0495		-56.71578		-62.49923	
% of correctly predicted	76.73		74.75		79.7		83.66		84.15	
Obs with Dep=0	137		117		154		54		23	
Obs with Dep=1	63		83		46		146		177	

Note: **, * indicates statistical significance at 5% and 10% levels, respectively.

Appendix 3: Marginal effects after Probit Estimation

	Agricultural wage employment		Non Agricultural wage-employment		Non Agricultural self-employment		Both wage and self employment (off-farm)		Agricultural self employment (Livestock)	
	Slope	z-statistic	Slope	z-statistic	Slope	z-statistic	Slope	z-statistic	Slope	z-statistic
Rain-fed area owned	-0.0795	-2.81	0.03348	0.98	0.07906	3.79	0.03491	1.55	-0.0128	-0.86
Irrigated area owned	-0.0664	-0.49	0.02928	0.17	-0.1329	-1.13	-0.1569	-1.39	-0.0662	-0.98
Possession of Livestock	0.01281	0.55	-0.026	-0.83	-0.049	-2.26	-0.0209	-1.26	0.0062	0.4
Sex of HoH*	-0.1218	-1.35	0.32306	3.96	-0.2254	-2.68	-0.0804	-1.79	0.0836	1.22
Age of HoH	0.06309	3.05	0.02885	1.22	0.02882	1.7	0.03798	2.75	0.0159	1.58
Age of HoH 2	-0.0007	-3.42	-0.0002	-1.01	-0.0003	-1.82	-0.0003	-2.58	-0.0002	-1.89
Year of schooling HoH	-0.0141	-1.25	0.0233	1.51	0.00291	0.3	0.01895	1.72	-0.0155	-2.14
Adult members	0.00045	0.01	0.08641	1.78	0.04148	1.49	0.05129	1.65	-0.0176	-0.93
Risk	0.11812	4.16	0.20648	5.61	-0.0362	-1.85	0.16647	6.12	0.0052	0.38
Number of dependents	0.01667	0.43	-0.0227	-0.5	0.0085	0.32	0.04668	1.46	-0.0102	-0.58
Dependency ratio	0.1088	1.28	-0.0418	-0.45	0.11352	2	0.06072	0.83	-0.0257	-0.84
Average education of HH members	0.0526	2.03	0.00124	0.04	0.02452	1.09	0.04543	2.11	-0.038	-2.48
Distance to the nearest tarmac road	0.00237	0.63	-0.0096	-2.46	0.00657	2.72	-0.0005	-0.17	-0.0016	-0.8
Social capital index	0.00038	0.75	-0.0013	-2.1	0.00049	1.24	-0.0003	-0.6	0.0002	0.55
Access to formal credit*	-0.0069	-0.09	0.01771	0.17	0.07263	0.92	0.13874	3.01	-0.0664	-0.86
Access to electricity					0.68247	5.96	-0.141	-0.86		
Dummy for the village of Hazega*	-0.1078	-0.34	0.56304	1.78	-0.4661	-4.31	-0.0124	-0.04	0.1237	1.13
Dummy for the village of Zigib*	-0.1516	-1.75	-0.0121	-0.09	0.501	2.39	-0.283	-1.12	0.0196	0.32
Dummy for the village of Adi-Tsenaf*	0.10607	0.33	0.32988	1.04	0.12197	0.43	-0.0868	-0.26	0.0357	0.28

(*) dy/dx is for discrete change of dummy variable from 0 to 1

The education of the head of household discourages participation in livestock production, holding other variables constant one year increase in the HOH's year of schooling decreases the probability of participation by 1.55% which is statistically significant. Similarly, the effect of education of head of household on probability of

participation in off-farm is positive and statistically significant with a unit increase in education of head of household increase the probability of participation by 1.90% holding the effect of other variables constant.

Additional years of education of all household members (measured by average education of household members) has statistically significant effect on the probability of participation in agricultural wage-employment and off-farm. The relationship between average education of all members of the household and probability of participation in non-agricultural wage-employment as well as non-agricultural self-employment is positive but insignificant. Thus, additional years of schooling make household members more employable (for example, because they would be more knowledgeable of employment opportunities and more adaptable in the range of tasks that they can perform as a hired worker or self-employed). On the other hand, a unit increase in average education of household members has statistically significant and negative effect on probability of participation in livestock production, which decreases by 3.80% holding other variables constant.

An additional adult member in a household contributes significantly to an increased level of participation in non-agricultural wage-employment and off-farm by 8.64% and 5.13% respectively. In Eritrea, for cultural reasons, the family ties are such that the younger adult members of the household provide for and take care of the elderly, and therefore, the elder members of the household probably do not participate intensively in non-agricultural activities. Also, having additional members in the household is viewed as a potential of more opportunities for the generation of income. With regard to the number of dependents in a household, it has no significant effect on probability of participation in any activity. Similarly, a unit increase in the ratio of dependents to working members leads to increased probability of participation in non-agricultural self-employment significantly by 11.35%, while the effects on agricultural wage-employment and off-farm are positive but insignificant. The reason might be, as dependency ratio increases it puts too much pressure on survival strategy of the household, so that members of the household would have to increase their income earning potential.

Social capital which is measured by social capital index leads to lower probability of participation in non-agricultural wage-employment, with a unit increase in the index leading to decrease in participation by 0.13%, and the relationship is statistically significant. Because time and responsibilities required for being involved in meetings and to actively participate in leadership of social organizations can be at odds that stems from villagers' high participation rates in their communal activities. The influence of social capital in probability of participation in off-farm is negative but not statistically significant. In contrast to the above findings, the effect of social capital in probability of participation on agricultural wage-employment, non-agricultural self-employment and livestock production was found to be positive but not statistically significant at 5% and 10% level of significance.

Access to the market and infrastructures, measured by the walking distance to the nearest tarmac road on foot, has the expected effect on participation in almost all activities. The longer a household needs to get to the nearest road, the more likely it will participate in non-agricultural self-employment and agricultural wage-employment. As distance increases the probability of participation in non-agricultural self-employment increases by 0.66% which is significant. This relationship reflects the fact that the rural non-agricultural self-employment sector is dominated by low skilled and traditional activities which are less dependent on large markets serving local markets with few visits to the larger markets. On the other hand, increasing distance reduces the likelihood of participation in non-agricultural wage-employment by 0.96% which is statistically significant. This may be so because the transaction costs are higher for households who have no relatively easier access to markets. Furthermore, Access of the village to electricity has a positive and significant effect on non-agricultural self-employment.

Borrowing money from formal credit organizations plays a role in determining activity participation. It significantly encourages participation in off-farm. When a household receives a loan, the probability of participation in off-farm increase by 13.87%, but its effect on participation in non-agricultural wage-employment and non-agricultural self-employment is positive but insignificant statistically. However, having access to formal credit discourages participation in agricultural wage-employment and livestock production where both effects are statistically insignificant.

Risk measured by number of crop failures in the last 5 years was found to be statistically significant contributor to the probability of participation in diversified economic activities of rural households. Except in non-agricultural self-employment the effect of risk in probability of participation of the activities is positive. A unit increase in risk increases the probability of participation in: agricultural wage-employment by 11.81%, non-agricultural wage-employment by 20.65% and off-farm by 16.65% which are statistically significant.

Finally, a number of regional variables (dummy for the villages) turned out to statistically significantly influence the participation in particular activities. The probability of involvement in non-agricultural self-employment is lower in the village of Hazega relative to Shimanus-Laelay (the reference village) by 46.61%. Whereas the probability of participation in non-agricultural wage-employment is higher in the village of Hazega by 31.85% and 56.30% respectively compared to the control variable (the village of Shimangus Laelay). On the other hand, the dummy for the village of Zigib contributes positively to probability of participation in non-agricultural self-employment and negatively to probability of participation in agricultural wage-employment by 50.10% and 15.16% respectively. All these relationships are statistically significant, which indicate the existence of certain regional factors that are not controlled for in the regression models.

7. Conclusions and Recommendations

From the findings of the study, the following conclusions can be drawn. The hypothesis that rural households with better access to assets and live in areas with better access to rural infrastructure, tend to participate more in diversified income generating activities can be verified. The likelihood of participation in: (a) agricultural wage-employment increase with age of head of household, risk, average education of household members, (b) non-agricultural wage-employment increases with being male headed households, adult members and risk, (c) non-agricultural self-employment increase with rain-fed area owned, dependency ratio, access to formal credit and longer distance to the market, (d) off-farm activities increase with age of head of household, adult members, risk, average education of household members and access to formal credit, (e) livestock production increase with age of head of household squared, year of schooling of head of household and average education of household members.

Based on the results of the econometric analysis, some policy recommendations may be drawn with respect to activity diversification and rural development which can be helpful in rural poverty reduction.

1. Policies aimed at the rural sector must be oriented toward providing public assets or incentives that stimulate households to participate in rural non-farm activities. Such incentives include public assets like roads, electricity, information and market institutions that enable them to access dynamic markets, as well as the capacity of households to respond to such incentives. Furthermore, the underlying factors that hinders farmers' participation in non-farm activities must be addressed and removed. There are attempts in the region to promote rural non-farm activities in order to provide farm households with alternative income sources and to supplement farm income. For example, public employment schemes such as 'cash for work'¹ have increased rural households' access to off-farm work. However, the efforts are small and insufficient.

2. The study found that participation in formal credit increases probability of participation in off-farm activities. Credit enables households to change their stock in physical capital within a short time to take advantage of income opportunities outside agriculture. Therefore, it is recommended that policy measures to enhance rural credit should be undertaken to improve the participation of households in formal credit with business extension advice, and especially targeted towards the non-agricultural activities.

3. Higher levels of average education of household members is one of the key factors found to be influencing participation in agricultural wage-employment and off-farm activities in the study areas. Likewise, more number of years of schooling of heads of household encourages participation in off-farm activities. Therefore, at the policy level, major attention should be given to improve access to education and the establishment of training centers to tackle skill barriers to facilitate diversification of activities. To this end, establishment of vocational trainings in the rural areas of the country is recommended.

4. While an expansion of non-farm activities is desirable, the evidence suggests the possibility of limited access for a large fraction of the rural population, especially women. Women headed households participate, to a considerable extent in non-agricultural self-employment. However, it appears that they are poorly placed vis-à-vis their participation in non-agricultural wage-employment compared to their male headed counterparts. Similarly, as the heads of households get older their participation in all activities decrease. This applies to both poor male and female headed households. So poverty reduction-focused rural non-farm promotion policies need to focus on activities, which are accessible to women headed households and the aged.

¹ Instead of food for work program which is practiced in many Sub Saharan Africa, Eritrea follows cash for work.

5. Local administrations and institutions should play an important role in promoting and relaxing some of the barriers to entry to non-farm activities as they control or participate in: land use planning decisions, part of educational system, labor training, certain levels of investment in public infrastructure works, the awarding of permits and licenses for the establishment of non-farm rural based business, assigning resources to rural development projects and so on, which are frequently powerful barriers to entry for non-farm activities.

Reference:

- Barrett, C. B. and Reardon, T. 2000. *Asset, Activity, Income Diversification Among African Agriculturists: Some Practical Issues*. Project report to the USAID BASIS CRSP.
- Barrett, C.B., Reardon, T. and Webb, P.2001. Non-farm income diversification and household livelihood strategies in Rural Africa: Concepts, dynamics, and Policy implications. *Food Policy*, 26: 315-331.
- CARE, WFP and ERREC.2003. Eritrea Rural Livelihood Security Assessment: Report of the findings. Asmara,Eritrea.
- Davis, J.R. and Bezemer, D.2004.*The Development of the Rural Non-Farm Economy in Developing Countries and Transition Economies: Key Emerging and Conceptual Issues*. Chatham, UK: National Resource Institute.
- Dutta, S.2004. *Rural Industrial Entrepreneurship: The Case of Bardhaman District in West Bengal*. Wageningen University. Ph.D-Thesis.
- Ellis, F.1992. *Peasant Economics: Farm households and agrarian development*. Cambridge University Press. Cambridge.
- _____.1998. Household Strategies and Rural Livelihood diversification'. *The Journal of Development Studies*, 35(1): 1-38.
- _____.2000a. *Rural Livelihoods and Diversity in Developing Countries*. Oxford: Oxford University Press.
- Escobal, J.2001. The Determinants of Non-Farm Income Diversification in Rural Peru. *World Development*, 29(3): 497-508.
- Food and Agricultural Organization (FAO).1998. *Rural Non-farm Income in Developing Countries, Part III of the state of food and Agriculture*. FAO: Rome. Available at:
<http://www.fao.org/docrep/w9500e/w9500e12.htm> [28/09/2006]
- Haggblade, S., Hazell, P. and Brown, J. 1989. Farm-NonFarm Linkages in Rural Sub Saharan Africa. *World Development*, 17(8): 1173-1201.
- International Labour Organization (ILO).1983. *Promotion of Employment and Income for Rural Poor Including Rural Women, Trough Non-Farm Activities*. Geneva. International Labour Office.
- Mehta, G. S.2002. *Non-Farm Economy and Rural Development*. GIRI Institute of Development Studies.
- Quantitative Micro Software (QMS).2005. *EViews 5.1User's Guide*. Quantitative Micro Software, LLC. United States of America
- Reardon, T. and Vosti, S.A.1995.Links Between Rural Poverly and the Environment in Developing Countries: Asset Categories and Investment Poverty. *World Development*, 23(9): 1495-1506.
- Reardon, T.1997.Using Evidence of Household Income Diversification to Inform Study of the Rural Non-farm Labour Market in Africa .*World Development*, 25(5): 135-74.

- Schwarze, S.2004. Determinants of Income Generating Activities of Rural Households: A Quantitative Study in the Vicinity of the Lore-Lindu National Park in Central Sulawesi/Indonesia. Göttingen University. Ph.D Thesis.
- Smith, D. R., Gordon, A., Meadows, K. and Zwick, K.2001. Livelihood diversification in Uganda: patterns and determinants of change across two rural districts. *Food Policy*, 26: 421-435.
- Start, D.2001. The Rise and Fall of the Rural non-farm Economy: Poverty impacts and Policy options. *Development Policy Review*, 19(4): 491-505.

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