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Factors Affecting Rural Households Participation in Off/Non-Farm Activities in Sinana District, West-Bale–Zone, Ethiopia

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Abstract: The main objective of this study was to identify the main factors affecting participation in off/non-farm activities in Sinana district, West Bale zone, Ethiopia. Off/non - farm income-generating activities play an important role to supplement income from agriculture. For this study, data were collected from 423 smallholder farmers in Sinana district. The study combined quantitative and qualitative data obtained from desk assessments, focus group discussions and an in-depth interview. Descriptive statistics and econometric models were used to analyze the data. Descriptive methods such as mean, percentage and frequency were used. Both Logistic and probit models were fitted to the data. Logistic regression had lower AIC and BIC. The lower the value of AIC and BIC, the better the model goodness of fit. Therefore, the logistic model is preferred in this study. The results of the logistic regression model showed that the education attainment of the household head, landholding size, credit, frequency of agricultural extension visits, distance to nearby town, cell phone ownership, number of oxen, membership to 'equb', crop insect attach and disease invasion were statistically and significantly affected participation in off/non-farm activities. Therefore, strengthening existing agricultural extension services, disseminating information on available jobs, providing loans and developing infrastructure are key areas to be considered.

Keywords: Participation in Off/Non–farm Activities, Logistic Regression, Ethiopia

1. Introduction

Ethiopia is the second-largest country in Africa after Nigeria, with 115 million populations (in 2020) and the fastest growing economy in the region. From 2015/16 to 2019/20, the economy grew at an average annual rate of 8.2% [13] and with a gross national income per capita of $890 [16]. Agriculture was the main driver of the economy during this period and it remained the largest employment sector in 2019 with 69% of the workforce working in agriculture, 21% in services and 10% in industry [7].

About 66% of Ethiopia's land is identified as having potential for agricultural development. The country's ability to cope with poverty, food insecurity and various economic crises is highly dependent on the performance of the agricultural sector [7]. Off-farm and/or non-farm employment has become a survival strategy for many rural households in Ethiopia. Historical experience from developed countries shows that workers move from agriculture to more productive non-farm sectors as economic growth accelerates [7].

In Ethiopia, off/non-farm activities are closely related to agricultural activities. Participation in off /non-farm activities are usually higher during crop failure. According to [10], the participation rate of rural households in off/non-farm activities in Ethiopia is 34%. Despite the growing importance of off-farm and non-farm activities in addressing poverty, little is known about participation in off/non-farm activities in Ethiopia. Therefore, the main objective of this study was to determine the factors influencing participation in off-farm/non-farm activities in the Sinana district of the West Bale Zone, Oromia region, Ethiopia.

2. Literature Review

2.1. Definitions

The rural economy is not only based on agriculture but also

on many different factors and businesses. Farming is still important but rural people are looking for various opportunities to increase and sustain their income. Many people use non-farm, off-farm and agricultural activities interchangeably. Their definition is given as follows.

According to Ellis, Frank., the term off-farm refers to income from income or exchange of work on other people's farms [8]. It includes labor payments in the form of harvesting schemes, and income from natural resources such as wood, coal, building materials, and wild plants. On the other hand, non-farm income refers to non-agricultural sources of income and this includes non-farm income or rental employment, self-employment in non-agricultural rural areas, rural income from renting land or property, and city to rural areas. Remittances from within national borders, as well as other city transfers to rural areas such as pension payments to retirees and exports from cross-border borders and migration.

Generally, non-farm activities are all activities performed by agricultural families outside of their farms.

2.2. The Role of Non-farm and Income-Sharing Activities

The off/non-farm income of farmers has become an integral part of the livelihood strategies of rural households in many developing countries. It generates income for farmers. This allows farmers to invest and raise funds. Farmers with other strong off/non-farm income sources will invest in tools and equipment needed for their main farming activities.

In Israel, using panel data, [4] found that participation in off/non-farm activities led to increased farmer investment up to the middle Ages. After about 45 years, farmers are no longer sensitive to off/non-farm work In Ethiopia, farmers are often unemployed during the downturn of the crop and Off/non-farm employment allows them to increase their income steadily throughout the year.

Money earned from failure period can be used to purchase farm inputs. This corresponds to their financial needs during the rainy season. It also helps them reduce shock naturally. Sometimes the rain comes too late. This can greatly affect their crop production. With the slow development of crop insurance in Ethiopia, off/non-farm income compensates farmers for unexpected shocks. The findings of [12] showed that rainfall availability increases agricultural activities leading to lower levels of participation in off/non-farmer activities, while changes in rainfall lead to increased off/non-farm activities participation. This implies that households use off-farm employment as a means of coping with climate shocks.

3. Methodology

3.1. Overview of the Study Area

The study area, Sinana District, is located in west Bale zone about 412 km southwest of Addis Ababa, the capital city of Ethiopia. Sinana is located between 6° 55’ 00” to 7° 18’ 00 N longitude and 39° 53’ 00” to 40° 26’ 00” East latitude. The total area of the District is about 1168km^2. The administrative center of the District is Robe town and District has 20 rural Kebeles. The total population of the District is 164,124 of which 86,324 are males and 77,800 are females [6]. Agriculture is the largest source of income in the Sinana district. The type of agriculture within the community includes animal rearing and production of different crops such as wheat, barley, maize, bean, field pea, potato, and teff.

The presence of the Sinana Agricultural Research Centre (SARC) and Oromia Seed Enterprise provides good opportunities for farmers in the study area to have access to enhanced agricultural technologies.

In this study, both primary and secondary data were collected. Primary data were collected through in-depth interviews, focus group discussions and semi-structured questionnaires using face-to-face interviews with sample household heads. Secondary data were collected from published as well as unpublished literature.

Household heads from a representative sample were selected using a multi-step technique. In the first stage, Sinana district was selected based on availability and potential of off/non-farm activities. In stage two, out of 20 Kebeles in the district, four Kebeles were chosen. In consequence, Hora Boka, Alage, Sanbitu and Selka were sampled. Third, a simple random sampling technique was used to select a sample of respondents from each kebele. Sample sizes were determined for each kebele relative to the total number of farm households.

Sample size is usually determined by considering the accuracy, reliability and variability of the measured attributes. It is usually calculated using statistics. The desired sample size for this study was determined in accordance with [11] by:

$$n = \frac{Z^2 \times P(1-P)}{e^2} = \frac{1.96^2(0.5)(0.5)}{0.05^2} = 384$$

Where, n - desired sample size.

Z - Values of standard variate at 95% confidence interval (Z = 1.96) and to be worked out from table showing area under normal curve.

P - The estimated proportion of households participating in non/off-farm activities.

e = given precision rate or acceptable error.

As the exact proportion of households participating in non/off-farm activities, p is not known a priori. P= 0.5 was used to obtain the maximum number of sample households. The formula gives 384 and the researcher added 10% as a reserve for possible errors and omissions thus 423 sample farm households were interviewed to achieve the objectives of the study.

3.2. Method of Data Analysis

The collected raw data were edited and analyzed using appropriate statistical tools such as mean, percentage, frequency and standard deviation to summarize and classify the collected information. Chi-square and t-tests were used to compare participants and non-participants based on various explanatory variables.

In this study, the dependent variable is a binary choice, whether the household is a participant (Y = 1) or not (Y = 0). It is believed that a combination of factors such as sex, age, family size, education level of the household head, landholding, frequency of extension contact, etc. being in the vector Xi affects the probability of being in either group.

Following Gujarati, D., the mathematical expression of the logit regression model is $\ln(\frac{p}{1-p}) = \beta_0 + \beta_i X_i$ this is the log (adds) of success [9]. Therefore, if we know the regression equation, we could, theoretically, calculate the expected probability that Y = 1 for a given value of X. Therefore, the probability of participation in non/off-farm income activities at a given value of Xi can be calculated from $p = \frac{e^{\beta_0+\beta_i X_i}}{1+e^{\beta_0+\beta_i X_i}}$ Then

$$\ln(\frac{p}{1-p}) = \ln[\frac{\frac{e^{\beta_0+\beta_i X_i}}{1+e^{\beta_0+\beta_i X_i}}}{1-\frac{e^{\beta_0+\beta_i X_i}}{1+e^{\beta_0+\beta_i X_i}}}] = \ln[\frac{\frac{e^{\beta_0+\beta_i X_i}}{1+e^{\beta_0+\beta_i X_i}}}{\frac{1+e^{\beta_0+\beta_i X_i}-e^{\beta_0+\beta_i X_i}}{1+e^{\beta_0+\beta_i X_i}}}] = \ln[\frac{\frac{e^{\beta_0+\beta_i X_i}}{1+e^{\beta_0+\beta_i X_i}}}{\frac{1}{1+e^{\beta_0+\beta_i X_i}}}] = \ln e^{\beta_0+\beta_i X_i} = \beta_0 + \beta_i X_i$$

Unlike the standard regression analysis, the parameter value ( ) is not directly interpretable as the effect of a change in the explanatory variable on the mean or expected value of the dependent variable. The coefficients need to be adjusted to be marginal effects in the case of logit model. In other words, the marginal effect, which gives the partial derivatives indicating the change in the probability of the dependent variable relative to a unit change in one of the independent variables, needs to be computed.

4. Results and Discussions

The comparison of mean values of participating households versus nonparticipating households for the model's continuous variables is shown in Table 1. The results of the survey showed that the education level of household head, the number of extension visits per year, the distance to the neighboring town in kilometers and the number of oxen owned differed significantly on average. As indicated by the t-value, on average, the significance of the t-value suggests that participating households are better educated, visit development agents more, own fewer oxen, and live closer to towns.

Table 2 below provides descriptive statistics and dummy variables used in the model. Accordingly, the chi-squared results show that access to credit, mobile phone ownership and participation in farmer training at FTC, membership to equb and crop diseases are significantly associated with participation in off-farm/non-farm income-generating activities.

Table 1. *Descriptive statistics of continuous variables.*

Independent variables	Non-participant (n1=318)	Participants (n2=105)	St Err	t value
Education	4.14	6.53	0.371	-6.45***
Family size	5.92	5.71	0.255	0.8
Age of household head	42.21	42.47	1.421	-0.2
Landholding	1.23	1.37	0.084	-1.6
Extension visit	7.61	13.06	1.201	-4.55***
distance to a nearby town	6.19	3.39	0.577	4.85***
oxen owned	1.67	1.31	0.119	3.1***

Note: *** shows that the variable is statistically significant at 1%
Source: computed from Survey data (2022).

Table 2. *Descriptive statistics of dummy variables used in the models.*

Variables	Category	Participation in Non/off-farm income activities			Pearson Chi2
		Non-participant	participant	Total	
Sex of household head	male	305 (76%.06)	96 (23.94%)	401 (100%)	3.22*
	female	13 (59.09%)	9 (40.91%)	22 (100%)	
	Total	318 (75.18%)	105 (24.82%)	423 (100%)	
received credit in the last cropping season	no	242 (84.62%)	44 (15.38%)	286 (100%)	42.15***
	yes	76 (55.47)	61 (44.53)	137 (100%)	
	Total	318 (75.18%)	105 (24.82)	423 (100%)	
Cellphone ownership	no	144 (90%)	16 (10%)	160 (100%)	30.30***
	yes	174 (66.16%)	89 (33.84%)	263 (100%)	
	Total	318 (75.18%)	105 (24.82%)	423 (100%)	
Participation in training	no	130 (89.04%)	16 (10.96%)	146 (100%)	22.96***
	yes	188 (67.87%)	89 (32.13%)	277 (100%)	
	Total	318 (75.18%)	105 (24.82%)	423 (100%)	
Membership to equb	no	283 (82.99%)	58 (17.01%)	341 (100%)	57.55***
	yes	35 (42.68%)	47 (57.32%)	82 (100%)	
	Total	318 (75.18%)	105 (24.82%)	423 (100%)	

Variables	Category	Participation in Non/off-farm income activities			Pearson Chi2
		Non-participant	participant	Total	
Crop diseases	no	189 (90.43%)	20 (9.57%0	209 (100%)	51.51***
	yes	129 (60.28%)	85 (39.72%)	214 (100%)	
	Total	318 (75.18%)	105 (24.82)	423 (100%)	

Note: *, *** shows that the chi-square is significant at 10% and 1%, respectively.
Source: computed from Survey data (2022).

4.1. Logistic Regression Results

Estimates of logistics regression and probit regression models are presented in Table 3. In general, the logit regression model fits the data well. The goodness of fit test of AIC and BIC gave lower results, and our interpretation is based on the logit model. Wald's chi-squared test (Wald chi2 (13) = 79.9) for logit regression model strongly rejects it. The null hypothesis that there is no explanatory power was rejected and the logit model correctly predicted the observations. The pseudo R-square of the logit regression model is = 0.385. In addition, Multicollinearity test using correlation matrix was reported in Table 5, and confirmed that there is no evidence of a strong correlation between the independent variables. To avoid the problem of variable variance, robust standard errors were reported.

Education level of household head, size of land owned, credit, extension visit, distance to nearby town, cell phone ownership, number of oxen owned, membership to *Equb*, insects attach and crop damage are significant factors influencing involvement in non/off-farm activities.

Table 3. *Econometrics model result.*

Independent variables	Logistic regression model			Probit regression model		
	Coef.	St.Err.	dy/dx	Coef.	St.Err.	dy/dx
Educational attainment of hhh	0.173***	0.049	0.019	0.089***	0.026	0.021
Sex of the household head	0.839	0.577	0.123	0.449	0.323	0.126
Family size in numbers	-0.112*	0.064	-0.013	-0.058	0.036	-0.013
Age of household head in years	0.022*	0.011	0.002	0.013**	0.006	0.003
Landholding size in hectares	0.801***	0.221	0.090	0.422***	0.12	0.099
Received credit(1=yes; 0=no)	0.821***	0.308	0.103	0.446***	0.173	0.113
Number of extension visit per cropping season	0.028**	0.012	0.003	0.015**	0.007	0.003
Distance to a nearby town	-0.095**	0.039	-0.011	-0.046**	0.02	-0.011
Ownership of cellphone(1=yes; 0=no)	1.017***	0.352	0.106	0.55***	0.194	0.121
Number of oxen owned	-0.379**	0.159	-0.043	-0.23***	0.088	-0.053
Participation in training (1=yes; 0=no)	0.599	0.376	0.063	0.27	0.203	0.060
Membership to equb	1.529***	0.34	0.238	.885***	0.193	0.260
Crop infestation with diseases (1=yes; 0=no)	1.393***	0.328	0.160	.768***	0.182	0.179
Constant	-5.463**	0.917		-2.97***	0.48	
Akaike's information criterion and Bayesian information criterion AIC=219.55 & BIC= 376.2				AIC= 323.857& BIC= 380.520		
Number of observation = 423				Number of observation = 423		
Wald chi2(13) = 79.94***				Wald chi2(13) = 100.98***		
Log pseudo likelihood = -145.77				Log pseudo likelihood = -147.93		
Pseudo R^2 = 0.385				Pseudo R^2 = 0.376		

Note: **, *** shows that the chi-square is significant at 5% and 1%, respectively.
Source: computed from Survey data (2022).

4.2. Interpretation of Significant Variables

Number of years of schooling of the household head: This variable has a positive effect on participation in off/non-farm income-generating activities. By the scale of the marginal effect, a one-year increase in school attendance improves participation in off/non-farm activities by 1.9%. This conclusion contradicts [10] and is consistent with [1, 2, 5, 14], who all found that education improves participation in off-farm/non-farm activities. The probable justification is that education helps farmers to acquire non/off –farm related job skills and creates more opportunities for them.

Landholding size in hectares: land is a traditional and essential input in agriculture. The coefficient for land variable is positive. The marginal effect of land size suggests that an extra 1-hectare increase in land ownership improves participation in off-farm activities by 9%. The probable justification is that having more cropland helps to diversify their agricultural activities. This helps them to get more revenue from crop sale. The revenue from such sources can be re-invested in other non/off –farm activities. This finding contracts with the findings of [15] that farm size does not show a significant effect on off-farm participation.

Extension Visit: Contacting agricultural extension workers is

often helpful because it encourages farmers to receive advisory services from them. Farmer training centres were established to demonstrate technology and train farmers to implement specific technologies and practices. When farmers are trained, they will receive agricultural input from the extension program to adopt (buy technology) and practice on their own farm or non-farm business. Therefore, extension services should promote a higher degree of diversification. This variable has a positive coefficient and is significant at the 5% significance level. This shows that when the number of extension visits increases by 1, the probability of participating in off-farm/non-farm activities increases by 0.3%. This result is consistent with [10] who also showed that access to agricultural extension has a positive impact on the participation of rural households in off/non-farm activities. The likely logic is that the staffs of development workers train farmers to obtain better agronomic practices to improve their yields. This ensures food security for farmers and helps them to save more money. Savings encourage investment in non/off-farm activities.

Distance to nearby town: This variable has a negative impact on farmer participation in off/non-farm activities. The justification is that farmers living close to urban areas have better access to off-farm/non-agricultural activities available in the city. This means that households residing in the nearby town/market are more likely to engage in off/non-farm activities. This is due to labour market opportunities and a reduction in travel expenses. The marginal effect of this variable indicates that with increasing distance from neighboring urban areas by 1km, the lower the probability that farmers engage in off-farm/non-farm activities is 1.1%. This result supports the findings of [2, 3].

Mobile phone ownership: Rural areas of Ethiopia are now connected to mobile networks. Access to mobile phones is believed to play an important role in disseminating knowledge and information and enabling farmers to access up-to-date knowledge of jobs available in the town and information on agricultural technology, markets, healthcare and other mobile communication services. Therefore, having mobile phones will improve farmers' access to market information and employment. Therefore, a significant and positive marginal effect of the variable indicates that access to mobile phones increases the probability of engaging in off-farm/non-farm activities by 10.6%. Mobile phone service facilitates access to information about potential business activities. Similar studies show that access to mobile phones increases participation in off-farm/non-farm income-generating activities [1].

Number of oxen owned: Oxen in Ethiopia can be used as traction during land tillage. A pair of oxen is often used during land preparation. The variable has a negative coefficient and is significant at the 5% significance level. The marginal effect of this variable suggests that an increase in the number of oxen by 1 will reduce the probability of participation in non/off-farm activities by 4.3%. The implication is that farmers who own more oxen can produce more crops, increasing the market surplus. The more oxen a farmer owns, the more prestige it shows. This allowed farmers to focus on their crops and livestock and less on finding other off/non-farm jobs. This result keeps the conclusion of [10] that the number of animals raised on the farm has a negative effect on the participation of rural households in non/off-farm activities.

Membership to 'Equb': Equb is a traditional means of savings in Ethiopia and exists entirely outside of the formal financial system. It is a form of revolving savings. The coefficient of the variable is positive and significant at the 1% significance level. The marginal effect of the variable shows that membership of equb increases the rate of participation in off-farm/non-farm activities by 23.8%.

Insects attach and crop diseases: In the study area, income from crops is the main source of income. In response to the shocks associated with insects attach to crops and the infestation of crops by disease, farmers are seeking off/non-farm employment and diversifying their income sources. This variable is significant at the 1% significance level. The results of the marginal effects show that insect attach of crops and destruction of crops by diseases increases participation in off-farm/non-agricultural participation by 16%.

Table 4. *Partial and semi partial correlations of participation in non/off-farm income activities.*

Variables	Partial Corr.	Semi-partial Corr.	Partial Corr.^2	Semi-partial Corr.^2	Significance vale Value
Educational attainment of	0.191	0.155	0.037	0.024	0.000
Sex of the household head	0.074	0.059	0.005	0.003	0.135
Family size in numbers	-0.095	-0.076	0.009	0.006	0.054
Age of household head in years	0.093	0.074	0.009	0.005	0.059
Landholding size in hectares	0.194	0.157	0.038	0.025	0.000
Received credit (1=yes; 0=no)	0.164	0.132	0.027	0.017	0.001
extension visits	0.106	0.084	0.011	0.007	0.032
Distance to a nearby town	-0.136	-0.109	0.018	0.012	0.006
Ownership of cell phone	0.123	0.098	0.015	0.010	0.012
Number of oxen owned	-0.098	-0.078	0.010	0.006	0.047
Participation in training	0.077	0.061	0.006	0.004	0.121
Membership to equb	0.244	0.199	0.059	0.040	0.000
Crop diseases	0.224	0.182	0.050	0.033	0.000

Note: *, *** shows that the chi-square is significant at 10% and 1%, respectively.
Source: computed from Survey data (2022).

Table 5. *Matrix of correlations between variables.*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Non/off-farm	1.0													
Education	0.30	1.0												
Sex	0.09	-0.001	1.0											
Family size	-0.04	0.03	-0.05	1.0										
Age	0.01	-0.26	0.002	0.09	1.0									
Landholding	0.08	-0.13	-0.02	0.11	0.12	1.0								
Credit	0.32	0.18	-0.003	0.14	0.01	-0.09	1.0							
extension	0.22	0.19	-0.11	0.02	0.02	-0.02	0.11	1.0						
Distance	-0.23	-0.25	-0.03	0.09	0.19	0.18	-0.13	-0.01	1.0					
cellphone	0.27	0.14	0.03	-0.01	-0.02	-0.04	0.20	0.22	-0.17	1.0				
oxen	-0.15	-0.06	-0.05	0.15	0.08	0.09	-0.07	-0.07	0.12	-0.1	1.00			
training	0.23	0.04	0.06	-0.001	-0.08	0.05	0.13	0.09	-0.01	0.26	-0.02	1.00		
equb	0.37	0.13	0.05	0.05	0.03	-0.10	0.31	0.18	-0.14	0.15	-0.03	0.22	1.0	
Crop diseases	0.35	0.23	0.06	0.02	-0.06	0.02	0.19	0.06	-0.11	0.08	-0.08	0.25	0.16	1.00

Source: computed from Survey data (2022).

The collinearity between variables in the model as observed from the above correlation, we could see that there is no severe collinearity problem.

5. Conclusions and Recommendations

The major objective of this study was to identify the major factors affecting participation in non/off-farm income activities in rural Ethiopia. Samples have been taken from four kebeles in Sinana Districts of West Bale – zone. A simple random sampling method was applied to draw 423 sample household heads. Both descriptive and logistic regression models were applied for data analysis. The results of the logistic regression indicated that Educational attainment of household head, landholding size, credit, extension visit, ownership of cellphone, quantity of oxen owned, membership to equb, insect attach and crop infestation with diseases had been positively and significantly affected participation in off/non-farm activities. On the other hand, number of oxen owned and distance to close by town affected participation in off and non-farm activities negatively. Therefore, strengthening the existing extension services, micro financing, dissemination of information, and infrastructural development are the predominant areas that have to be focused by government and non-governmental institutions.

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