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Does non-farm employment increase rural households’ consumption: Empirical Evidence from West Ethiopia?

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Abstract: In rural areas where the farmer's livelihood is based on farming, non-farm activity was considered as an additional source of income that plays an important role in improving household consumption. The Hackman results indicate that non-farm participation decision of households has positive significant effect on their level of household consumption. Incomes of the household, education level and family size have positive significant effect on household consumption. Variables such as education, access to credit, membership to iquh, household health status, access to training, and own savings, were identified to be the main factors positively influencing household decision to non-farm with a statistical significant level. The study's recommendation was; provide various pieces of farm and non-farm training provide the infrastructure that is a barrier to rural development and develop the culture of saving in the community.

Key words; consumption, impact, rural household, farm

1. Introduction

Agriculture is vital source of income generation for the rural population in Sub-Saharan African countries, and it remains a viable choice for boosting growth, alleviating poverty, and ensuring food security (Abdurezak and Adinan, 2020). However, farming as a primary source of income has failed to provide a sufficient living for farming households in rural areas (Gazuma et al., 2019). This is owing to the region's (Sub-Saharan Africa's) agricultural sector being characterized by drought, erratic rainfall, diminishing per capita land size, low production per hectare, and a high degree of subsistence farming (Iqbal et al., 2017).

Non-farm activity becomes an alternative source of income that increases household consumption. As a result, non-farm activity has the potential to play a key role in the holistic and inclusive development of Ethiopia's rural areas by improving rural household income and increasing household consumption (Apelike et al., 2021). Danso et al. (2020) argues that non-farm participation is a central topic in the improvement of household consumption in rural Ethiopia, given its role in reducing poverty through income generation and, more generally, for ensuring rural household welfare.

Non-farm employment has received a lot of attention in recent literature due to its significant impact on improving rural households' well-being (Drakopoulos and John, 2021 and Tamrat et al., 2020). According to Neglo et al. (2021), non-farm employment activities improve rural household consumption by providing job opportunities to a growing rural labor force that cannot find work in agriculture. On the other hand, non-farm activities may boost income growth and creates improvement of consumption among households (Yenesew et al., 2015). In the absence of credit constraints, non-farm income becomes an important factor in ensuring rural households’ food security (Zewdu and Woldeyohannis, 2021). Non-farm participation can assist in alleviating financial and liquid asset constraints in agriculture while also boosting agricultural competitiveness (Ganamo and Astatike, 2019).

Indeed, empirical research on the impact of non-farm employment on rural household consumption has yielded conflicting results. For example, some authors such as; Alemu et al., (2021); Asfaw, (2022) have found that non-farm employment improves household consumption by using a probit model of qualitative data and household characteristics such as age, gender, educational level, marital status, household size, and landholding size that are statistically significant, and the other researchers like Awoke, (2019); Anteneh and Gazuma, (2019)
have found that non-farm is ineffective to improve household consumption by using a logistic model, and it was discovered that some forms of non-farm jobs reduce household consumption. However, the disparity could be attributable to methodological and variable variances among the disputants.

Non-farm rural income enables families to improve their consumption and spending habits, be more financially stable, and achieve their goals. Poorer farm households that engage in non-farm activities increase their assets, which are needed for children's education, agricultural land ownership, input purchases, and adoption of productivity-enhancing technology, all of which help to increase agricultural production and yields (Ermias, 2019). According to Neglo et al.,(2021), the non-farm sector facilitated upward mobility and increased consumption among low-educated households.

The impact of non-farm activities have usually been viewed as having the ability to increase employment possibilities and increase household consumption(Tamrat et.al, 2020). Non-farm activities provide a significant portion of the revenue and so attract a large rural labor force (Gideon et.al, 2020). According to Gebru et al.,(2018),non-farm income accounts for 35-50 percent of rural family income and 33 percent of rural labor force income in developing countries .According to Kimty,(2015), non-farming is expanding and indicates that it increases food production and farm income. According to Alemu et al.,(2021; Endiris et al.,(2021)),non-farm reduces the income gap between farm and non-farm households and the study by Drakopoulos and John,(2021)and Tshabalala,(2020); indicates that non-farm employment ensures food security and poverty alleviation.

According to Musa and Hiwot,(2017),there is a negative relationship between bigger land-holdings and engagement in non-farm activities .Highlighted access to credit is another proxy for the availability of money, which is recognized to boost income and involvement in non-farm activities(Oladimej et al., 2015). Locations, where non-farm activities are carried out, have a significant impact on non-farm activity participation and success. Anteneh and Gazuma,(2019), discovered a negative relationship between non-farm activity participation and household location. Households in remote rural areas were less likely than those in nearer to urban areas to be employed in the non-farm economy.

A parallel study by Endiris et al.,(2021) discovered that proximity to large cities was an important driver of non-farm income levels in Bangladesh. These studies by researchers revealed that closeness to markets enhances the likelihood of engaging in high-return non-farm activities. The empirical findings emphasize the importance of improving rural household consumption in order to boost growth in high-return wages and self-employment in non-farm businesses.

Considering the issue of these gaps, this study focused on impacts of rural household’s non-farm participation on consumption in the western part of the country in general and in Horo Guduru Wollega zone in particular. Horo Guduru Wollega zone is one of the eighteen administrative zones in Oromiya National Regional State, Ethiopia .The capital of the administrative zone is-Shambu, which is located at 310 km west of Addis Ababa, the capital city of the country. It has twelve administrative districts and one town municipality. The 2018 population projection of the Central Statistical Agency (CSA) of Ethiopia shows that the zone has a total population of 511,737, out of which 50.1 percent are male and 49.9 percent are female. Rural areas are home to approximately 89 percent of the zone's population.

The total area of the Horo Guduru Wollega zone is 712,766.22 hectares. In terms of agro-ecology, the highland comprises 37.9 percent, the mid-highland comprises 54.75 percent, and the lowland comprises 7.86 percent (HGWOARD, 2022). Its rainy season occurs between May and September, and the dry season lasts from October to April. The rainy season in the area actually fluctuates from year to year, but it covers about five month (Endiris et al., 2021).
3.2 Research design

To collect information for this study, a cross-sectional research design was selected for this research in a way that the researcher can describe the current and up-to-date information about consumption expenditure, household characteristics, challenges and opportunities of non-farm from primary data, rather than secondary data, through direct interviews with stakeholders (Heckman et al., 1997). This research design includes both qualitative and quantitative data, which includes the 2021/2022 production year, and was applied to this research work.

3.3 Sources of data and methods of data collection

This study used the data collected from primary sources in Western Ethiopia; empirical evidence from Horo Guduru Wollega zone. To supplement the primary data, secondary data was collected from concerned district offices (like Woreda Agricultural Office, Zonal Agricultural Office, and Central Statistical Authority) and from published and unpublished sources. The data collection for this study was qualitative in nature. Primary data contains detailed information on households’ characteristics, socioeconomic characteristics, demographic characteristics, farm characteristics, agricultural inputs utilization, output produced, and production problems encountered. The data was collected from 383 selected sample farm households using structured and semi-structured questionnaires filled by trained data collectors who are good at local language.

3.3.1 Consent of respondents

Respondents confirm that they have read/heard and understand the information sheet dated for their responses and they understood that their participation was voluntary and free to withdraw at any time without giving any reason when the data was collected. In addition, they also agree that they take part in this study.

3.3.2 Ethical approval

We confirm that all the research meets ethical guidelines and adheres to the legal requirements of Wollega University.

3.4 Sample size determination and sampling procedure

The most commonly used formula for a questionnaire analysis is sample size determination when the population is large and finite according to Kothari, (2004) a representative sample is needed to analyze proportion. According to the study area money and economic cooperative plan office of (2022) data, the total household heads of the study area was 106,038. To determine the sample size the formula was:
Where, \( n \) = the required numbers of sample
\( z \) = the value of the desired confidence level or confidence interval (95\% = 1.96).
The maximum variability among the population \( p = 0.5 \), \( q = 0.5 \) which is equal to \((1 - p)\)
And \( e = \pm 5 \% \) margin of error/precision by looking the expected criteria

When we apply the formula

\[
n = \frac{z^2pqN}{e^2(N-1)+z^2pqN}
\]

Therefore, the required sample sizes of this study were 383 households. But, the question is how can these individuals be selected? These sample sizes were allotted to the three districts based on proportionate sampling method. However, with this method each district was fairly represented, a proportional allocation of the sample was made based on the size of households in each district. This means, sample size was allotted to three woreda (districts) using proportionate stratified sampling formula. Through this formula, each district was fairly represented as follows:

1. Sample size of Horo Woreda = \( \frac{5703 \times 383}{20,318} = 107 \) household heads
2. Sample size of Hababo Guduru Woreda = \( \frac{6728 \times 383}{20,318} = 127 \) household heads
3. Sample size of Amuru Woreda = \( \frac{6436 \times 383}{20,318} = 149 \) household heads

There are 11, 12 and 21 rural kebeles in Horo, Hababo, Guduru, and Amuru districts respectively, and the total kebeles in these three districts is 44. It is possible to allocate the determined sample households to all 44 kebeles. But due to time and budget constraints and for the simplicity of the data, 16 kebeles were determined from all 44 kebeles by convenience sampling based on (Kothari, 2004).

To reduce the biasness of the convenience sampling problem, the selected kebeles were allocated to each woreda proportionately, as 4 kebeles from Horo district, 4 kebeles from Hababo Guduru district, and 8 kebeles from Amuru district. In the third stage, sample households were allocated to each of the selected kebeles proportionately based on the total household number in each sampled kebele. In the fourth stage, a simple random sampling technique was used to select a total of sample households from the list of households in each kebele by using a random number table because all households have an equal chance of being selected. Therefore, this study was based on the use of both probability and non-probability techniques for sampling. The proportionate sample in each kebele was:

\[
n_{ki} = \frac{N_{ki}}{\sum N_k} \times n_k
\]

Where \( i = 1, 2, 3 \ldots \) list of each kebele and \( k \) = represents name of each kebele

\( n_{ki} \) =sample in each kebele

\( N_{ki} \) =total household head number in each kebele

\( \sum N_k \) =Total household head number in given woreda of kebele (total population)

\( n_k \) =total sample of household head in a given district that means 108 from Horo woreda, 127 from Hababo Guduru Woreda and 148 sample from Amuru woreda.

3.5. Methods of data analysis
3.6 Econometric analysis

There are different econometric approaches to the analysis of impact assessment. Some researchers (Tamrat et.al, 2020; Ganamo and Astatike, 2019; Danso et al, 2020) have employed an instrumental variable approach (IV), but this method assumes that the outcome function would differ only by unobservable factors between the participating and non-participating households in the non-farm work, and this model cannot fit to this study. PSM techniques are also another method for the evaluation of impact assessments. The problem with PSM is that there may be data missing problems. In addition, PSM needs a large sample size (more than 500 samples) for quasi-experiment randomizing (Musa and Hiwot, 2017).
A double hurdle econometric model can be used for impact analysis, but this model was designed to deal with survey data that has many zero observations on a continuous dependent variable (EEA, 2021). Double hurdle generalizes the separate Tobit model as the first and second hurdle. As a result, this cannot be chosen for this data. According to Heckman et al. (1997) and Heckman et al. (1998), it is likely that the differences between two individuals, with or without exposure to a programme or technology, maybe more systematic even after conditioning on unobservable or observable factors. So, in this study, a two-stage Heckman regression approach was employed to examine the impacts of rural household’s non-farm participation on consumption expenditure. In the probit model, the inverse standard normal distribution was shown as a linear combination of the predictors. Econometrically, the model can be expressed as:

\[ p_Y(x) = \Phi(x^T \beta) \]  

Where \( p_Y = \) represents the probability, \( \Phi \) denotes the distribution function of the standard normal distribution, and stands for unknown parameters that are estimated by maximum likelihood. Assuming there is an auxiliary random variable, the probit regression can be regarded as a latent variable model:

\[ Y^* = X^T \beta + \epsilon \]  

Where \( \epsilon \sim N(0,1) \), \( Y \) indicates if the latent variable is positive

\[ Y = \begin{cases} 
1 & \text{if } Y^* > 0 \\
0 & \text{otherwise}
\end{cases} \]

By symmetry of the normal distribution, the equivalence of both models above can be presented as follows:

The regression equation on consumption expenditure is:

\[ C_i = X_i \beta + \epsilon_{2i} \]

And the selection equation (non-farm participation equation) is

\[ Z_i \beta + \epsilon_{1i} \]

Where, \( Z_i \) is a latent (unobserved) dichotomous variable equal to 1 if the household head participate in non-farm activities and 0 otherwise.

\( X_i \) = vectors that are assumed to affect rural household consumption such as education, total family size, household disposable income

\( \beta \) = is coefficients of the explanatory variables.

\( \epsilon_{1i} \) and \( \epsilon_{2i} \) are error terms of outcome and selection equations respectively

The inverse mills ratio is calculated from the probit estimation result as follows:

\[ \text{Mill ratios } (\lambda_i) = \frac{F(\chi_1 \beta_1)}{1 - F(\chi_1 \beta_1)} \]

Where \( F(\chi \beta) \) = a density functions

\[ 1 - F(\chi_1 \beta_1) \] = distribution function

This Mills ratio \( (\lambda) \) can be interpreted as the probability of being selected in participation of non-farm activity given that none participants. The OLS regression was then fit alongside the probit estimate in the second stage. The inverse Mill’s ratio is a variable for controlling bias due to sample selection in order to find factors influencing non-farm employment decisions (Heckman, 1979). In the second stage, the Mills ratio is added to household consumption expenditure equation, and the equation is estimated using Ordinary Least Squares (OLS). The second step is to perform an ordinary least squares regression with the inverse Mills ratio as an additional regressor in the consumption expenditure (outcome equation), which is written as follows:

\[ C_i = \gamma_0 + \gamma_1 X_i + \gamma_2 \lambda_i + \epsilon_{1i} + \epsilon_{2i} \sim (0, \delta) \]

\( X_i \) = are variables affecting households’ consumption expenditure such as disposable income, family size and education.

\( C_i = \) Household Consumption expenditure.

The variance of \( \epsilon \) is normalized to one because only \( C_i \), not \( Z_i \) is observed.

\( C_i \) = regressed on the explanatory variables, \( X_i \), \( Z_i \), and the vector of inverse Mills ratios \( \lambda_i \) from the selection equation by ordinary least squares (OLS).
\( \gamma_i \) = coefficients of explanatory variables

\( \epsilon_i \) = residuals in the observation equation that are independently and normally distributed with zero mean and variance.

And \( \epsilon \sim N(0, \delta) \) and \( \epsilon_2 \sim N(0,1) \) and \( \text{corr}(\epsilon_1, \epsilon_2) = \rho \)

4. Results and discussions

4.1 Heckman two step results of the study

Before the model is finalized, the significant variables are analyzed in the model, and all of the predictor variables are validated as statistically independent without co-linearity. The necessary analysis and estimates were carried out using STATA v.15. To avoid inter-variable correlations, the correlation test was used to determine which variables should be included in the model. Two-step Heckman selection regressions were used. The first model was a selection model that determined whether or not non-farm participants participated. The second step looks at the impact of the independent variables on consumption. Each stage has a residual, or a set of unknowns, for each observation. The link between the residuals for the two stages (stages 1 and 2) was evaluated to test for bias. If the unobservable in the selection model is connected with the unobservable in the stage 2 model, there are skewed estimates without adjustment, implying that the unobservable in non-farm selection affects the stage two (consumption) models. If the unobservable in stage 1 are unrelated to the unobservable in stage two, it means that stage 1 has no effect on the results in stage 2. This means that inclusion in the stage 2 sample is a random process unaffected by various observables.

The odds of selection bias are reduced if all of the proper variables are chosen for the models and there are only a few unobservable factors that affect the outcome. If all of the appropriate variables are chosen for the models and there are only a few unobservable elements that affect the outcome, the chances of selection bias are reduced. The best model specification of non-farm engagement and consumption as Heckman selection models is provided in Table 1. When it is positive, the unobservable are favorably associated with one another; when it is negative, the unobservable are negatively connected. The error terms are 0.74, as shown in Table 1, indicating that the unobserved factors that drive non-farm activity/consumption are positively linked with one another. The standard deviation of the consumption error terms is substantial, implying that the heterogeneity is captured in terms of consumption. With values of 300.24, the Wald test reveals that the combined models outperform the standalone probit and linear regression models.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Coef.</th>
<th>St.Err.</th>
<th>t-value</th>
<th>p-value</th>
<th>[95% Conf Interval]</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family size</td>
<td>359.14</td>
<td>201.746</td>
<td>1.78</td>
<td>.075</td>
<td>-36.276 - 754.555</td>
<td>*</td>
</tr>
<tr>
<td>Dis-income</td>
<td>.516</td>
<td>.03</td>
<td>17.03</td>
<td>0.000</td>
<td>.456 - .575</td>
<td>***</td>
</tr>
<tr>
<td>education</td>
<td>391.385</td>
<td>192.913</td>
<td>.042</td>
<td>13.283</td>
<td>769.488</td>
<td>**</td>
</tr>
<tr>
<td>Selection age</td>
<td>-.153</td>
<td>.036</td>
<td>-4.31</td>
<td>0.000</td>
<td>-.223 - .084</td>
<td>***</td>
</tr>
<tr>
<td>education</td>
<td>.996</td>
<td>.052</td>
<td>1.82</td>
<td>.069</td>
<td>-.007 - .198</td>
<td>*</td>
</tr>
<tr>
<td>Member idir</td>
<td>.302</td>
<td>.001</td>
<td>3.22</td>
<td>.001</td>
<td>.38 - 1.563</td>
<td>***</td>
</tr>
<tr>
<td>Total livestock</td>
<td>-.136</td>
<td>.015</td>
<td>-2.72</td>
<td>.007</td>
<td>-.234 - .038</td>
<td>***</td>
</tr>
<tr>
<td>Land size</td>
<td>.24</td>
<td>.146</td>
<td>1.46</td>
<td>.144</td>
<td>-.082 - .562</td>
<td></td>
</tr>
<tr>
<td>Health status</td>
<td>1.982</td>
<td>.497</td>
<td>3.99</td>
<td>.000</td>
<td>1.008 - 2.956</td>
<td>***</td>
</tr>
<tr>
<td>Access train</td>
<td>.533</td>
<td>.282</td>
<td>1.89</td>
<td>.059</td>
<td>-.019 - 1.086</td>
<td></td>
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<tr>
<td>Marital status</td>
<td>1.315</td>
<td>.586</td>
<td>2.25</td>
<td>.025</td>
<td>.167 - 2.463</td>
<td>**</td>
</tr>
<tr>
<td>Dist-market</td>
<td>-.228</td>
<td>.045</td>
<td>-5.11</td>
<td>.000</td>
<td>-.316 - .141</td>
<td>***</td>
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<tr>
<td>Own save</td>
<td>.732</td>
<td>.272</td>
<td>2.69</td>
<td>.007</td>
<td>.199 - 1.264</td>
<td>***</td>
</tr>
<tr>
<td>Member idir</td>
<td>-.364</td>
<td>.383</td>
<td>-0.95</td>
<td>.342</td>
<td>-.114 - .386</td>
<td></td>
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<tr>
<td>Dependent numb</td>
<td>-.145</td>
<td>.065</td>
<td>-2.23</td>
<td>.026</td>
<td>-.273 - .017</td>
<td>**</td>
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<tr>
<td>Gender</td>
<td>-.878</td>
<td>.428</td>
<td>-2.05</td>
<td>.040</td>
<td>-1.718 - .039</td>
<td>**</td>
</tr>
<tr>
<td>Access credit</td>
<td>2.366</td>
<td>.911</td>
<td>2.60</td>
<td>.009</td>
<td>.58 - 4.151</td>
<td>***</td>
</tr>
<tr>
<td>Own mobile</td>
<td>-.1531</td>
<td>.816</td>
<td>-.88</td>
<td>.061</td>
<td>-.3.13 - .068</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>5.725</td>
<td>1.694</td>
<td>3.38</td>
<td>.017</td>
<td>2.405 - 9.045</td>
<td>***</td>
</tr>
</tbody>
</table>
LR test of independent. eqns. (rho = 0): chi2(1) = 2.38  Prob > chi2 = 0.1228
At the 95% confidence level, this means that the two models reject the equation’s independence. The next thing to determine is how to interpret the estimated selection effect. To do this, we compute lambda (mills ration) which is:

$$\lambda = \rho \cdot \mu = 0.32703 \times 7375.809 = 2412.107.$$ 

The interpretation of this is that non-farm participation has an increasing impact on consumption of rural households. Thus, the numerical values suggest that there are positive effects of non-farm on household consumption.

Table 2: Econometric results of Heckman selection model –two-step estimates

| Household Consumption(C)         | Coef.    | Std.err. | z      | p>|z| |
|----------------------------------|----------|----------|--------|-----|
| education                        | 424.4623 | 196.777  | 2.16   | 0.031 |
| Family size                      | 382.4702 | 202.9648 | 1.88   | 0.060 |
| Disposable income                | 0.5161595| 0.0304191| 16.97  | 0.000 |
| cons                             | 2985.34  | 2025.635 | 1.47   | 0.141 |
| **Non-farm participation**       |          |          |        |      |
| Age2                             | -0.1487574| 0.0358392| -4.15  | 0.000 |
| education                        | 0.0900356| 0.0525272| 1.71   | 0.087 |
| Membership of iqub               | 0.9340799| 0.3004393| 3.11   | 0.002 |
| TLU                              | -0.1250547| 0.0494741| -2.53  | 0.011 |
| Household health status          | 2.006476 | 0.5021802| 4.00   | 0.000 |
| Land size                        | 0.2703066| 0.1639709| 1.65   | 0.099 |
| Access to train                  | 0.5949265| 0.2795136| 2.13   | 0.033 |
| Marital status                   | 1.23994  | 0.5853941| 2.12   | 0.034 |
| Distance from market             | -0.2250437| 0.0446165| -5.04  | 0.000 |
| Own saving account               | 0.6902965| 0.2709476| 2.55   | 0.011 |
| Membership of idir               | -0.2794011| 0.3755374| -0.74  | 0.457 |
| Dependent number                 | -0.1474085| 0.0656171| -2.25  | 0.025 |
| gender                           | -0.905108 | 0.4300645| -2.10  | 0.035 |
| Access to credit                 | 2.376215 | 0.9166985| 2.59   | 0.010 |
| Own mobile phone                 | 1.52069  | 0.8180502| 1.86   | 0.063 |
| cons                             | 5.427164 | 1.703591  | 3.19  | 0.001 |
| /mills/lambda                    | 2412.107 | 1770.295  | 1.36  | 0.063 |

rho=0.32703  
Sigma =7375.809  
Number of obs= 383  
Wald chi2= 300.24

1 The LR null hypothesis was H₀=there is selection bias. The result of Hackman selection from table 1 shows that we cannot reject the null hypothesis. The result reveals that the selection equation has positive effect on household consumption. That means:

$$\rho = 0.278033 \times 7301.401 = 2030.034.$$ 

reho (ρ) = 0.2780332 = correlation coefficient between the two error terms  
Sigma (σ) = 7301.401 = standard error of the two dependent variables
## 4.2 Discussion and results

### Education

The evidence from this study suggests that education increases rural household consumption and non-farm participation in a positive way. If the household heads increase their years of education by one year, their consumption increases by 424 units. This shows that education is a tool for improving livelihoods to increase household consumption. This means that as the education of the head of household increases, the decision-making influence of the head of household in non-farm increases or becomes stronger.

### Family size

This variable is significant at 10 per cent and has a positive effect on rural household consumption. A possible reason is that households with larger family sizes tend to have more labor, which is divided into different workplaces such as non-farm and farm with higher income that can improve consumption. Family size also effectively cultivates arable land and increases production. The study reveals that a one unit increase in family size increases consumption by 382.47 units that confirms the study by Gebru et al., (2018).

### Disposable income

This variable is an income generated by the head of household from the sale of farm and non-farm products. The head of the household covers the consumption of every member of the household with this income. Disposable income remains in the pocket of the household head after government taxes are paid, and according to Heckman's results, this disposable income affects consumption in a positive way. This is statistically significant at 1 percent and the interpretation of this is that as disposable income increases by one unit, additional consumption of household (MPC) increases by a proportion of 0.52 units.

### Participation in training

The variable access to training is found to positively affecting non-farm participation at 5 percent level of significance. There are three development agents (one each for crops, livestock, and natural resource management) in each Farmer’s Training Centre. Each development agent is expected to train rural-farmers every year in his or her field of specialization. The rationale behind training farmers is that farmers will be able to acquire skills through training and thus transform themselves from unskilled to skilled farmers. Trainings provided at FTC level includes seeds preparation, land preparation, planting, fertilizer rate and application method, irrigation, disease and pest control, harvesting and post-harvest handling and animal breeding. Since farming is depending on climatic condition, additional non-farm training smallholder farmers are indispensable as it increases the probability of non-farm decision which improves rural household consumption. The interpretation of this data is that if training is given to the head of household from time to time, the decision of the head of household to participate in non-farm will increase and it will play an important role in strengthening household consumption.

### Distance to market area

This variable has a negative and statistically significant effect on participation in non-farming at 1 percent level. This is because farmers who are far from the road/market area are less attracted to non-farm activity as it is costly for the farmers to engage in non-farm activities. Moreover, the farther the farmer away from all-market area, the lesser is his/her profit margin as he/she pays more money for transportation and intermediaries. Hence, non-farm decision of household heads depends on infrastructural development. This result corroborates the findings of Abdurezak and Adinan,(2020) that is based on a study conducted in Eastern Hareruge, Ethiopia.

### Membership to iqub

Farmers who live closer to urban areas can save their money in banks. However, because banks are less accessible in distant rural locations, households save money by using iqub. Iqub, according to Oladimej et al., (2015)and Tshabalala,(2020), is a traditional money-saving system in which a group of people gives cash every predetermined day of the week. It is a classic source of fund raising and/or mobilization. As a savings institution, Iqub combines regular member savings with the delivery of a lump sum to one of the members on a rotating basis. Membership in iqub is determined to be statistically significant at the 10% probability level, supporting the a priori hypothesis. One probable explanation is that farmers typically preserve money in the form of iqub in order to deal with financial hazards. Furthermore, as a social network, iqub plays a role in transmitting accurate information, facilitating information exchange, and facilitating the diffusion of market experiences. The results of this study showed that besides strengthening the culture of saving, becoming a member of iqub strengthens social bonds among people. Additionally, the study found that iqub membership has provided an easy way for the head of the household to start a non-farm with savings accumulated slowly.

### Access to credit

The positive and statistically significant at 1 percent level of significance suggests that this variable has significance effect to improve the likelihood of engagement in non-farming activities. One such argument is that having access to loans is important in the adoption of modern farming technologies. Credit can be utilized as working capital for new businesses as well as to balance out consumption. Farmers, on the other
hand, require finances soon following harvesting for the following farming season. High-yielding variety seeds, fertilizers, and plant protection chemicals are critical to farm output.

Farmers can diversify their farm and non-farm businesses by making new investments or adopting new technology because credit is readily available and accessible. Credit also helps farm households strengthen their ability to withstand risks, which leads to the application of new technologies and the diversification of crop output and revenue sources. The finding is congruent with the findings of (Beyene, 2019), who argue that access to credit is one potential motivator for farmers to participate in non-farming activities. This makes sense because farmers with limited access to credit may be especially sensitive to market volatility and may find greater security in a non-farm setting. Some non-farming also offers farmers the opportunity to get loans in cash and/or in kind, providing an additional incentive for credit-constrained farmers to participate in non-farming.

**Gender:** - The results from second stage estimation indicated that being a female contributed to a decrease in rural household consumption and the result is significant at (P < 0.05). Female-headed households in Ethiopia generally do not have access to higher payoff activities that could enable them to sustain their livelihoods (Alemu et al., 2021). The interpretation of this result is that the societies of the study area are dominated by long-time cultural systems that provide little or no place for women in society and have rural women who cannot inherit because of the interpretation of customary inheritance rules. Typically, these women are "pushed" to negotiate or even pay to access productive resources like land, water, and forest, often owned or controlled by men. A home-based conditional exchange program for women is a successful approach to improving the lives of children and women. According to the findings of this study, the probable causes for women's lower engagement than males may be due to cultural backwardness and men's inferior attitude towards women.

**Landholding:** This is the size of land owned by the household in hectares. Having large farmland is an indicator of wealth and perhaps a proxy for social status and influence non-farm participation. As a result, this variable was found to affect participation in non-farming positively at 1 percent significance level. The implication of this result is that as the size of land increase, wealth of household status increases and this help the heads to increase yield increase. Hence, this helps the head of rural family income increase. Such condition helps the probability of increasing the participation of non-farm activity.

**Household health status:** - This variable was hypothesized to affect non-farm participation in a positive way. According to the Heckman results, this variable affected non-farm participation in a positive way at p= 1 percent statistically significant level. The interpretation of this result is that if the head of household is healthy, he/she can participate in non-farm and increase household consumption, but if the head of household is not healthy, he/she will not participate in non-farm and this will reduce household consumption. The results reveal that household health status plays a significant role in the determination of participation in non-farm.

**TLU:** This variable denotes the total number of livestock owned by the rural household. Cattle had a TLU conversion ratio of 0.7, goats or sheep had a TLU conversion value of 0.1, mules had a TLU conversion factor of 0.7, and horses had a TLU conversion factor of 0.8. After converting total livestock into Tropical Livestock Units (TLU), the Heckman model result shows that the variable has a statistically significant negative influence on non-farm participation at a p-value of 1%. According to the findings, the majority of livestock was viewed as a source of income for households. Households are uninterested in non-farm activities since they spend the majority of their time caring for and protecting animals. As a result, a 1% increase in TLU reduces the likelihood of non-farm participation by 0.12%.

**Marital status:** According to the findings of this study, this characteristic has a beneficial impact on non-farm decision-making. Marriage status has a beneficial effect on non-farm decision-making and is statistically significant at a p-value of 5%. The data suggest that those who are married rather than single are more successful in a non-farm job than those who are single.

**Own savings account:** this variable is one of the benefits of beginning a non-farm business. Savings that are gradually accumulated are critical for strengthening non-farm businesses. The savings account has positive and a statistically significant beneficial effect on non-farm involvement at a p-value of 1%. This means that persons or heads of households who are unable to obtain microfinance or idir loans save in the form of iqub and use the savings as starting capital to start a non-farm. This has effect in increasing household consumption.

**Household Dependent number:** Children who require particular care, the elderly who require care, and people with various illnesses who spend time in bed are all examples of family reliance. As a result, household dependents have a statistically significant negative effect on non-farm involvement at the 5% level of significance. The interpretation is that because the family heads spend so much time caring for these people, they choose not to engage in non-farm activities.

**Membership to idir:** - This variable has a positive effect on non-farm participation; nevertheless, it is not statistically significant. The interpretation of this result is that the objective of idir is to help each other with
social concerns such as days of trouble and happiness, rather than to save money and operate as a source of credit. As a result, iqub membership is insignificant on non-farm involvement.

**Own mobile phone;** Ethiopia's rural areas are now connected to mobile networks. Mobile phone connectivity is thought to play a crucial role in transmitting knowledge and information, allowing farmers to gain up-to-date knowledge of available jobs in town as well as information on agricultural technologies, markets, healthcare, and other mobile communication services. As a result, possessing a cell phone will boost farmers' access to market information and employment opportunities. The variable has a positive effect on non-farm decisions and is statistically significant at a 10 percent level of significance. Access to mobile phones increases the likelihood of engaging in non-farm activities by 1.52 percent. The interpretation is that owning a mobile phone is a benefit for rural households because it serves as a source of current generating information. This confirms the study conducted by (Ermias,(2019) and Zewdu and Woldeyohannis,(2021).

**Fig.2 Conceptual framework of the result**

<table>
<thead>
<tr>
<th>Demographic factor</th>
<th>Institutional factor</th>
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<tbody>
<tr>
<td>Age</td>
<td>Land</td>
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<tr>
<td>Education</td>
<td>Credit</td>
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<tr>
<td>Marital status</td>
<td>Transport</td>
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<td>Health</td>
<td>Electricity</td>
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<td>Training</td>
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<tr>
<th>Economic factor</th>
<th>Improve rural household welfare</th>
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<tbody>
<tr>
<td>Disposable Income</td>
<td>Non-farm participation</td>
</tr>
<tr>
<td>Education</td>
<td></td>
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<tr>
<td>TLU</td>
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Source: (Eshetu & Mekonnen, 2016)

5. Conclusions

The study's finding focused on examining the impact of non-farm participation on household consumption. Variables affecting non-farm activities, such as membership to iqub, age, education, gender, credit availability, size of land holding, TLU, number of household dependents, household health condition, and distance from market area, own saving account are among the highlighted factors affecting non-farm participation. The Heckman two-step results, on the other hand, confirmed that the household head's decision on non-farm work has a positive impact on household consumption. As a result of the study's findings, the following recommendations were made.

According to various data from Danso et al.(2020) and Drakopoulos and Stavros, (2017), the land used for agriculture in rural area is reducing due to population growth. If this trend continues, the most significant issue is that rural household consumption would decline and rural people's livelihoods will deteriorate. This implies that, because agriculture alone cannot supply family consumption, other options, such as non-farming, are required. As a result of the study's findings in the study area, the following recommendation was made: The rural community can only work to support their families and play their part in the national economy if their health is fully maintained. Therefore, the health office should provide training to household heads in the study area on how to prevent diseases in advance. If savings habits are strengthened in rural areas, it will help to solve the problem of credit deficit and help as starting non-farm as starting capital. However, one of the obstacles to iqub savings is that people who save as members stop paying after receiving the money and cause iqub to be dissolved. To minimize the number of people who accept money in iqub and deny it, the traditional court of the Abba Gada should be strengthened in the study area.

- Infrastructure, such as electricity and roads, should be provided by the government.
• Non-farm and farm training should be provided on a regular basis by agricultural professionals in order to improve people's resource usage skills.
• Land property is still held by a small number of people. This means that young graduates who can generate a variety of profits are currently confronted with a variety of issues owing to a lack of land. Accordingly, the land management policy implemented by the government should be reviewed by experts to narrow this land ownership gap.
• To overcome the cash crunch experienced by the head of the home, rural households are doing non-farm work by employing traditional saving methods such as iqub, idir. Although very few people have succeeded in this manner, many family heads are still unable to escape the financial crisis. As a result, the government and non-governmental groups should collaborate to make it easier for rural household heads to obtain loans.

Author’s contribution

Wakuma Dufera Tesgera: Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. Dr. Amsalu Bedemo Beyene: Data curation, Investigation, Writing – original draft, Writing – review & editing. Dr. Temesgen Kebede Wakjira: Data curation, Writing – original draft, Writing – review & editing. Dr. Amsalu Bedemo Beyene: Project administration, Resources, Supervision, Writing – review & editing. Dr. Temesgen Kebede Wakjira: Project administration, Resources, Supervision, Writing – review & editing.

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Statement and Declarations

Competing Interest: not applicable

Data availability: not applicable

Ethical Approval: The authors declare that the study followed Internal Review Boards and guidelines of Wollega University. When applicable, it was with the consent participants of the study and consent to respond the questionnaire of the study.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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Appendix

Heckman’s two-stage procedure is specified as follows:

There are two estimators that can be employed in Hackman two step models. These steps are:

1. Run Probit on the Selection Model
2. Recover Estimated Inverse Mills Ratio. Finally, using Ordinary Least Squares, run the regression.

The first step is the probit model which is expressed as:

\[ p(Y = 1/X) = \Phi(X^T \beta) \]  \[ \text{(A1)} \]

Where \( p \) = represents the probability, \( \Phi \) denotes the distribution function of the standard normal distribution, and stands for unknown parameters that are estimated by maximum likelihood. Assuming there is an auxiliary random variable, the probit regression can be regarded as a latent variable model:

\[ Y^* = X^T \beta + \epsilon \]  \[ \text{(A2)} \]

Where \( Y = 1 \) if the latent variable is positive

\[ Y = \begin{cases} 1 & \text{if } Y^* > 0 \\ 0 & \text{otherwise} \end{cases} < X^T \beta \]  \[ \text{(A3)} \]

And the selection equation (non-farm participation equation) was generalized as:

\[ Y^* = Z_{ij} \gamma + \epsilon_{2j} \]  \[ \text{(A4)} \]

Where

\( Y^* \) is a latent (unobserved) dichotomous variable equal to 1 if the household head participate in non-farm activities and 0 otherwise.

\( Z_{ij} \) = vectors that are assumed to affect non-farm participation such as age, education, land size, iqub, idir, train, distance to market, mobile phone ownership, gender, marital status, TLU, credit, own saving, number of dependent and household health status.

\( \epsilon_{2j} \) = error terms of the selection equations

The second step is the outcome equation (linear) equation that is quantitative model. To estimate the outcome equation which is approximately total household consumption expenditure was developed by linear regression as:

\[ C_j = X_j \beta_i + \epsilon_{1j} \]  \[ \text{(A5)} \]

Where:

\( C \) = total consumption of rural households
\( X_i \) = Factors that affect rural household consumption such as education, family size and disposable income.
\( \beta_i \) = is coefficients of the explanatory variables in outcome equation.

\( \epsilon_{1j} \) = an error terms of outcome equation

The inverse mills ratio for selection equation is calculated from the probit estimation result as follows:

\[ \text{Mill ratios (} \lambda \text{)} = \frac{F(X_i \beta_i)}{1-F(X_i \beta_i)} \]  \[ \text{(A6)} \]

Where \( F (\chi\beta) \) = a density functions

\[ 1-F (\chi\beta) \] = distribution function

The selection equation is estimated by maximum likelihood as an independent probit model to determine the decision to join using information from the whole sample of members and non-members. A vector of inverse Mills ratios (estimated expected error) can be generated from the parameter estimates (Greene, 2002). The level of \( C \), is observed only when the selection equation equals 1 and is then regressed on the explanatory variables, \( X_i \), and the vector of inverse Mills ratios from the selection equation by ordinary least squares. Therefore, the second stage reruns the regression with the estimated expected error included as an extra explanatory variable, removing the part of the error term correlated with the explanatory variable and avoiding the bias. Sample
selection bias has been corrected by the selection equation, which determines whether an observation makes it into the non-random sample. On the other hand, selection bias may not be an issue since some household heads have joined for other reasons besides using advances, such as different alternative farm activities. The existence of selection bias can be investigated by testing against zero the coefficient of the expected error term from performing the Heckman two-stage procedure.

This Mills ratio \( \lambda \) can be interpreted as the probability of being selected in participation of non-farm activity given that none participants. The OLS regression was then fit alongside the probit estimate in the second stage. The inverse Mill's ratio is a variable for controlling bias due to sample selection in order to find factors influencing non-farm employment decisions (Heckman, 1979). In the second stage, the Mills ratio is added to household consumption expenditure equation, and the equation is estimated using Ordinary Least Squares (OLS). The second step is to perform an ordinary least squares regression with the inverse Mills ratio as an additional regressor in the consumption expenditure (outcome equation), which is written as follows:

\[
C_i = \gamma_0 + \gamma_1 X_i + \gamma_2 \lambda_1 + \varepsilon_i \sim (0, \delta)
\]

Where
\[
\lambda_1 = \delta \rho
\]

\( \rho \) = correlation coefficient of error terms between the two equations

\( C_i \) = outcome variable

\( \gamma_0 \) = constant variable

\( \gamma_1 \) = Coefficient of the outcome explanatory variable and

\( \gamma_2 \) = coefficient of inverse mills ratio.

If \( \rho = 0 \), it indicates that there is no selection bias and only OLS is used to estimate an observed variable. But if \( \rho > 0 \), there is selection bias and the estimation is that non-farm activity has a positive effect on rural household’s consumption.