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The relation between farm and non-farm activities among smallholder farmers in Western Ethiopia

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Abstract

As a result of shifting social and economic conditions, smallholder farmers in rural Western Ethiopia are implementing a wide range of livelihood options. In order to understand the patterns, causes, and consequences of these farmers' involvement in both the farm and non-farm sectors, this study delves into the complex interaction between the two. Data was gathered from a statistically valid sample of smallholder households using a mixed-methods strategy that included surveys, interviews, and focus groups. Results show that diversifying one's livelihood is complex and multi-faceted, with agricultural and non-farm activities frequently complementing one another. Household demographics, resource availability, market opportunities, and external shocks are some of the factors that impact the decision to participate in non-farm activities. Income, food security, and general well-being are some of the outcomes that this dual engagement is studied for. In order to alleviate poverty and support sustainable rural livelihoods in Western Ethiopia, it is essential for development practitioners and policymakers to have a deep understanding of the dynamics of farm-non-farm linkages.

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INTRODUCTION

The study of the relationship between farm and non-farm activities among smallholder farmers in Western Ethiopia encompasses a multidisciplinary approach, drawing from fields such as agricultural economics, rural sociology, development studies, and geography (Abdu & Adem, 2021; Abera et al., 2021; Adem Endiris, 2021). This research explores the intricate dynamics and interactions between agricultural production and non-farm activities within the context of smallholder farming systems prevalent in the region. Contextualizing Western Ethiopia is essential for analyzing the dynamics of farm and non-farm activities. This region is characterized by diverse agroecological zones, including highlands, midlands, and lowlands, each with distinct agricultural practices, natural resource endowments, and market access (Adem Endiris, 2021; Adem et al., 2018; Ademe Ayalew & Mohanty, 2022). Smallholder farmers form the backbone of agricultural

production in Western Ethiopia, typically operating on small plots of land with limited access to resources such as capital, technology, and markets (Adera & Abdisa, 2023). Their livelihood strategies often involve a mix of farming and non-farm activities to diversify income sources, mitigate risks, and enhance household resilience.

Farm-based activities primarily involve crop cultivation and livestock rearing, which serve as the main sources of food and income for rural households (Alesane et al., 2019; Anang and Apedo, 2023; Anang & Apedo, 2023; Ankrah Twumasi et al., 2023). Smallholder farmers in Western Ethiopia cultivate a variety of crops such as cereals, pulses, oilseeds, and cash crops, while livestock, including cattle, sheep, goats, and poultry, contribute significantly to household income and nutrition (Gansonre, 2021; Gebiso et al., 2023; Tesgera et al., 2024).

Non-farm activities encompass a wide range of income-generating endeavors beyond traditional agriculture, including off-farm employment, small-scale businesses, wage labor, and remittances (Tigabu et al., 2023). These activities can be both rural-based, such as petty trade, artisanal work, and transportation services, as well as urban-based, such as employment in manufacturing, construction, and services sectors. Several factors drive smallholder farmers in Western Ethiopia to engage in non-farm activities, including limited land availability, declining farm productivity, seasonal fluctuations in agricultural income, aspirations for higher incomes and improved living standards, demographic pressures, access to education and skills training, infrastructure development, and market opportunities arising from urbanization and globalization (Van Nguyen et al., 2022; Wonde et al., 2022; Wondimagegnhu et al., 2019; Wondimu, 2023; Wordofa et al., 2021).

Research on the relationship between farm and non-farm activities examines the impacts and trade-offs associated with diversification strategies (Anang & Apedo, 2023; Ankrah Twumasi et al., 2023; Ashine, 2024). While non-farm activities can provide additional income, reduce vulnerability to agricultural risks, and contribute to poverty alleviation, they may also entail trade-offs in terms of time allocation, resource allocation, environmental sustainability, and social cohesion within rural communities. Insights from studies on farm-non-farm linkages inform the design and implementation of policies and interventions aimed at promoting rural development, livelihood diversification, and inclusive growth in Western Ethiopia (Beriso et al., 2023). These may include investments in agricultural extension services, infrastructure development, vocational training, access to finance, market linkages, and social protection programs tailored to the needs of smallholder farmers and rural households.

By studying the interplay between farm and non-farm activities among smallholder farmers in Western Ethiopia, the objectives of this study were to gain a deeper understanding of the complex dynamics shaping rural livelihoods and devise more effective strategies for sustainable

development and poverty reduction in the region.

MATERIALS AND METHODS

Description of the study area

Horo Guduru Wollega zone in Figure 1 is one of the eighteen administrative zones in Ethiopia's Oromiya National Regional State. The administrative zone's headquarters, Shambu, is situated 310 km west of Addis Ababa, the country's capital. There is one town municipality and nine administrative districts. There are 511,737 people living in the zone overall, according to the Central Statistical Agency's (CSA) 2018 population forecast for Ethiopia. Of these, 50.1 percent are men and 49.9 percent are women. Approximately 89% of the zone's population lives in rural areas (CSA, 2018).

Horo Guduru Wollega zone has 712,766.22 hectares in total. Approximately 37.9 percent of the area is highland, 54.75 percent is mid-highland, and 7.86 percent is lowland in terms of agroecology. The dry season is from October to April, and the wet season is from May to September. Although it varies from year to year, the region has a rainy season for roughly five months. The two main soil types in the zone are clay and sandy soils (CSA, 2013).

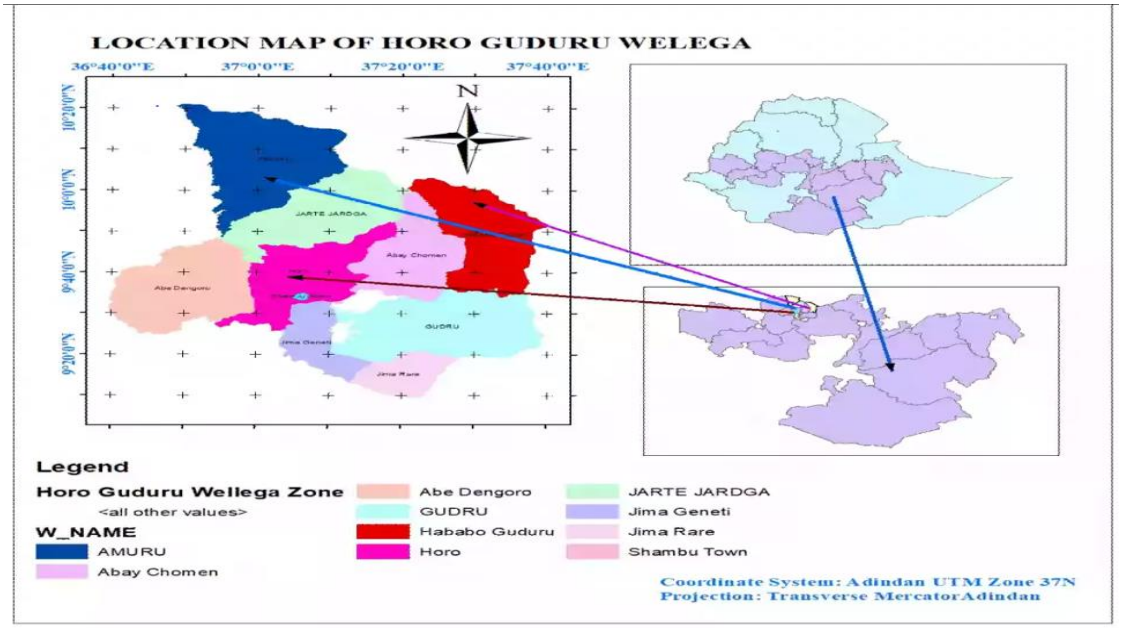

Figure 1. *Map of the study area. Source:(Tesgera et al., 2024)*

Research design

In order to obtain data for this study, a cross-sectional research design was chosen. This allows the researcher to describe the most recent and accurate information regarding household characteristics, consumption expenditure, farm/non-farm linkages, and the determinants of non-farm from primary data—as opposed to secondary data—by conducting in-person interviews with stakeholders. Both qualitative and quantitative data, encompassing the

production year of 2021–2022, are incorporated into this research design and utilized in this investigation.

Sources of data and methods of data collection

Primary sources of data were used in this study. Secondary data was also collected from published and unpublished documents, as well as from pertinent district agencies including the Woreda Agricultural Office, Zonal Agricultural Office, and Central Statistical Authority, in addition to the main data. This study used a qualitative method of data collection. Comprehensive information on a range of topics, including household characteristics, socioeconomic position, demographic factors, farm attributes, input use in agriculture, output produced, and production obstacles encountered, made up the primary data. The study had 383 carefully chosen farm homes in total, and data were gathered using structured and semi-structured questionnaires that were given out by qualified data collectors who were fluent in the local tongue.

Sample size determination and sampling procedure

According to the 2022 report from the study area's Financial and Economic Cooperation Planning and Programming Department, 106,038 household heads were living in the nine districts, making up 20% of the entire population there. Stated otherwise, the total number of household heads accounted for 20% of the 511,738 people living in the zone. Based on these data, the population variability was calculated and represented as p=0.2 and q=0.8 (where q=1-p). Using the sample determination formula that the researcher provided in Equation 3.1, it was clear that increasing the sample size was required to improve the quality of the data.

Therefore, adhering to the methodology commonly employed in questionnaire analysis, particularly when dealing with a large and finite population, as suggested by Kothari (2004), it was imperative to ascertain a representative sample size for proportion analysis. The formula utilized for this purpose was:

$$\frac{Z^2pqN}{e^2(N-1)+Z^2pq}$$

where z is the target confidence level or confidence interval (95%=1.96) and n is the number of samples that must be collected. The greatest population variability is given by p = (0.5), q = 0.5, which is equivalent to (1-p).

And e=±5% precision/error margin by examining the anticipated criterion

When the formula is used

$$n = \frac{(1.96)^2 0.5(0.5)106{,}038}{(0.05)^2(106{,}037)+(1.96)^2\,(0.5)(0.5)} = \frac{101{,}838.8952}{266.0529} = 382.7 \approx 383$$

As a result, 383 homes were the minimum number of samples needed for this investigation. But how can these people be chosen, is the question. The proportionate sampling approach was used to determine the sample sizes that should be distributed to the three districts. However using this approach, every district was fairly represented, and the sample was distributed proportionately according to the size of the households in each district. This indicates that a proportionate stratified sampling formula was used to divide the sample size among the three woredas (districts). Each

district was fairly represented using the following formula:

1. A sample size of Horo Woreda = $\frac{5703x383}{20,318} = 107$ household heads
2. A sample size of Hababo Guduru Woreda= $\frac{6,728x383}{20,318} = 127$ household heads
3. A sample size of Amuru Woreda =$\frac{6,436x383}{20,318} = 149$ household heads

In Horo, Hababo, Guduru, and Amuru districts, there are 11, 12, and 21 rural kebeles respectively, with a total of 44 kebeles across these three districts. Although it was feasible to distribute the determined sample households to all 44 kebeles, practical constraints such as time and budget limitations, as well as the desire for data simplicity, led to the selection of only 16 kebeles using convenience sampling, as recommended by C.R. Kothari (2004).

The selected kebeles were distributed proportionately to each woreda, with four coming from the Horo district, four from the Hababo Guduru district, and eight from the Amuru district, in order to reduce the bias that comes with convenience sampling. The sample households were then proportionately assigned to each chosen kebele in the third stage, taking into account the total number of households in each sampled kebele. In order to guarantee that every home had an equal chance of being chosen, a basic random sampling technique was used in the fourth step to choose the sample households from the household lists in each kebele using a random number table. As a result, both probability and non-probability sampling strategies were used in this investigation. In each kebele, the sample was distributed proportionately as follows:

Where i=1,2,3….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

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

n_k=total sample of household heads in a given district means 108,127 and 148 samples for Horo, Hababo Guduru, and Amuru districts respectively.

Methods of data analysis

In the realm of econometric modeling, particularly concerning the association between involvement in the farm and non-farm sectors, much of the literature has focused on delineating the connection between these two domains. Within this context, two proxies were employed to represent the dependent variables related to farm/non-farm linkage: non-farm participation (where Y = 1 denotes participation and 0 signifies non-participation) and farm activity participation (where Y = 1 indicates engagement in farm activity and 0 denotes no involvement). To scrutinize this relationship, a Seemingly Unrelated Regression (SUR) bivariate model was utilized.

Econometric model

When examining the connection between farm and non-farm involvement, various linear multiple regression equations can each shed light on different economic phenomena. One way to address this complexity is by employing a simultaneous equations model. This model allows for the

possibility that certain explanatory variables in one equation may also serve as dependent variables in another equation within the overall system. Conversely, if none of the variables in the system fulfill both explanatory and dependent roles simultaneously, a different approach may be warranted.

To explore the relationship between farm participation and involvement in rural households, a seemingly unrelated bivariate probit model was utilized. In this model, both non-farm participation (coded as 1 if the household head participates, 0 otherwise) and agriculture participation are represented as binary variables. Unlike the traditional probit model, which deals with a single binary dependent variable (Y), the bivariate probit model accommodates two binary dependent variables, Y1 and Y2. These are associated with two latent variables, Y1* and Y2*. Each observable variable is assumed to take a value of 1 if its underlying continuous latent variable is positive, and 0 otherwise. Considering non-farm (Y1) and farm (Y2) participation as endogenous variables, while socioeconomic, demographic, and institutional factors are considered exogenous, the equation for a skewed unrelated bivariate probit regression model can be formulated as follows:

With

$$Y_{1t} = X_1\beta_1 + e_1 \quad (1)$$

$$Y_{2t} = X_2\beta_2 + e_2 \quad (2)$$

And where Y_{1t} and Y_{2t} are mutually dependent or endogenous Y_1 and Y_2 are binary coded participation in farm activity and X's are exogenous variables, ε_1 and ε_2 are the stochastic disturbance terms. Fitting the bivariate probit model involves estimating the value of β_1, β_2 and Y_i.To do so; the likelihood of the model is maximized as:

$$L(Y_1, Y_2) = [p(Y_1 = 1, Y_2 = 1/Y_1, Y_2)^{Y_1 Y_2} p(Y_1 = 0, Y_2 = 1/\beta_1, \beta_2)^{(1-Y_1)Y_2} p(Y_1 = 0, Y_2 = 0/Y_1, Y_2)^{(1-Y_1)(1-Y_2)} \quad (3)$$

$$p(Y_1 = 1, Y_2 = \frac{0}{Y_1(1-Y_2)} \quad (4)$$

The coefficients of these parameters must be transformed to yield estimates of the marginal effects. The bivariate probit model is based on whether or not p is significant. If a Wald test shows that p is significant, then both farm and non-farm participation employment are endogenous. If p is not significant, then no endogenous bias is present and both equations can be estimated separately as binary probit.

RESULTS AND DISCUSSION

In rural Ethiopia, there exists a positive correlation between agricultural and non-agricultural pursuits, as highlighted by Gebru et al. (2018). This interplay between farming and non-farming activities significantly contributes to the betterment of rural households' livelihoods. To ensure the credibility of the data gathered within the study area, factors influencing both farm and non-farm endeavors were separately analyzed through a probit model. Subsequently, employing Seemingly Unrelated Regression (SUR) to assess the correlation between farm engagement and non-farm participation, the variables representing farm and non-farm involvement were examined individually. Consequently, Table 1 presents the relationship between

farming and non-farming activities as elucidated through SUR.

Econometric Results of a Seemingly Unrelated (SUR) Bivariate Probit Model

A significant portion of agricultural and non-agricultural outputs plays a crucial role in bolstering the consumption levels of rural families in western Ethiopia. Non-agricultural endeavors can serve as a vital component in strategies aimed at enhancing individual consumption. However, the extent of its contribution to elevating rural household consumption hinges on various interconnected factors, including an evaluation of agricultural activities and responses to gauge the effectiveness of non-agricultural pursuits. The adoption of suitable non-agricultural activities may be perceived as imperative in selecting an efficient approach to augmenting consumption. According to the findings of this study, farmers who refrain from engaging in non-agricultural activities struggle to enhance consumption levels effectively. The level of non-agricultural participation may vary, influenced by agricultural engagement, ranging from low participation among those heavily involved in farming to high participation among those with minimal farming involvement. Numerous factors affect agricultural activities in the study area, such as shortages of seeds, pesticides, fertilizers, and technical support for household heads, leading to diverse scenarios. Non-agricultural involvement can be undertaken by individuals or groups, irrespective of their affiliation with farming or non-farming activities. This underscores the significance of both agricultural and non-agricultural engagement, rather than solely relying on specific agricultural outputs, in improving the living standards of rural households.

Table 1 presents the outcomes of the full information maximum likelihood estimation of a seemingly unrelated bivariate probit model. The null hypothesis of no correlation between the disturbance term of non-agricultural participation and agricultural participation is rejected at a 5% significance level, thereby justifying the utilization of the unrelated bivariate model. Moreover, the Tetrachoric correlation indicates a positive and interconnected relationship between non-agricultural and agricultural participation at the 1% significance level. This implies that factors influencing non-agricultural activities also impact non-agricultural participation, illustrating the interdependence between the two domains.

Table 1

Parameter estimates of seemingly unrelated bivariate probit regression

Variables	Coefficient	Robust Std. Error	Z-value
Participation in farm activity			
Age^2	-.0126002***	.0021354	-5.90
Education	.0158087**	.0001122	3.84
Membership of iqub	.0779253**	.021024	8.71
Total livestock	-.0087583***	.0030633	-2.89
Land size	.026945***	.0092132	2.92

Table 1 continues…

Household health status	.3237226***	.0268367	12.06
Access to train	.0933027***	.0249504	3.74
Distance from market	-.0259301***	.0030844	-8.41
Membership of idir	-.0151024	.0049263	-1.15
Number of household dependent	-.0336533**	.292147	3.07
Gender	-.0718509***	.0218929	-3.28
Access to credit	.252207***	.0254481	8.06
Number of oxen	.0417744***	.0117372	3.16
Const.	.9515775***	.1052157	9.04
Participation in non-farm activity			
Age	-.0177547***	.0029765	-5.97
Education	.0109661**	.0048578	2.26
Membership of iqub	.0872551**	.0297303	2.93
Total livestock	-.0103008**	.0043274	-2.38
Land size	.03442***	.0131231	2.62
Household health status	.2780152***	.0398279	6.98
Access to train	.1203023***	.0347655	3.46
Marital status	.0461026*	.0344938	1.34
Distance from market	-.0524941***	.0042722	-7.61
Household saving participation	.0328844	.243919	1.35
Membership of idir	-.322275	.0421717	0.77
Number of household dependent	-.0217637***	.0070547	-3.65
Gender	-.1208713***	.0337287	-3.58
Access to credit	.1313117***	.1357108	3.68
Own mobile phone	-.07204051*	.0265074	-2.72
Cons.	1.369982***	.1524885	8.98
/athrho	14.32674	457.1472	2.68
Rho	0.32	0.058	

*Note: Wald test of rho=0: chi2(1) = 17.3863**, Wald chi2(19) =264.90*** , Log pseudo likelihood = -62.68 , Tetrachoric rho = 0.7898*** ,Std error = 0.0481,Test of Ho: participation in farm and non-farm activity are independent,Pearson's correlation coefficient = 0.4710***,Joint probability of success = 0.118 and Joint probability of failure = 0.214; ***, **,*, represent level of significance at 1%, 5% and 10%, respectively. Source: Own Computation Result Based on Survey Data (2022).*

This strongly emphasizes that involvement in non-farm activities, rather than relying solely on specific agricultural products, significantly contributes to improving the living standards of rural households. At the 1% significance level, Pearson's correlation coefficient is also 0.4710, indicating a positive and significant association between household farming and their decision to engage in non-farming activities. Overall, a seemingly unrelated bivariate probit model fits the data well. The Wald chi-square test decisively rejects the null hypothesis, and the model accurately predicts the observations. Robust standard errors are applied to address the issue of heteroscedasticity.

Table 1 showcases the outcomes of an unrelated bivariate probit analysis, which demonstrates that variables such as participation in training, access to credit, distance to neighboring roads, membership

in iqub, and landholding size significantly influence non-farming participation. Below are interpretations of the results for each variable:

Participation in Training: This variable has a positive and significant effect on both farm and non-farm participation at 9% and 12%, respectively. Training positively impacts both agricultural and non-agricultural activities.

Age: At a 1% statistically significant level, age negatively affects both farms and non-farms. As individuals age, their capacity to engage in agricultural and non-agricultural activities diminishes.

Education: Education has a statistically significant positive effect on both farm and non-farm participation at 5% and 1%, respectively. Education facilitates adaptation to technology and enhances the ability to benefit from business opportunities.

Distance to Market/Road: This variable negatively and significantly affects both farm and non-farm participation at 2.5% and 5.2%, respectively. Greater distance from roads discourages participation in both agricultural and non-agricultural markets due to higher transportation costs.

Access to Credit: Access to finance positively and significantly influences engagement in both agricultural and non-farm activities. Credit enables the adoption of modern technologies and serves as working capital for agricultural inputs or start-up capital for non-farm ventures.

Landholding Size: Land size positively and significantly affects both farm and non-farm participation at 1%. Larger landholdings provide security and opportunities for both agricultural production and non-farm enterprises.

Household Health Status: This variable positively and significantly affects both farm and non-farm participation at a 1% significance level. A healthy household head can actively engage in both sectors to support the family.

Number of Family Dependents: An increase in family dependents negatively affects both farm and non-farm participation at 5% and 10%, respectively. More dependents lead to reduced participation in agricultural and non-agricultural activities due to caregiving responsibilities.

Membership in Iqub: Membership in iqub is statistically significant at a 10% level, indicating its role in financial risk management and information exchange, although it does not directly influence agricultural or non-agricultural participation decisions.

Gender: Being a female head of household negatively affects both agricultural and non-agricultural participation at a statistically significant level of 1%.

Number of Oxen: Ownership of oxen positively impacts agricultural participation with statistical significance at 1%, facilitating agricultural tasks such as plowing and threshing.

Marital Status: Marital status has a statistically significant positive effect on non-farm participation at 10%, indicating that married individuals are more likely to engage in non-agricultural activities.

Own Mobile Phone: Ownership of a mobile phone negatively impacts non-agricultural participation at a 10%

significance level due to challenges such as power outages and network failures in rural areas.

Overall, these findings provide valuable insights for both agricultural and non-agricultural participants, suggesting interventions to enhance household finance and mitigate financial crises related to agricultural production and non-agricultural activities.

CONCLUSION

The study explores the relationship between farm and non-farm activities among smallholder farmers in Western Ethiopia. It emphasizes the significance of both agricultural and non-agricultural pursuits in enhancing rural household livelihoods. Through the utilization of a seemingly unrelated bivariate probit model, the study investigates various factors influencing farm and non-farm participation, shedding light on the interplay between these activities. Data analysis reveals a positive association between household farming and engagement in non-farming activities, underscoring the importance of diversifying livelihood strategies. Key determinants affecting participation in both sectors include access to training, credit availability, distance to markets, landholding size, and household health status. The study provides valuable insights into the complex dynamics of rural livelihoods in Western Ethiopia, highlighting the need for targeted interventions to improve household welfare.

The findings of the study underscore the integral role of both farm and non-farm activities in bolstering rural household livelihoods in Western Ethiopia. The positive correlation between farming and non-farming engagement emphasizes the importance of adopting a diversified approach to income generation. Factors such as access to training, credit facilities, and proximity to markets significantly influence participation in both sectors, suggesting avenues for policy intervention to promote sustainable rural development. Addressing challenges such as infrastructure deficits and gender disparities can further enhance the effectiveness of livelihood enhancement strategies. Overall, the study contributes valuable insights for policymakers, development practitioners, and smallholder farmers alike, emphasizing the need for holistic approaches to rural development that encompass both agricultural and non-agricultural dimensions.

Recommendations

Based on the findings of the study on the relationship between farm and non-farm activities among smallholder farmers in Western Ethiopia, several recommendations can be made to enhance rural livelihoods and promote sustainable development:

i. **Diversification Support**: Encourage smallholder farmers to diversify their livelihood activities by providing training and capacity-building programs focused on non-farm sectors such as small-scale businesses, handicrafts, and service provision. This can reduce dependency on agriculture and

enhance household resilience to economic shocks.

ii. **Access to Credit**: Improve access to financial services, including microcredit and savings schemes, to facilitate investment in both farm and non-farm enterprises. Tailor financial products to the specific needs of smallholder farmers, particularly women and marginalized groups, to ensure inclusivity and empowerment.

iii. **Infrastructure Development**: Invest in infrastructure development, including road networks, market facilities, and access to electricity and water resources, to improve connectivity and reduce transportation costs for both agricultural and non-agricultural products. This will stimulate economic growth and enhance market access for smallholder farmers.

iv. **Extension Services**: Strengthen agricultural extension services to provide technical assistance, knowledge transfer, and training on modern farming practices, crop diversification, and value-addition techniques. Additionally, expand extension services to cover non-farm activities, including entrepreneurship, business management, and marketing skills.

v. **Gender Empowerment**: Promote gender equality and women's empowerment by providing access to education, training, and resources for female smallholder farmers. Implement policies and programs that address gender disparities in access to land, credit, and decision-making opportunities, thereby enabling women to actively participate in both farm and non-farm sectors.

vi. **Market Linkages**: Facilitate market linkages and value chain development for agricultural and non-agricultural products by establishing cooperatives, producer groups, and marketing networks. Support smallholder farmers in accessing local, regional, and international markets through market information systems, product certification, and quality standards compliance.

vii. **Policy Support**: Advocate for policy reforms and institutional support to create an enabling environment for farm and non-farm activities. Promote inclusive policies that recognize the diverse needs and contributions of smallholder farmers, including land tenure reforms, social protection programs, and incentives for rural entrepreneurship.

viii. **Research and Innovation**: Invest in research and innovation to identify opportunities for diversification, value addition, and sustainable resource management in both farm and non-farm sectors. Encourage partnerships between government, academia, and private sector stakeholders to develop and disseminate technologies, best practices, and innovations that

benefit smallholder farmers. By implementing these recommendations, policymakers, development practitioners, and stakeholders can contribute to enhancing the resilience, livelihoods, and well-being of smallholder farmers in Western Ethiopia, fostering inclusive and sustainable rural development.

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DECLARATION

The author declares that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

All data are available from the corresponding author upon request.

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