



S A M <ethan.eryn@gmail.com>

Invitation to review for Heliyon

1 message

Heliyon <em@editorialmanager.com>

Sun, Aug 21, 2022 at 8:19 PM

Reply-To: Heliyon <info@heliyon.com>

To: Samuel PD Anantadjaya <ethan.eryn@gmail.com>

Determinants and Challenges of Off-Farm Employment in Rural Areas of Northwest Ethiopia: A Heckman Model Approach
Manuscript Number: HELIYON-D-22-00101R3

Dear Dr Anantadjaya,

We are considering a new submission for publication in Heliyon, an open-access journal from Cell Press. Your expertise seems appropriate to give feedback on this article. Would you be willing to review?

Abstract:

The major purpose of this study is to determine the motivations, constraints, and drivers of household involvement in off-farm employment. The aforementioned research objectives were addressed using a sequential embedded mixed research design. A three-stage, multiple-stage sampling method was used to collect primary data from 385 sample households. It was revealed that sample households tended to diversify their portfolios away from agriculture in order to complement their agricultural revenue. As a risk-mitigation strategy, the majority of households in the study area have engaged in off-farm activity. According to the survey, off-farm employment accounts for the remaining 35 percent of households' income. Various socioeconomic, institutional, and geographic elements have been proven to influence household decisions about off-farm participation and its extent. Households in the study area worked off-farm primarily as a result of pushing factors such as a lack of land, uncertain agricultural performance, and a decrease in agricultural productivity. Lack of startup capital, on the other hand, is a major constraint that limits off-farm employment involvement. In addition to the government policy of ADLI (Agricultural Development Led Industrialization), which seriously believes that growth in agriculture through technological advancement stimulates growth in rural off-farm activities, rural policy in Ethiopia should strive to integrate farm and off-farm activities.

Heliyon publishes scientifically accurate and valuable research across the entire spectrum of science and medicine. Heliyon received its first Impact Factor (3.8) in June 2022 and we are indexed in the Science Citation Index Expanded (SCIE).

Please click the following link to accept this invitation and view the manuscript. To encourage you to submit your review in a timely manner, we are now offering Editor-Invited discounts for reviewers. Once you complete an appropriate review in the time frame given, you will be eligible to publish with Heliyon at a reduced rate. If you complete more than one review, you may receive a full waiver of the article publication fee.

<https://www.editorialmanager.com/heliyon/l.asp?i=3710176&l=01CZM050>

By agreeing to review this manuscript, you are declaring that you have no conflict of interest.

Please click the following link to decline the manuscript. We would very much appreciate if you could suggest an appropriate alternate reviewer. Please do keep diversity of gender, career stage, and geography in mind as you make these suggestions.

<https://www.editorialmanager.com/heliyon/l.asp?i=3710177&l=FZ7ZABX3>

If, for any reason, the above links do not work, please log in as a reviewer: <https://www.editorialmanager.com/heliyon/default.aspx>.

If you accept this invitation, I would be very grateful if you would return your review within 14 days of accepting this invitation. We understand that the global COVID-19 situation may well be causing disruption for you and your colleagues. If that is the case for you and you would need more time than usual to be able to complete this review, please let us know so we can agree on a time frame that works for you.

Please note that you should treat this invitation, the manuscript, and your review as confidential. You must not share your review or information about the review process with anyone without the agreement of the editors and authors involved, even after publication. This also applies to other reviewers' comments to author which are shared with you after a decision (and vice versa).

We look forward to receiving your response to this review request and thank you in advance for your contribution and time.

Kind regards,

Romanus Osabohien

Associate Editor - Business & Economics

Heliyon

As a reviewer you are entitled to complimentary access to references, abstracts, and full-text articles on ScienceDirect and Scopus for 30 days. Full details on how to claim your access via <https://reviewerhub.elsevier.com> will be provided upon your acceptance of this invitation to review.

Please visit the Elsevier Reviewer Hub to manage all your refereeing activities for this and other Elsevier journals on Editorial Manager.

More information and support

FAQ: How do I respond to an invitation to review in Editorial Manager?

https://service.elsevier.com/app/answers/detail/a_id/28524/supporthub/publishing/

You will find guidance and support on reviewing, as well as information including details of how Elsevier recognizes reviewers, on Elsevier's Reviewer Hub.

FAQ: How can I reset a forgotten password?
For further assistance, please visit our customer service site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about Editorial Manager via interactive tutorials. You can also talk 24/7 to our customer support team by phone and 24/7 by live chat and email
#REV_HELIYON#

To ensure this email reaches the intended recipient, please do not delete the above code

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/heliyon/login.asp?a=r>). Please contact the publication office if you have any questions.



Review for Heliyon - next steps

1 message

Heliyon <em@editorialmanager.com>
Reply-To: Heliyon <info@heliyon.com>
To: Samuel PD Anantadjaya <ethan.eryn@gmail.com>

Mon, Aug 22, 2022 at 4:58 PM

Manuscript Number: HELIYON-D-22-00101R3
Title: Determinants and Challenges of Off-Farm Employment in Rural Areas of Northwest Ethiopia: A Heckman Model Approach

Dear Dr Anantadjaya,

Thank you for agreeing to review the above referenced manuscript HELIYON-D-22-00101R3 for Heliyon.

If possible, we would appreciate receiving your review by Sep 05, 2022.

Note that we may ask you to answer a set of questions about the manuscript, enabling you to convey your recommendations for improvement in a structured way to myself and the author(s).

Please read the following instructions carefully before starting your evaluation: <https://www.elsevier.com/reviewers/how-to-conduct-a-review>, and have a look at <https://www.elsevier.com/reviewers/how-to-review/structured-peer-review> for an overview of the reviewer questions.

As a reminder, our review criteria are displayed below:

1. Methods: Are the methods described in sufficient detail to understand the approach used and are appropriate statistical tests applied?
2. Results: Are the results or data that support any conclusions shown directly or otherwise publicly available according to the standards of the field?
3. Interpretation: Are the conclusions a reasonable extension of the results?
4. Ethics: Does the study's design, data presentation, and citations comply with standard COPE ethical guidelines and has proper approval and consent been acquired as outlined in our Editorial Policies: <https://www.cell.com/heliyon/ethics>?

We have provided some useful links at the end of these instructions, if you would like to develop your knowledge in writing effective peer review reports. Please take a moment to look at these resources, which will guide you through the peer review process.

Please also note these important ethical guidelines all reviewers are asked to follow:

- * You should treat the manuscript and your review as confidential. You must not share your review or information about the review process with anyone without the agreement of the editors and authors involved, even after publication. This also applies to other reviewers' "comments to author" which are shared with you on decision (and vice versa).
- * If you suspect plagiarism, fraud or have other ethical concerns, please raise your suspicions with the editor, providing as much detail as possible.
- * Any suggestion you make that the author include citations to your (or your associates') work must be for genuine scientific reasons and not with the intention of increasing your citation counts or enhancing the visibility of your work (or those of your associates).
- * Please flag any potential conflict of interest that you may have to the editor.

To view the manuscript, please click here: <https://www.editorialmanager.com/heliyon/l.asp?i=3718158&l=TWKHREH8>.

When you are ready to submit your review, you may access the submission record here <https://www.editorialmanager.com/heliyon/l.asp?i=3718159&l=J7PPJ3NS>. Please click on the "Submit Recommendation" link to enter your comments.

If, for any reason, the above link does not work, please log in as a reviewer at <https://www.editorialmanager.com/heliyon/>.

As a reviewer you are entitled to complimentary access to ScienceDirect and Scopus. This 30-day access can be activated in the [Rewards] section of your profile in Reviewer Hub (reviewerhub.elsevier.com) and you have six months to activate it.

Please visit the Elsevier Reviewer Hub (reviewerhub.elsevier.com) to manage all your refereeing activities for this and other Elsevier journals on Editorial Manager.

I look forward to receiving your review soon.

Thank you in advance for your contribution and time.

Kind Regards,

Heliyon

DISCLAIMER: This email is intended for the named recipient only. Please do not forward this email or share the links included here as these allow immediate access to your Editorial Manager account.

Resources for new reviewers to prepare you for writing a Peer Review report:

* We encourage you to take part in Elsevier's Certified Peer Review Course. The course will allow you to develop an in-depth knowledge of the peer review process and assist you in writing a helpful peer review report: <https://researcheracademy.elsevier.com/navigating-peer-review/certified-peer-reviewer-course>

* You can view Cell Press's initiatives designed to improve the peer review process and to help early career researchers become effective reviewers here: <https://www.cell.com/peer-review>

* You can view Heliyon's guide for reviewers here: <https://www.cell.com/heliyon/guide-for-referees>

More information and support

FAQ: How can I submit my review in Editorial Manager?

https://service.elsevier.com/app/answers/detail/a_id/28465/supporthub/publishing/

You will find guidance and support on reviewing, as well as information including details of how Elsevier recognizes reviewers, on Elsevier's Reviewer

Hub: <https://www.elsevier.com/reviewers>

FAQ: How can I reset a forgotten password?

https://service.elsevier.com/app/answers/detail/a_id/28452/supporthub/publishing/

For further assistance, please visit our customer service site: <https://service.elsevier.com/app/home/supporthub/publishing/>

Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about Editorial Manager via interactive tutorials. You can also talk 24/7 to our customer support team by phone and 24/7 by live chat and email

#REV_HELIYON#

To ensure this email reaches the intended recipient, please do not delete the above code

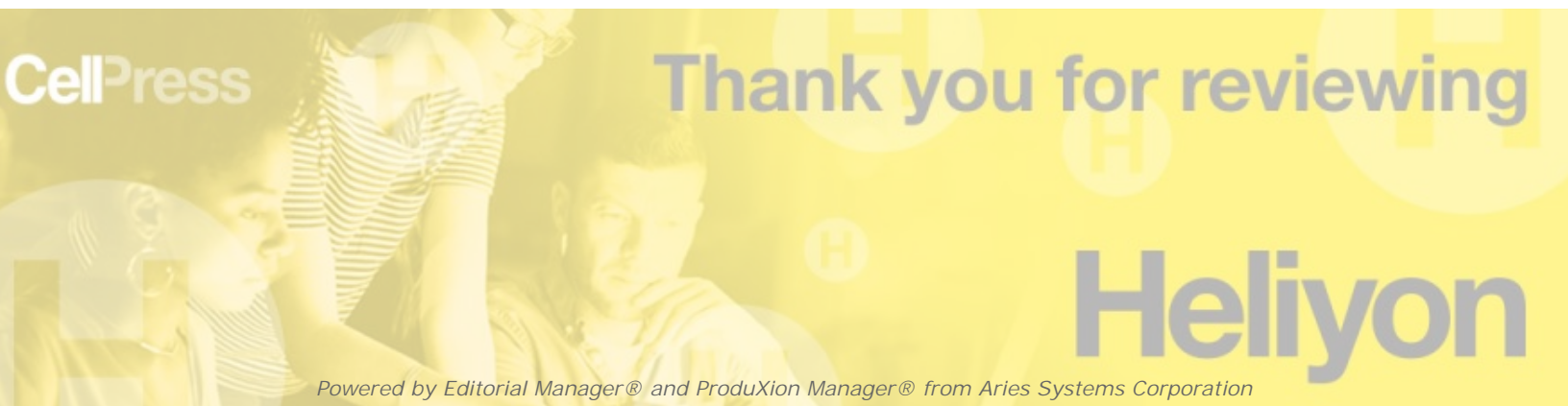
In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/heliyon/login.asp?a=r>). Please contact the publication office if you have any questions.

 **Review_Due.ics**
1K

Heliyon

Determinants and Challenges of Off-Farm Employment in Rural Areas of Northwest Ethiopia: A Heckman Model Approach --Manuscript Draft--

Manuscript Number:	HELIYON-D-22-00101R3
Article Type:	Original Research Article
Keywords:	Off-Farm Employment; Income; Heckman Model; Livelihood and De-agrarianization
Abstract:	<p>The major purpose of this study is to determine the motivations, constraints, and drivers of household involvement in off-farm employment. The aforementioned research objectives were addressed using a sequential embedded mixed research design. A three-stage, multiple-stage sampling method was used to collect primary data from 385 sample households. It was revealed that sample households tended to diversify their portfolios away from agriculture in order to complement their agricultural revenue. As a risk-mitigation strategy, the majority of households in the study area have engaged in off-farm activity. According to the survey, off-farm employment accounts for the remaining 35 percent of households' income. Various socioeconomic, institutional, and geographic elements have been proven to influence household decisions about off-farm participation and its extent. Households in the study area worked off-farm primarily as a result of pushing factors such as a lack of land, uncertain agricultural performance, and a decrease in agricultural productivity. Lack of startup capital, on the other hand, is a major constraint that limits off-farm employment involvement. In addition to the government policy of ADLI (Agricultural Development Led Industrialization), which seriously believes that growth in agriculture through technological advancement stimulates growth in rural off-farm activities, rural policy in Ethiopia should strive to integrate farm and off-farm activities.</p>



CellPress

Thank you for reviewing

Heliyon

Powered by Editorial Manager® and ProduXion Manager® from Aries Systems Corporation

Editor and Reviewer comments and Responses to reviewer's comments

Thank you for your suggestions and comments. The comments made and the corrections made are listed below.

1. *Reviewer point #1:* The grammar level is poor:

Response: *We agreed with the reviewer and used grammar checkers and English language expertise from the University of Gondar to fix the grammar.*

2. *Reviewer point #2* The topic is too long, consider modifying it

Response: *We have modified the topic to make it short.*

3. *Reviewer point #1* Method: Firstly, the paper does not well introduce the livelihood diversification in the study area, especially the land ownership of farmers. Secondly, the paper does not introduce the variables used in the econometric model, especially the dependent variables of the second model. How to obtain the extent of farmers' participation in off-farm employment?

Response: *We have added the variables used in the model in table 3.1. in the method section. To identify the extent of participation in the off-farm sector, the amount of income gathered from it was considered. It is explained in the definition of the variable in table 3.1.*

Determinants and Challenges of Off-Farm Employment in Rural Areas of Northwest Ethiopia: A Heckman Model Approach

¹Mersha Tewodros Getnet, ²Mengistu Ketema, ³Bamlaku Alemu, ⁴Girma Demilew

¹Assistant Professor in University of Gondar, College of Social Science and the Humanity, Department of Development and Environmental Management Studies, Gondar, Ethiopia

²Professors in School of Agricultural Economics and Agribusiness Management, Director, Research-Extension and Publication Office, Haramaya University, Ethiopia

³Associate Professor in Addis Ababa University collage of development studies, Addis Ababa, Ethiopia

⁴Assistant professor in University of Gondar, College of Economics, Gondar Ethiopia

kukuget22@gmail.com

ABSTRACT

The major purpose of this study is to determine the motivations, constraints, and drivers of household involvement in off-farm employment. The aforementioned research objectives were addressed using a sequential embedded mixed research design. A three-stage, multiple-stage sampling method was used to collect primary data from 385 sample households. It was revealed that sample households tended to diversify their portfolios away from agriculture in order to complement their agricultural revenue. As a risk-mitigation strategy, the majority of households in the study area have engaged in off-farm activity. According to the survey, off-farm employment accounts for the remaining 35 percent of households' income. Various socioeconomic, institutional, and geographic elements have been proven to influence household decisions about off-farm participation and its extent. Households in the study area worked off-farm primarily as a result of pushing factors such as a lack of land, uncertain agricultural performance, and a decrease in agricultural productivity. Lack of startup capital, on the other hand, is a major constraint that limits off-farm employment involvement. In addition to the government policy of ADLI (Agricultural Development Led Industrialization), which seriously believes that growth in agriculture through technological advancement stimulates growth in rural off-farm activities, rural policy in Ethiopia should strive to integrate farm and off-farm activities.

Keywords: Off-Farm Employment, Income, Heckman Model, Livelihood and Deagrarianization

1 INTRODUCTION

Rural populations in developing countries generate a large proportion of their income from agriculture and have relied almost purely on agriculture for a long time. It is one of the most important economic sectors in most of the world. It has always been at the top of the global development agenda as it is tied to the top two Sustainable Development Goals (SDGs) of eradicating poverty and hunger, achieving food security, improving nutrition, and promoting sustainable agriculture by 2030 (UN, 2017). However, since the late 1990s, there has been an increased recognition that Africans diversify their livelihood strategies (Worku, 2016 and Carlos, 2004). Diversification of income sources (the allocation of productive assets among different

1
2
3
4 income-generating activities) has been put forward as one of the strategies households employ to
5 minimize household income variability and ensure a minimum level of income.
6

7
8 Bryceson (2002) calls this process "deagrarianization," i.e., the shrinking role of agriculture in
9 the household's income and livelihood strategy. Deagrarianization is essentially a multi-
10 dimensional process of change involving livelihood re-orientation, occupational work
11 adjustment, spatial realignment of residential settlements, and social re-identification, all of
12 which entailing movement away from agrarian patterns in local and regional economies
13 (Bryceson 2002). This process is on-going, resulting in a process of sectoral transformation,
14 evidenced by a declining proportion of the national population and total labor time engaged in
15 agriculture (Loison, 2016). This process of livelihood diversification is explained differently in
16 different literature. Generally, it can be perceived as a strategy of rural individuals or households
17 in which they expand their number of activities, regardless of the location and/or sector (Loison,
18 2016; Saha and Bahal, 2012).
19
20
21

22
23 Though in Sub-Saharan Africa (SSA), the process of "deagrarianization" has begun lately
24 (Loison, 2016), various studies show that the pace and extent of deagrarianization is significant
25 in the region (Babatunde, 2013). Many recent studies show that rural off-farm incomes in SSA
26 are increasing and play an important role in determining rural household incomes, consumption,
27 expenditure, and household food security (King, 2012; Haggblade et al., 2010). Researchers in
28 the field of rural development tend to agree that the number of poor people in rural areas of
29 Ethiopia exceeds the capacity of agriculture to provide sustainable livelihood opportunities
30 (CFSVA, 2014; Guush et al., 2013). As a result, despite the persistent image of Ethiopia as a
31 continent of subsistence farmers, over the past decades, there has been an outstanding tendency
32 for rural economic diversification (Adamnesh et al., 2014; Babatunde, 2013). The share of off-
33 farm income to total income ranges from 30% to 50% (Davis et al., 2017; Ghimire et al., 2014;
34 and Losch et al., 2012).
35
36
37

38
39 Subsequently, the diversity of rural livelihoods has generated a lot of discussion among
40 researchers in Ethiopia (Davis et al., 2017; Ghimire et al., 2014; Prowse, 2015; Worku, 2016;
41 Yishak 2017; Geremew et al. 2017). Multiple motives prompt households and individuals to
42 diversify their assets, incomes, and activities. These motives include various push and pull
43 factors such as seasonality of agriculture, rising agricultural input prices, risk aversion, scarcity
44 of land, and earning more income (Mathewos and Nigatu 2016; Geremew et al. 2017). However,
45 alongside the focus given to structural transformation and its determinants, in all of the studies
46 above, determinants of off-farm employment in Ethiopia are assessed either using Tobit
47 regression or Logit regression models. This may lead to a wrong conclusion in cases where a
48 household gain most of its income from a single source while the rest is derived from more than
49 one source. Besides, given the violation of random participation in the labor force, estimating the
50 coefficient of determinants using these regression models would bias the estimated coefficients,
51 resulting in selectivity bias.
52
53
54

55
56 Given the increasing importance of off-farm employment in rural areas, the central question is:
57 what are the hurdles, opportunities, and factors that influence off-farm employment involvement
58 in rural Ethiopia? Thus, this research is interested in conducting scientific research using a
59 combination of approaches relevant to the respective research questions to examine the
60
61
62
63
64
65

determinants, constraints, and motivations for off-farm employment. For this study, a Heckman two-stage model was used because it models both the decision to participate and the level of engagement at the same time. This method was chosen for this study because it accounts for selection bias that may occur as a result of an unobservable factor. The findings of this study will provide policymakers with a clear picture to help them make appropriate policy interventions and may shift the policy focus.

2 METHODOLOGY

A mixed research design was used for this study as the nature of the research objectives set and the research questions raised necessitated both quantitative and qualitative evidence. However, it should be understood that a mixed research approach does not imply giving equal weight to both qualitative and quantitative studies (Creswell, 2012). The current study used a sequential embedded mixed method where qualitative data was used as a supportive data set. The intention to gain a deeper understanding of the consequences of farm household livelihood strategies necessitated a focus on selected sample districts. Thus, the study was conducted in three districts of the Central Gondar Zone in Amhara Regional State. These are the Wegera, Lay-Armachio and Gondar Zura Districts (see Figure 2-1). The selection has been undertaken with close discussion and consultation with the experts of the zonal and regional agricultural offices. These districts are a typical representation of diverse agro-ecological conditions. Moreover, the strategic location of the districts for the promotion and scaling-out of the research findings to other districts for livelihood analysis in the zones was considered. It was revealed that sample respondent households own 1.18 hectares of land on average. The primary data for the study were gathered between February and June of 2021.

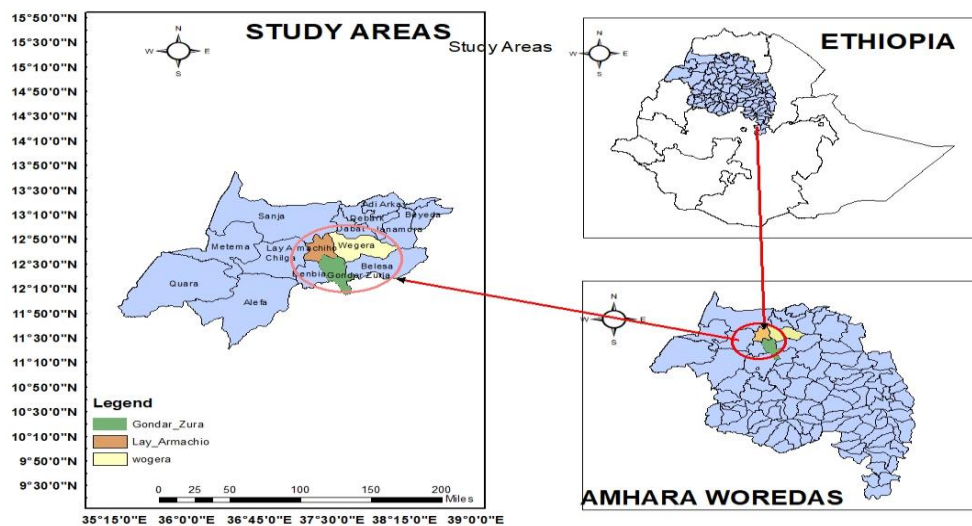


Figure 2-1: Map of Ethiopia and location of the study areas

Primary data were collected from 385 sample household's determined using Cochran (1977) formula. The formula is:

$$n_0 = \frac{Z^2 p * q}{e^2}$$

1
2
3
4 Where; e is the desired level of precision (i.e., the margin of error), p is the (estimated)
5 proportion of the population which has the attribute in question and q is 1 – p. Thus, the
6 assumption used for sample size determination in this research is the maximum tolerable error
7 value of e = 0.05; and the desired level of confidence of 0.95, which corresponds to a Z- value of
8 1.96. Following the livelihoods approach, in this research household was used as the unit of
9 analysis for the sample survey, as it is considered a suitable unit of analysis for the study of
10 livelihoods due to the strong social and economic interdependence between the group of
11 individuals that constitute a household (Ellis, 2000). Thus, stratified random proportional
12 sampling techniques were used to select sample households from three selected administrative
13 districts.
14
15
16

17 **2.1 Methods of Data Analyses**

18 Given the violation of random-participation in the labor force, attempting to estimate using
19 ordinary least square regression would bias the estimated coefficients, resulting in selectivity
20 bias. As a result, Heckman's two-stage model is appropriate for this study because it models both
21 the decision to participate and the level of diversification at the same time. Heckman models are
22 created by estimating two multiple regression models, an outcome equation and a selection
23 equation, at the same time (Barnighausen et al., 2011).
24
25
26

27 In the first stage, it estimates the selection or participation equation using the binary Probit
28 model. In this model, the response variable was binary, taking only two values: 1 if the
29 household participated in none-farm employment, and 0 if not. The model was specified as
30 described by Wooldridge (2002).
31

$$32 \quad Y^* = Z'a + \epsilon_1$$
$$33 \quad Y = 1 \text{ if } Y^* > 0$$
$$34 \quad Y = 0 \text{ if } Y^* \leq 0$$

35
36

37 Where: Y^* = is a latent (unobservable) variable representing farmer`s discrete decision whether
38 to diversify or not; Z' = is a vector of independent variables hypothesized to affect farmer`s
39 decision of diversification; α = is a vector of parameters to be estimated which measures the
40 effects of explanatory variables on the farmer`s decision; ϵ_1 = is normally distributed disturbance
41 with mean (0) and standard deviation of δ_1 , and captures all unmeasured variables. Y is a
42 dependent variable which takes on the value of 1 if the farmer diversifies and 0 otherwise.
43
44

45 In the second stage conditional on their decision to diversify, farmers make continuous decision
46 on the intensity of participation measured in the amount of income collected from off-farm
47 employment. The Heckman selection equation /is specified as:
48
49

$$50 \quad Z_i^* = W_i'a + e_2$$

51
52

53 Then, the lambda (λ) is used as an additional regressor with the view to controlling for
54 selectivity bias in the second-step. Descriptions of variables used in the Heckman model are
55 described below:
56

57 **(i). Dependent variables**

58 The first stage of the Heckman model is the participation decision, and it is a dummy variable
59 taking the value "1" if the household participates in any non-farm employment and "0"
60
61
62
63
64
65

otherwise. For the second stage Heckman model, households' income from non-farm employment is a continuous variable measured in Ethiopian Birr (ETB).

(ii). Independent variables and researchers expected relations

The independent variables used in the Heckman estimation and the researchers prior expectation are explained in Table 2-1.

Table 2-1 Explanatory variables included in Heckman model and researchers prior expectation

Variable Name	Symbol	Definition of the variable and its measurement	Researcher Expectations	
Dependent Variables				
A. Participation in non-farm employment	PPOFF_FARM	Binary, 1 if the household participate in any off-farm employment (NFE); and 0 otherwise	A	
B. Extent of non-farm participation	EX_OFF_FARM	Continuous, amount of income collected from off-farm employment (NFE)		B
Independent Variables				
Age of household head	AGE_HH	Discrete, Age of household head in years	-	-
Family size in AE	AD_FAMSIZE	Continuous, Total sizes of household member in AE takes the value of 1, 2, 3....	+	+
Sex of Household Head	SEX_HH	Binary, 1 if the household head is male and 0 if household head are female	±	±
Household head Education	HH_EDU	Binary, 1 if the household head is literate and 2 if household head is illiterate	+	+
Adult literacy rate	ADU_LR	Continuous, Percentage of people ages 15 and above who can both read and write	+	+
Access for non-labor income	NLI_ACC	Categorical, 1 if the household have access; and 0 otherwise		
Farm Size	FARM_SIZE	Continuous, Land size holding of the household in hectare	-	+
Soil Quality	INFER_LAND	Continuous, Proportion of landholdings perceived as "infertile in quality"	-	-
Livestock ownership	LIV_OWN	Continuous, Total livestock ownership in tropical Livestock unit (TLU)	+	+
Ox-ownership	OX_OWN	Discrete, Oxen owned by the households and take the value of (0, 1, 2, 3...).	-	+
Road access	ROAD_DIS	Continuous, Walking distance to all weather roads in minute	+	-
Credit access	CREDIT_ACC	Binary, 1 if households were access credit within the last 5 years and 0 otherwise	-	-
Agricultural Income	FARM_INC	Continuous, Total annual household incomes from on-farm activity in BIRR	+	+
Agroecology	AGRO_ECO	Binary, 1 if households live in highland agro ecologies, and 0 otherwise	±	±
Risk exposure	RISK_OCC	Binary, 1 if the household exposed to drought/ and flooding in the last 5 years; and 0 otherwise	+	NP

Note: +, -, ± and NB stands for positive, negative, empirically do not determined relation and not applicable, respectively.

3 RESULT AND DISCUSSION

The involvement of households in various portfolios of activities is referred to as "livelihood diversification." Households in the study area are distinguished by the presence of a diverse range of livelihood activities. Some are agricultural in nature, while others are not. They consist of productive activities, investment strategies, and reproductive decisions. According to the study, on-farm activity accounts for approximately 65 percent of total income in the area on average (See Figure 3-1). Other sources of income account for the remaining 35% of household income, with off-farm employment, agricultural wage employment, and non-labor income accounting for 23.2 percent, 5.47 percent, and 6.6 percent of total income, respectively. Similar findings were also made in Ethiopia by Adugna and Wagayehu (2012), Dereje (2016), and Beyene (2008).

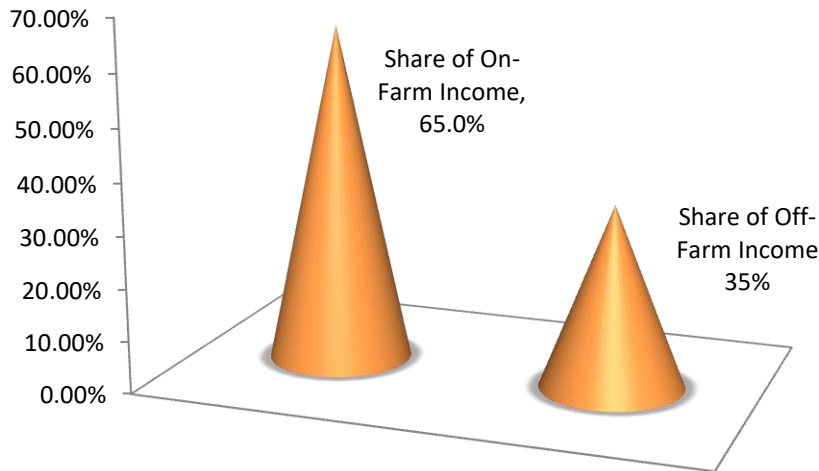


Figure 3-1 Mean-share of on-farm and off-farm livelihood portfolios

3.1 Households motivation and constraints of off-farm employment

Two-step procedures were used during the data collection for this study to identify factors and motivations for off-farm diversification. First, during the FGD, households were asked to list out possible push and pull factors that motivate farm households in their locality to diversify their livelihood towards off-farm employment as well as a factor that constrains them. Then, in the next step during the survey, households who diversified in their off-farm portfolio were asked to indicate factors that motivated them, and households who did not were also asked to indicate constraining factors that affected them. Since farmers' decisions are not only affected by a single factor, multiple response questions were employed to identify motivating and hindrance factors. Multiple push and pull factors prompt households and individuals to diversify their assets, incomes, and activities (King, 2012). Thus, the diagram below contains household motives and constraints of off-farm diversification collected based on a multiple response approach.

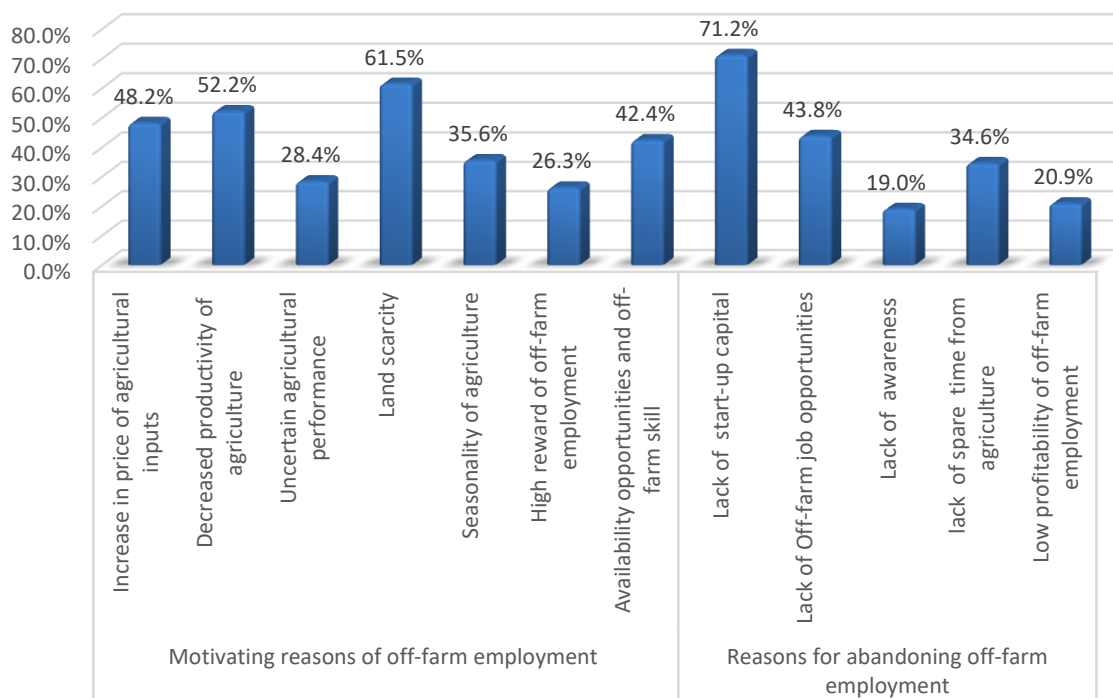


Figure 3-2 Household motivation for Off-Farm Diversification and reasons for abandoning off-farm portfolios

As indicated in Figure 3-2, there is various push and pull factors for household decisions of off-farm participation. Scarcity of land is the most frequently mentioned pushing factor accounting for 61.5% of households engaged in off-farm employment. Due to population pressure land per capita becomes decreasing. Thus, farmers have no choice other than to diversify their livelihoods towards off-farm portfolios (Tesfaye, 2008). Decreasing productivity of land (52.2%) and the increased price of agricultural inputs like fertilizer and new seed varieties (48.2%) are the second and third most frequently indicated reasons for off-farm diversification, respectively. In the study area, land fragmentation, cultivation of marginalized land, climate change, and soil erosion are among the reasons for the decrease in productivity of agriculture. On the other hand, limited access to fertilizer and infections were among the reasons for the increased price of agricultural inputs. The other driving factors, which account for 35.6% and 28.4% of the reasons for off-farm employment, respectively, were the seasonality of agricultural activities and the uncertainty of agricultural performance. Due to the limited access to irrigated land, households in the study area performed on-farm activities only during the summer season. Moreover, limited performance becomes uncertain due to the high variability of rainfall and pest effects.

On the other hand, pulling factors like availability of skills or off-farm employment and high profitability of off-farm employment per labor were mentioned by 42.4% and 26.3% of off-farm participant households as reasons for participation. Households in the town that have a skill other than agriculture (basket making, carpentry, etc.) are among the enabling reasons mentioned by the households in the study area. According to Ambachew et al. (2016), in areas of land-scarce farmers' survival in many low-income areas, non-agricultural sources of income have positive attributes for livelihood security that outweigh negative connotations. Assuming the fact that

rural off-farm activities are heterogeneous by their very nature, the constraints also have varying characteristics. Therefore, this study focuses on the major constraints of diversification identified by the study population. As indicated in Figure 3-2, lack of start-up capital, lack of off-farm opportunities, lack of awareness, lack of spare time or labor in the family, and perception of less reward of off-farm employment are among constraining factors to diversify into off-farm employment. As shown in Figure 3-2, among the households that do not diversify into off-farm employment, 71.2% of the households indicated that lack of startup capital is a primary constraint that limits livelihood diversification.

Lack of capital in this sense does not represent the various forms of capital; rather, it is only associated with the financial type of capital. Farmers who prefer to engage in self-off-farm employment face acute entry barriers in terms of financial capital. According to the study participants, nowadays, investment in off-farm businesses needs high financial capital, and there is no way of getting this higher financial capital to invest it in off-farm business activities. Hence, farming households prefer to engage in some other source of income that may not require capital. This problem is aggravated by the limited availability of credit in the study area. Other factors limiting off-farm participation were identified by 43.8%, 34.6%, 20.9%, and 19% of respondents as a lack of off-farm job opportunities, a lack of labor, perceived low profitability of available off-farm employment, and a lack of awareness about off-farm employment, respectively. This could be due to a lack of organized nonfarm livelihood generating enterprises that can motivate and provide technical and financial assistance to farming households so as to engage in off-farm livelihood activities other than agriculture.

3.2 ECONOMETRIC RESULTS

To evaluate socio-economic, institutional, and location factors affecting household decisions on off-farm participation and their extent of engagement, the Heckman two-stage models were employed. As can be seen in Table 3-2 the coefficient of Mills Ratio (Lambda) in the Heckman two-stage estimation was significant at a probability of less than 5%. Lambda is statistically significant, implying that there is a problem with selection bias that cannot be overlooked. Moreover, the log likelihood ratio test was used to assess the overall joint goodness of fit for the Heckman selection model parameter estimates. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness of fit for the Heckman selection model was statistically significant at a probability of less than 1% (Wald $\chi^2= 140.17$ with $P=0.001$).

Table 3-1 Result of first stage Heckman selection equation on factor-affecting likelihood of off-farm employment

Explanatory Variables	Regression		Marginal Effect		
	Coefficient	Std. Err	Coefficient	Std. Err	P> z
Constant	-3834.062	11143.85			
SEX_HH					
Female	2.973626	1.158387	-.0807952	.0249144	0.001***
HH_EDU					
Literate	.5367334	1.253856	.0136606	.032043	0.670
CREDIT_ACC					
Yes	2.749842	.8732808	.0854755	.0201755	0.000***

RISK_OCC						
Yes	2.630225	.85786	.0804951	.0184624	0.000***	
AGE_HH	-.022601	.021724	-.0005722	.0005412	0.290	
AD_FAMSIZE	.3148752	.173629	.0079717	.0041246	0.053***	
FARM_SIZE	-.1314538	.539364	-.003328	.0136406	0.807	
INFER_LAND	.0174385	.0107216	.0004415	.0002603	0.090*	
ADU_LR	.0710137	.0172948	.0017979	.0002667	0.000***	
LIV_OWN	.2910264	.1312041	.0073679	.0029854	0.014**	
OX_OWN	-.8120348	.3375217	-.0205583	.0075721	0.007***	
ROAD_DIS	-.0956524	.0248608	-.0024216	.0004258	0.000***	
FARM_IN	-.0000127	5.10e-06	-3.21e-07	1.12e-07	0.004***	
NLI_ACC						
Yes	1.012296	.7214962	.0298799	.0238493	0.210	
AGRO_ECO						
Midland	-2.47061	.8092276	-.069645	.0172839	0.000***	

Number of observations = 385

LR χ^2 (11) = 442.62

Prob > χ^2 = 0.0000

Log pseudo likelihood = -33.198182

Pseudo R^2 = 0.8696

Note: ***, **, * significance levels at $P < 0.01$, $P < 0.05$ and $P < 0.1$ respectively

The selection and outcome equation depicted in Table 3-1 and Table 3-2 presents factors affecting household off-farm participation and its extents along with the levels of statistical significance. The calculated marginal effects measure the expected changes in the probability of adaptation and perception for a unit change in an independent variable from the mean value, while other things remain unchanged. The model result shown in the preceding table shows that a household's decision to participate in off-farm activity, as well as the extent to which it participates, is influenced by a variety of factors. As a result, the following sections discuss significant factors influencing household involvement and the extent of their involvement in the off-farm sector.

Table 3-2 Result of second stage Heckman model on the determinant of extent of off-farm employment

Explanatory Variables	OUTCOME MODEL		
	Coefficient	Std. Err	P> z
CONSTANT	-5664.465	9673.77	0.558
SEX_HH			
Female	-2155.164	7547.29	0.075*
HH_EDU			
Literate	17333.65	3264.653	0.000***
CREDIT_ACC			
Yes	2380.102	3155.685	0.451
AGE_HH	151.1103	152.1783	0.321
AD_FAMSIZE	2519.693	843.4988	0.003***
FARM_SIZE	-3158.822	2928.746	0.281
INFER_LAND	163.9845	54.70398	0.003***
ADU_LR	182.0556	60.98702	0.003***

LIV_OWN	1209.212	483.1473	0.012**
OX_OWN	2636.675	1883.406	0.162
ROAD_DIS	-159.3783	71.12093	0.025**
FARM_IN	.1383202	.0434797	0.001***
NLI_ACC			
Yes	6594.145	3865.504	0.008**
AGRO_ECO			
Midland	-2573.091	3726.607	0.490***
IMR	-2634.48	-13.338	0.035**
Number of observations = 385			
Censored Observations =144			
Uncensored Observations = 241			
Wald chi2(14)= 140.17			
Prob > chi2 = 0.0000			
Rho= 0.16959, Sigma=49.569			
Note: ***, **, * significance levels at P<0.01, P<0.05 and P<0.1 respectively			

3.3 DISCUSSION

i) Socio-Demographic Factors

A household head is a person who financially supports or manages a household or who is regarded as the head by other members of the household due to age or respect. The type of headship should be mentioned as a determining factor in the discussion of family participation in off-farm economic activities. The gender of the household is found to be negatively related to the household's participation in off-farm employment. The negative sign of this variable indicates that being a female-headed household has a negative impact on a household's involvement and extent of involvement in the off-farm sector when compared to its counterpart, male-headed households. In other words, male-headed households are more likely to be involved in and earn more money from off-farm activities than female-headed households. This relationship is significant at a 1 and 10% probability level for the likelihood of off-farm participation and extent of involvement in off-farm activities, respectively. Other things being constant, female-headed households were 8% less likely to participate in off-farm activities and collect 2155.1 ETB less income from off-farm employment.

This is consistent with the studies by Ambachew et al. (2016) and Rahman and Akter (2014). Male-headed household's participated more than female-headed households since male-headed households have more access to opportunities than female-headed households. This is due to better access to finance and information as well as mobility opportunities for males, while women are more engaged in household chores and do not have the necessary time left for off-farm activities. According to the qualitative study, the main off-farm employment opportunities in the area are trading (of any kind), handcrafting (of any kind), casual daily laborer, and selling local food and drink. Transporting wood, trading, handcrafting, and casual daily labor in the town are mainly dominated by male-headed households, while the selling of local drinks (like *Arki*, *Tela*, and *Tegne*) is mainly done by female-headed households.

The family size of households is the other demographic variable. Family size, as expected, has a positive influence on the likelihood and extent of participation. The size of a given household influences its participation in off-farm livelihood activities. This implies that households with a large number of family members are more likely to have someone working outside the home. The marginal effect shows that increasing the size of the family increases the probability

1
2
3
4 of participating in off-farm employment by 0.79 percent, with all other factors held constant at a
5 probability level of less than 1%. Likewise, the coefficient in Table 3-2 indicates *cetruspuribus*,
6 a unit increase in family size measured in adult equivalent, increases amount of household
7 income from off-farm employment by 2519.6 ETB. Households with a relatively large number
8 of member individuals face difficulties fulfilling the needs of their household using income
9 earned only from the on-farm sector. As a result, they tend to diversify their livelihoods to
10 include off-farm livelihood options that can support their major livelihood. Further, off-farm
11 income sources may help to create job opportunities for large family households where there are
12 highly disguised or under-employed members. This finding is in agreement with the findings of
13 Zerai and Gebreeziabher (2011), Apata (2010), and Babatunde and Matin (2009).
14
15
16

17
18 Education is one of the social variables that indicate individual ability and understanding. This
19 study took into account both the educational status of the household heads and adult literacy. As
20 expected, the educational status of the household head has a positive impact on both the selection
21 and outcome equations. It was discovered that the educational status of the household head is
22 associated with a high probability of engaging in off-farm employment as well as the amount of
23 income earned from off-farm employment. Literate households were found to be 1.3 percent
24 more likely than illiterate households to engage in nonfarm employment and earn 17.3333 ETB
25 more. The impact of household head education is only significant for the outcome equation at a
26 1% probability level, but it is not significant in the selection equation. It may be due to the fact
27 that most of the off-farm activities do not require formal education, and most of the off-farm
28 engagement decisions and activities are performed by adult members of the household rather
29 than the household head.
30
31
32

33
34 Correspondingly, the rate of adult literacy was found to have a positive and significant effect on
35 both the selection and outcome equations. At a 1% alpha level, the marginal effect of the adult
36 literacy rate demonstrated that one extra year of schooling could increase the probability of
37 smallholder farmers engaging in off-farm economic activities by 0.17 percent and the amount of
38 off-farm income collected by 180 ETB. A large number of studies on the determinants of income
39 diversification and off-farm employment found the same thing (Asnake, 2010; Akaakohol and
40 Aye, 2014; Beyene, 2008; Demissie and Legesse, 2013). This could be because educated
41 households are more aware of the opportunities available in off-farm employment, have a greater
42 ability to look at existing opportunities for income-generating activities, and have a better chance
43 of taking calculated risks. Furthermore, education is one of the barriers to household entry into
44 off-farm activities (Fabusoro et al., 2010.)
45
46
47

48 ii) Institutional Factors 49

50 The financial position of the household also has an impact on the decisions of farm households.
51 The results of the analysis show that a household's access to credit has a positive effect on both
52 the selection and the outcome equation. It is indicated that households who get credit access are
53 more likely to be engaged and collect more income from off-farm employment than those who
54 do not get it. As it is confirmed by the marginal effect of the coefficient, households that have
55 credit access are 8.5% more likely to participate in off-farm employment at a 1% probability
56 level. The probable reason could be that credit money helps the household to reduce the entry
57 points of liquidity problems. This finding is in line with the studies by Ambachew et al. (2016),
58 Davis (2004), Asmah (2011), and Saha and Bahal (2012). However, contrary to the above fact,
59
60
61
62
63
64
65

1
2
3
4 Eneyew and Bekele (2012) argue that when farmers have access to credit, they may use the
5 money to buy new farm inputs for agricultural intensification, which reduces their motive to get
6 involved in other sectors. However, the relationship is not significant in the extent of off-farm
7 livelihood diversification.
8

9
10 Proximity to all-weather roads is thought to encourage rural residents to engage in off-farm
11 economic activities. Farmers who live further away from the road are less likely to have access
12 to the market and other basic infrastructure and information, which has an impact on transaction
13 costs. This study discovered that household road access has a negative and significant impact on
14 both the selection and outcome equations at less than 5% alpha level. The marginal effect of the
15 study revealed that each additional minute of walking distance to all-weather road decreases
16 household's likelihood of off-farm employment by 0.24% and amount of income by a factor of
17 159.3 ETB (see Table 3-1 and Table 3-2). Perhaps it could be due to the fact that distance to the
18 road determines a household's access to the market and other basic infrastructure. According to
19 Cristian and Grace (2017) and Jonasson and Helfand's (2010) arguments, individuals with
20 market access are more likely to engage in off-farm activities.
21
22

23 24 iii) Possession of Productive Assets 25

26 It is expected that there might be variations among farming households' engagement in off-farm
27 livelihoods due to the quality of land matters for its productivity. Thus, as expected by the
28 research household's proportion of land perceived as infertile from the total land is associated
29 with the household decision of off-farm livelihood diversification positively. It is indicated that
30 the proportion of land perceived as infertile is significantly and positively associated with the
31 household probability of off-farm employment at 10% probability levels. According to the
32 marginal effect of the result shown in Table 3-2, a unit increase in the proportion of land
33 perceived as infertile from household total land owned increases the likelihood of engaging in
34 off-farm employment by 0.04 percent. Similarly, at a 1% probability level, a unit increase in the
35 percentage of land perceived as infertile increases households' income from off-farm
36 employment by 163 ETB (see Table 3-2). Perhaps this is because households have land, but if
37 the land is infertile, they have no choice but to engage in other off-farm employment to secure
38 their lives. Similarly, Atamanov (2011) discovered that insufficient land size and poor land
39 quality were driving forces for off-farm diversification.
40
41
42
43

44 Household ownership of ox and other TLU is associated with households' decision to pursue off-
45 farm employment and the extent of income collected from it. Tropical livestock holding refers to
46 the total number of livestock owned by the household, measured in Tropical Livestock Units
47 (TLU). As indicated in the model result, Tropical Livestock Unit (TLU) ownership had a
48 positive impact on both the selection and the outcome equation. In other words, the more the
49 household owns TLU, the more they are likely to engage in off-farm employment and collect
50 more income. The result of the study indicated that a unit increase in TLU increases households'
51 probability of participation in off-farm employment by 0.7% and the amount of land collected
52 from off-farm employment by 1209 ETB for those who engage. The relationship is significant at
53 a 5% alpha level. This could be due to the fact that in rural areas, livestock is one of the financial
54 resources that households quickly convert into cash when they require cash to start new off-farm
55 employment. In contrast to the study's findings, but consistent with the researcher's expectations
56 Gecho (2017), Yisehak et al. (2014), and Yenesew et al. (2015) discovered negative associations
57
58
59
60
61
62
63
64
65

1
2
3
4 with household livestock ownership, concluding that household livestock ownership is
5 negatively associated with household livelihood diversification. This could be due to, according
6 to them, the better opportunity to earn more income from livestock production and less being
7 pushed by poverty.
8
9

10 On the other hand, at a 1% probability level, the number of oxen owned is associated with a
11 lower probability of off-farm employment and its extent. Other things being equal, each
12 additional unit of ox ownership reduces the likelihood of off-farm employment by 2% and the
13 extent of off-farm participation by a factor of 2636.67 ETB. It is possible that because oxen are a
14 critical source of traction power for farmers in rural Ethiopia, households with ox are less likely
15 to be pushed to engage in off-farm employment. Gecho (2017) investigated similar outcomes.
16
17
18

19 iv) Households other income sources (On-farm and Transfer Income)

20

21 It was found that farm households' on-farm income was negatively associated with household
22 off-farm participation. As indicated in the marginal effect results in Table 3-1 and the coefficient
23 in Table 3-2, *cetruspuribus* it is clear that a unit increase in the amount of income from
24 agricultural activity per adult equivalent decreases households probability of off-farm
25 engagement by $1.12e-07$ in a 1% probability level and amount of income from off-farm
26 employment by a factor of 0.138 with a 5% probability. Perhaps this could be due to the fact that
27 household with high agricultural income has more land which reduces time available for off-
28 farm employment. Consistent findings were revealed by Fabusoro et al. (2010). He argued that
29 whenever farming activities provide sufficient income for the household, their tendency of
30 diversifying into off-farm livelihoods will be diminished.
31

32 Households with limited land, on the other hand, may be forced to participate in off-farm
33 economic activities in order to supplement their income from such activities if farmers are unable
34 to produce enough crops to meet their food demand. According to Atamanov (2011), insufficient
35 land size and poor quality are driving forces for off-farm diversification for households with
36 limited and poor land resources. This result, however, contradicts the findings of Yenesew et al,
37 (2015), who argued that better-off households in rural areas would have a more diverse income
38 than poor households. This could be true if there are high-paying off-farm employment
39 opportunities available.
40
41
42
43

44 Aside from agriculture, households in the study area also earn some money from non-labor
45 sources. Pensions, remittances, food aid, and relief gifts from governmental and non-
46 governmental organizations are examples of non-labor income. Beyene (2008) discovered that
47 the availability of transfer income alleviates liquidity constraints and increases household
48 capacity to start off-farm businesses, which is expected to increase the selection of more
49 lucrative livelihood strategies. Others, such as Reta et al. (2010)), found a negative and
50 significant association between access to remittance and the likelihood of households engaging
51 in off-farm activities because the money received from remittance is used for consumption rather
52 than productive investment, increasing reliance on aid, which was not recognized in this study.
53
54
55

56 v) Exposure to Risk and Location Factors

57

58 In this context, risk refers to whether farming households are vulnerable to droughts, floods, pest
59 disease, and low harvests that affect their livelihood. As expected, it was found that households'
60
61
62
63
64
65

1
2
3
4 exposure to environmental risks like drought and flood is a driving factor that attracts farm
5 households to the less environmentally sensitive off-farm livelihood portfolios. As indicated in
6 Table 3-1, the marginal effect of households who had been exposed to various risks is 8.0% more
7 likely to participate in off-farm likelihood diversification as compared to those who are not. At a
8 1% probability level, the relationship is significant. It is possible that this is due to the fact that
9 agricultural employment is generally associated with increased environmental risk; rural nonfarm
10 income may provide a new opportunity in this situation (Ackah, 2013). In other words, because
11 nonfarm activities are typically regarded as less risky than crop production, a risk-averse
12 household would prefer to engage in nonfarm work than a less risk-averse household.
13 Furthermore, shocks and risks are among the push factors mentioned in the preceding section.
14 Thus, it appears likely that off-farm enterprises will fulfill a survival or risk-diversification
15 strategy for rural households in areas with a high climate change trend and lower productivity
16 (Ackah, 2013).
17
18
19
20

21 Besides, the incentives to participate in off-farm employment may vary due to agro-ecological
22 characteristics, as livelihood is agro-ecologically sensitive in its nature. Therefore, we have two
23 agro-ecologies that exist in the three study sites: midland and highland. As revealed in the study,
24 negative relations were found. The negative coefficient both in the selection and outcome
25 equation indicated in the model result by Table 3-1 and Table 3-2, revealed that household in
26 midland agroecology are less likely to participate in nonfarm employment and collect income
27 from it as compared to households living in highland agroecology. It is indicated that households
28 in midland areas are 6% less likely to participate in off-farm employment and collect 2573.09
29 ETB less in off-farm employment income as compared to farmers in highland areas at a 1%
30 probability level. Perhaps this could be due to households' having greater access to physical and
31 financial institutions in highland areas as compared to midland households. This includes a
32 household's proximity to the road, town, and market and their access to credit services and
33 remittances.
34
35
36

37 vi) Lambda

38 Inverse mill's is a probability density function to cumulative density function ratio. This has a
39 negative effect that is significant ($P < 0.05$). Lambda is statistically significant, indicating that the
40 model contains selection bias. The negative sign indicates that there are unobserved variables
41 that have a negative impact on the amount of income from off-farm employment.
42
43
44

45 **4 CONCLUSION AND RECOMMENDATION**

46
47 According to the study's findings, farming was not the only source of income for households in
48 the study areas. It was discovered that in order to supplement their agricultural income, sample
49 households tended to diversify their activities away from agriculture. On-farm activity accounts
50 for roughly 65 percent of total income in the area on average; according to the study. The
51 remaining 35% of household income comes from other sources. The findings indicate that
52 households in the study area participate in off-farm employment primarily as a result of "push
53 factors." The most frequently mentioned driving factor is a lack of land, which accounts for 61.5
54 percent of households engaged in off-farm employment. Seasonality of agricultural activities,
55 uncertain agricultural performance, an increase in agricultural input prices, and a decrease in
56 agricultural productivity are among the other driving factors. Lack of start-up capital, on the
57 other hand, is the most significant constraint to livelihood diversification, followed by a lack of
58
59
60
61
62
63
64
65

1
2
3
4 off-farm employment opportunities, a lack of labour, the perceived low profitability of available
5 off-farm employment, and a lack of awareness about off-farm employment.
6

7
8 Household participation in off-farm activities, as well as the extent of participation, is influenced
9 by a number of factors. The gender of the household head, credit access, and the household's risk
10 exposure, family size, ownership of infertile land, adult literacy rate, TLU and oxen ownership,
11 road access, agricultural income, and agro ecology have all been shown to have a significant
12 impact on participation in off-farm economic activities in rural areas. Similarly, the impact of
13 household heads' sex, educational status, credit, family size, road, ownership of TLU and oxen,
14 adult education, agricultural income, and agro ecology factors on off-farm participation is
15 significantly related in the outcome equation.
16
17

18
19 The central tenet of ADLI (Agricultural Development Led Industrialization), which adheres to
20 the rural growth linkage model approach, is that growth in agriculture stimulates growth in rural
21 off-farming activities in Ethiopia. Nevertheless, rather than agricultural productivity growth,
22 pushing factors drive participation in rural off-farming sectors. Furthermore, because rural
23 households engage in a variety of income-generating activities, the government's priority sectors
24 may not produce the expected results due to resource fungibility for other purposes. Policies
25 should strive to integrate farm and off-farm activities for the reasons stated above, and the
26 traditional sector-based approach should be broadened by adopting and implementing a local
27 development strategy that includes both farm and off-farm activities.
28

29 **Acknowledgements**

30
31 The first author would like to thank University Of Gondar and Ethiopian Ministry Of Education
32 for Ph.D candidate fund for supporting the cost of data collection.
33

34 **Availability of data and materials**

35 All data and materials used in the study are presented in the main paper.
36

37 **Funding**

38 This research was fully funded by University of Gondar Under Ministry of education student
39 fund.
40

41 **Ethics approval and consent to participate**

42 Not applicable.
43

44 **Consent for publication**

45 Not applicable.
46

47 **Competing Interests**

48 The authors declare that they have no competing interests.
49
50

51 **5 REFERENCE**

- 52
53 Ackah, C. (2013). Non-Farm Employment and Income in Rural Ghana. *Journal of International*
54 *Development*, 25:325–339.
55
56 Adamnesh, Atnafu, Oucho, L., &Zeitlyn, B. (2014). Poverty, youth and rural-urban migration in Ethiopia.
57 Working Paper 17. University of Sussex: DFID
58 Akaakohol MA, Aye GC (2014). Diversification and Farm Household Welfare in Makurdi, Benue State,
59 Nigeria. *Development Studies Research* 1(1):168-75.
60
61
62
63
64
65

- 1
2
3
4 Ambachew, M.D. and Ermiyas, A. (2016). determinants of rural household livelihood diversification strategy
5 in South Gondar zone, Ethiopia. *Journal of Agricultural Economics, Extension and Rural Development*:
6 ISSN- 2360-798X, Vol. 4(8):, pp, 548-560.
- 7 Apata, T.G. (2010). Linkages between Crude-oil Exploration and Agricultural Development in Nigeria:
8 Implications for relevant qualitative data collection and analysis to improve rural economy. Department
9 of Agricultural Economics and Extension, Joseph Ayo Babalola University. Retrieved from
10 www.fao.org/fileadmin/templates/ess.../WYE_2010.4.3
- 11 Asmah, E. E. (2011). Rural Livelihood diversification and agricultural household welfare in Ghana. *Journal*
12 *of Development and Agricultural Economics*, 3(7): 325-334.
- 13 Asnake, W. (2010). Participation into off-farm activities in rural Ethiopia: who earns more? *International*
14 *university of social studies (ISS)*, Erasmus university of Rotterdam, The Hague, The Netherlands
- 15 Atamanov, A. (2011). Microeconomic analysis of rural nonfarm activities in the Kyrgyz Republic: What
16 determines participation and returns?
- 17 Babatunde, R.O. (2013). On-Farm and Off-farm Works: Complement or Substitute? Evidence from Rural
18 Nigeria. Contributed paper for the 4th International Conference of the African Association of Agricultural
19 Economists, September 22-25, 2013, Hammamet, Tunisia. URL: <http://ageconsearch.umn.edu>.
- 20 Babatunde, R.O., & Qaim, M. (2009). Patterns of income diversification in rural Nigeria: determinants and
21 impacts. *Quarterly Journal of International Agriculture*, 48, No4: 305-320. Retrieved from
22 <https://unilorin.edu.ng>
- 23 Barnighausen, T., Bor, J., Wandira-Kazibwe, S., (2011). Correcting HIV prevalence estimates for survey
24 nonparticipation using Heckman-type selection models. *Epidemiology* 22, 27-35
- 25 Beyene, A. D. 2008. “Determinants of Off-farm Participation Decision of Farm Households in Ethiopia.”
26 *Agrekon: Agricultural Economics Research Policy and Practice in Southern Africa* 47 (1): 140–159.
- 27 Bogdan, R.C. & Biklen, S. K. (2006). *Qualitative research for education: An introductory to theory and*
28 *methods.* (5th ed.). Needham Heights, MA:
- 29 Bryceson, D. F. (2002). The Scramble in Africa: Reorienting Rural Livelihoods. *World Development*, 30(5):
30 725–739.
- 31 Carlos Pomareda (2004). *Diversification or Specialization: Challenges for Rural Livelihoods in a Changing*
32 *World.* Science and Policy Forum Food Systems and Food Security. San José, Costa Rica, November 5,
33 Carlos.
- 34 Cochran, W. G. (1977). *Sampling Techniques*, 2nd Ed., New York: John Wiley and Sons, Inc.
- 35 Comprehensive Food Security and Vulnerability Analysis (CFSVA) 2014 The Ethiopia CFSVA is a joint
36 publication between the Ethiopia Central Statistical Agency and the World Food Programme. This report
37 and a summary report are available online: <http://www.csa.gov.et> <http://www.wfp.org/food-security/>
- 38 Creswell, J.W., (2012). *Educational Research Planning, Conducting, and Evaluating Quantitative and*
39 *Qualitative Research.* 4th Edition . University of Nebraska–Lincoln.
- 40 Cristian Vasco and Grace Natalie Tamayo (2017). Determinants of non-farm employment and non-farm
41 earnings in Ecuador. *CEPAL Review*, No. 121
- 42 Davis, B., Winters. P., Reardon, T., and Stamoulis, K. (2017). Rural nonfarm employment and farming:
43 household-level linkages. *Agricultural Economics*, 40(2), 119-123
- 44 Davis, J. (2004). *The Rural Non-farm Economy, Livelihoods and their Diversification: Issues and Options.*
45 *Natural Resource Institute, Chatham, UK.*
- 46 Demissie A, Legesse B (2013). Determinants of income diversification among rural households: The case of
47 smallholder farmers in Fedis district, Eastern hararghe zone, Ethiopia. *Journal Development Agricultural*
48 *Economic* 5(3):120-128.
- 49 Dereje TesemaRegasa (2016). *Rural Livelihood Strategies and Household Food Security: The Case of*
50 *Farmers Around Derba Cement Factory, Sululta Woreda, Oromia Regional State.* A Thesis Submitted to
51 the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for
52 the Degree of Master of Arts in Sociology. Unpublished
- 53 Ellis, F. (2000). The Determinants of Rural Livelihood Diversification in Developing Countries. *Journal of*
54 *Agricultural Economics*, 51(2), 289–302.

- 1
2
3
4 Fabusoro, E., A. M. Omotayo, S. O. Apantaku and P. A. Okuneye. 2010. Forms and Determinants of Rural
5 Livelihoods Diversification in Ogun State, Nigeria. *Journal of Sustainable Agriculture*.
6 Gecho Yishak 2017. Rural farm households' income diversification: The Case of Wolaita Zone, Southern
7 Ethiopia. *Social Sci.* 6 (2):45-46.
8 Geremew Worku Kassie, Sangho Kim and Francisco P. Fellizar Jr (2017). Determinant factors of livelihood
9 diversification: Evidence from Ethiopia: *Journal of Cogent Social Sciences* (2017), 3: 1369490
10 <https://doi.org/10.1080/23311886.2017.1369490>
11 Ghimire R., Huang W, Shrestha, R.B (2014). Factors affecting nonfarm income diversification among rural
12 farm households in central Nepal: *Int. J. Agric. Manag. Dev.* 4 (2), 123e132
13 Haggblade, S., Hazell, P., & Reardon, T. (2010). The rural non-farm economy: Prospects for growth and
14 poverty reduction. *World Dev.* 38(10), 1429-1441.
15 Jonasson, E. and S.M. Helfand (2010), "How important are locational characteristics for rural non-
16 agricultural employment? Lessons from Brazil", *World Development*, vol. 38, No. 5, Amsterdam,
17 Elsevier
18 King, R. (2012). *Theories and typologies of Migration: An Overview and a primer*. Willy Brandt Series of
19 Working Papers in International migration and Ethnic Relations. Sweden: Malmö University
20 Loison, A. S. (2016). The Dynamics of Rural Household Livelihood Diversification : Panel Evidence from
21 Kenya. *Journées de recherche en sciences sociales*. Page 1-29, 1125–1138.
22 Losch B, S Fréguin-Gresh and ET White (2012). Structural Transformation and Rural Change Revisited:
23 Challenges for Late Developing Countries in a Globalizing World. African Development Forum series.
24 World Bank. Washington, D.C
25 Mathewos Mentamo a, Nigatu Regassa Geda (2016). Livelihood diversification under severe food insecurity
26 scenario among smallholder farmers in Kadida Gamela District, Southern Ethiopia: Elsevier.
27 http://www.elsevier.com/locate/kontakt_9_771212_411601_0
28 Prowse M (2015). The Determinants of Non-Farm Income Diversification in Rural Ethiopia: *Journal of*
29 *Poverty Alleviation and International Development* 6(1):109-130
30 Rahman, S., & Akter, S. (2014). Determinants of Livelihood Choices: An Empirical Analysis from Rural
31 Bangladesh. *Journal of South Asian Development*, 9(3), 287–308.
32 Reta Hailu. (2010). Livelihood Strategies among the Agricultural Land Scarce Peasants in the Central
33 Highlands of Ethiopia- Implications on Natural Resource Base: A Case Study from Tole Wereda,
34 Southwest Shewa, and Ethiopia
35 Saha, B., & Bahal, R. (2012). Constraints impeding livelihood diversification of farmers in West Bengal.
36 *Indian Research Journal of Extension Education*, 12, 59–63
37 Tesfaye Fikru. (2008). A case study of non-farm rural livelihood diversification. Masters Thesis, Addis Ababa
38 University, Retrieved on Dec 11/2014 from <http://www.jstor.org/action/showPublisher>
39 UN (2017). The Sustainable Development Goals Report 2017. United Nations New York, 2017
40 Van den Berg, M. and Kumbi, G.E. (2006). Poverty and the Rural Nonfarm Economy in Oromia, Ethiopia.
41 *Agricultural Economics*, Vol. 35 (Suppl), pp.469-75.
42 Wooldridge, J.M., (2002). *Econometric Analysis of Cross Section and Panel Data*. Boston: MIT Press.
43 Workulfa Dadi (2016). Livelihood Diversification as Household Strategies. A Case Study Of Rural Kebeles
44 Around Gelan Town, Oromia, Ethiopia. A Thesis Submitted to the Department of Geography and
45 Environmental Studies Presented in Partial Fulfillment of the Requirements for the Degree of Master of
46 Arts in Geography and Environmental Studies (Population, Resources and Development). Unpublished
47 Yenesew, S. Y., Eric, N. O., and Fekadu, B. (2015). Determinants of livelihood diversification strategies:
48 The case of smallholder rural farm households in Debre Elias Woreda, East Gojjam Zone, Ethiopia.
49 *African Journal of Agricultural Research*, 10, 1998-2013. doi: 10.5897/AJAR2014.9192
50 Yisehak K, Johan D, Janssens GPJ (2014). Effects of supplementing tannin rich diets with polyethylene
51 glycol on digestibility and zoo technical performances of zebu cattle bulls (*Bos indicus*). *J. Anim.*
52 *Physiol. Anim. Nutr.*, 98(3), 431–438.
53 Zerai, B. and Gebreegziabher, Z. (2011). Effect of nonfarm income on household food security in eastern
54 Tigray, Ethiopia: an entitlement approach. *Food Science and Quality Management*, 1:1-23
55
56
57
58
59
60
61
62
63
64
65