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Determinants of Rural Non-Farm Income Diversification in Ethiopia: Evidence from Panel Data Analysis

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COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THESIS ON:

**DETERMINANTS OF RURAL NON-FARM INCOME DIVERSIFICATION
IN ETHIOPIA: EVIDENCE FROM PANEL DATA ANALYSIS**

BY:

YISAK NIGUSSE

AUGUST, 2020

BAHIR DAR, ETHIOPIA.

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DETERMINANTS OF RURAL NON-FARM INCOME DIVERSIFICATION
IN ETHIOPIA: EVIDENCE FROM PANEL DATA ANALYSIS
BY:
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AUGUST, 2020
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APPROVAL SHEET

BAHIR DAR UNIVERSITY
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DEPARTMENT OF ECONOMICS

The Thesis Titled **Determinants Of Rural Non-Farm Income Diversification In Ethiopia: Evidence From Panel Data Analysis**". Is Approved For The Degree Of Masters Of Science In Development Economics.

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DECLARATION

I, the undersigned, declare that this thesis entitled “Determinants of Rural Non-Farm Income Diversification in Ethiopia: Evidence from Panel Data Analysis” is my original work and has not been presented for a degree or any other purpose in any institution and all the sources used for the thesis have been dully acknowledged.

Yisak Nigusse

July, 2020

BAHIR DAR, ETHIOPIA

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LETTER OF CERTIFICATION

This is to certify that Yisak Nigusse has carried out his thesis on the topic entitled: **“Determinants of Rural Non-Farm Income Diversification in Ethiopia: Evidence from Panel Data Analysis”**. This work is original in nature and suitable for the award of Masters of science (MSC) in Development Economics.

Getachew Yirga. (Ph.D.).

July, 2020

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Acronyms

ADLI: Agricultural Development Led Industrialization

CSA: Central Statistical Agency

DHM: Double Hurdle Model

ERHS: Ethiopian Rural Household Survey

ESS: Ethiopia Socioeconomic Survey

FAO: Food and Agriculture Organization

LAD: Least square absolute deviation

NBE: National Bank of Ethiopia

OLS: Ordinary Least square

RIGA: Rural Income Generating Activities

RNFE: Rural Nonfarm Economy

SLA: Sustainable livelihood analysis

RULIS: Rural Livelihoods Information System

SUR: Seemingly Unrelated Regression

WB: World Bank

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Abstract

This study examines the determinants of nonfarm participation, intensity and dynamics in rural nonfarm economy (RNFE) in Ethiopia. The determinants of nonfarm activity are analyzed using probit models for nonfarm participation, and censored Tobit models for intensity. It also analyzes the dynamics of nonfarm income share using Quantile regression. It aims to enhance the role of non-farm activities in improving rural economy. A balanced panel data of 6,222 rural households were obtained from Ethiopia Socioeconomic Survey (ESS) 2014 and 2016. Control function approaches were used to reduce the severity of endogeneity problem. The results of the study reveal that credit access and poverty status have significant and positive effects on households' participation in and income share of nonfarm economy. Household having old age heads, married heads, higher dependency ratio, faced with input price rise shock, land owners and having higher livestock are less likely to participate in nonfarm economic activities. Income share of nonfarm economy is low for households owning large livestock, higher dependency ratio, and older aged head and ill head. Household size, primary and secondary schooling, electricity, and other income improve household nonfarm share of income. Meanwhile, household having large household size and high land owner have dynamics affect share of nonfarm income. Governments should promote nonfarm employment by introducing infrastructure and financial facilities like, electricity, credit, and others in order to create new nonfarm employments opportunities and make profitable for the existed ones.

Key words: *Nonfarm; Intensity; Dynamics; Probit Model.; Censored Tobit; Ethiopia*

CHAPTER ONE:

INTRODUCTION

1.1. Background of the study

In developing countries, the large portion of the household income is generated from the agriculture sector, and their economic activities depends up on socio-economic and agroecological conditions such as drought, rainfall shock, and etc. Livelihood strategies is composed of activities that generate the means of household survival and are planned activities that men and women undertake to build their livelihood (Ellis, 2000).

In rural Africa diversification is the norm. the agriculture sector in rural Africa was incapable to feeding the household members. Low productivity of livestock raring and seasonal crop production in long dry season made households to diversify their livelihood strategy. In rural area; merely depending on farming is not a remedy for livelihood improvement, therefore to reduce dependency on subsistence farming The rural household to diversify their livelihood due to improve their living standard, generate cash, enouncing security, increasing the level of health, and reducing the poverty (Barrett, Reardon, & Webb, 2001; Segun, 2010).

Multiple motives Serve as the inciting cause of households and individuals to diversify assets, incomes, and activities. The first set of motive is “push factors”: risk reduction, response to diminishing factor returns in any given use, such as family labor supply in the presence of land constraints driven by population pressure and fragmented landholdings, reaction to crisis or liquidity constraints, high transactions costs that induce households to self-provision in several goods and services, etc. The second set of motives comprise “pull factors”: realization of strategic complementarities between activities, such as crop-livestock integration or milling and hog production, specialization according to comparative advantage accorded by superior technologies, skills or endowment (Barrett et al., 2001; Davis, 2006).

The nonfarm activity may take place at home, in factories or by place to place works. It includes small and largescale activities of widely varying technological. This diverse collection of seasonal trading, household-based and large-scale agro-processing, manufacturing and service activities plays a crucial role in sustaining rural populations, in servicing a growing and modern agriculture, and in supplying local consumer goods and services. In rural areas the scarcity of land prevails, rural nonfarm activity offers as the major economic alternatives for rural poor. The non-farm economy offers opportunities for the rural poor as well as the rich. Poor households frequently seek economic security through distress diversification into low-skill nonfarm activities such as basket making, weaving, pottery, small-scale retailing and seasonal labor migration (Haggblade, 2013)

In sub-Saharan African countries ranging from 30-50 per cent of the income source is from non-farm sector, but in Southern Africa attains 80-90 per cent. In South Asia closely 60 per cent of income source is from the non-farm income diversification. however, this proportion varies widely between, for example, landless households and those with access to land for farming. In sub Saharan Africa reliance on agriculture tends to diminish continuously as income level rises, i.e. the more diverse the income portfolio the better-off is the rural household (Ellis, 1999).

According to Bedemo, Getnet, Kassa, & Chaurasia (2013); Ellis (2000); Ibekwe (2010) the main determinant factor the household engaged in the non-farm income diversification is:- a seasonality of agriculture product, risk, labor market, credit access, asset strategies and coping strategies, age, gender, marital status and education level, household characteristics (size of the household, dependency ratio, age, gender and education head of the household), household assets(the number of cattle and the size of owned land), location characteristics and access to infrastructure due to this reason the households are participate in non-farm income diversification to sustain their living standard. Rural nonfarm economic activity plays a pivotal role in the rural economies of many developing countries. It accounts for roughly 25% of fulltime rural employment and 35-40% of rural incomes across the developing world (Haggblade et al., 2002) and as much as 40%, 32% and 42% of average household income in Latin America, Asia and Africa respectively (Reardon et al., 2000). In Ethiopia, the sector was found to have an income share of 17% in 1994 Lemi (2009) and this became 14% in 2004 and 25% in 2009.

Currently Ethiopia has among the highest dependence on agriculture of any country in the world. Ethiopia's agriculture sector is a major contributor to the Ethiopian economy to food security and poverty reduction. Agriculture accounts 36.7% of GDP, 80.6% of export and 77% of employment. Nearly 90% of the poor depend on agriculture for their livelihood, but by its nature agriculture is highly degraded, rain fed, declining farm size and productivity, uncertainty of climatic patterns like drought shocks (Chen et al., 2018; NBE, 2017). According to Ethiopia Socioeconomic survey (ESS) of 2015/16 approximately 25% of Ethiopian households own and operate a non-farm activity, and food availability. Rural households tend to participate in the non-farm activities at the time of food shortage seasonal. And the other factor affects the household engage in non-farm such as is Shocks: - illness of household member, drought, increase in the price of food items, and increasing price for inputs.

According to Eneyew & Bekele (2012), livelihood diversifications can protect the rural household from economic and environmental shocks, trends and reasonability of their living. The Agricultural sector of Ethiopia is characterized by low labor productivity, a diminishing farm size, survival farming, soil degradation, insufficient and flexible rainfall, occupation insecurity, feeble agricultural research base and extension system, lack of financial services, lacking agricultural markets and poor infrastructure.

In rural areas of Ethiopia, labor market participation is the major source of income for many landless and small farm households. Farming is one of the riskiest businesses due from the impact to of the combination of environmental conditions, unpredictable economic shocks, and consequently, the financial situation of farm households. Different decisions on agricultural sector may have their own importance to reduce the risk. As a result, farm owners seek to diversify their sources of income and run other strategies aiming to stabilize their earning through off-farm and non-farm activities(Woldegiyorgis et al., 2017).

Many of the previous studies in rural Ethiopia Damena & Habte (2017); Demeke & Jayne (1998); Gemechu (2014); Woldehanna (2000) agreed that the number of poor people in rural Ethiopia exceed the capacity of agriculture to provide sustainable livelihood opportunities. Even with a decline of fertility rates, and a slowing down of population growth, this situation is believed not to change significantly

In rural Ethiopia livelihood diversification has a strong positive production and consumption linkages with Agriculture. Specifically, non-farm activities can affect production decision of farmers as evidenced by Damena & Habte (2017) using data from small farmers in southern Ethiopia finds that non-farm income increases the use of fertilizer, cultivated land, cash crop production and revenue from crop sale which are an input for increasing farm productivity. This implies that non-farm economic sector is initial finance for the agriculture and technological transfer.

The purpose of this study is to investigating socio-economic and demographic, shock, and infrastructure factor that affect participation, intensity and its dynamics on non-farm economic diversification in rural Ethiopia by using unique longitudinal data of 2013/14 and 2015/16 via using Panel Probit, and Tobit models were used to estimate participation and intensity for balanced panel data. Whereas, quantile regression for the intensity dynamics by using second and third waves of Ethiopia socioeconomic survey.

1.2. Problem Statement

Due to inefficiency of agricultural sector, rural household look to make choice between the livelihood strategies like non-farm and off-farm economic activities. The households are who more engaged in livelihood diversification households are landless and poor at the time of shock and drought. The main roles of non-farm enterprise are seasonal income generation, consumption smoothing, and risk mitigation. Non-farm enterprises have an opportunity for households to smooth their income in the agricultural off-season.

In most of developing countries non-farm enterprises are component of dynamic rural economies. The probability of new firms enter into the nonfarm sector are being created at a high rate; in each year up to 20 percent are new entrants in most of developing countries. The annual growth rate of surviving rural nonfarm enterprises is high, but a minority of enterprises fuels the bulk of this expansion. Jobs created through the expansion of existing enterprises are more likely to reflect increasing efficiency, and demand-pull forces in the economy. These expanding firms are more likely to be younger, to have started smaller, and to be operated out of the entrepreneurs' homes by males in the manufacturing or service sector.(Haggblade. et al, 2007).

Rural farming systems in Ethiopia are vulnerable to number of challenges, including continues population growth, urbanization, income inequalities, land degradation, rain fed declining farm size and productivity, uncertainty of climatic patterns (Chen et al., 2018). Most of the people living in the rural area are vulnerable for different types of risks like natural disaster, scarcity of irrigation water pump, non-availability of other income sources, and etc. Although, there are new sources of income available to the rural households, mostly run by rich farmers. Income diversification is one of effective and valuable strategy to rural households to cope with weather shock. Since income diversification can reduce the impact of weather disasters, enhance the ability of computing and recovering from drought, make rural households' livelihood system more stable, and provide new idea for rural disaster management (Fentahun, 2018).

According to Atamanov & Berg (2012) rural household motive to participating in the non-farm economic activities due to incapability of agricultural sector to generate income, to smooth consumption, inefficient land size, market imperfection, and inability of cash flow. even though non-farm public employments have low return, but it is secure than agriculture sector.

Anyhow virtually-conclusive literature on the various roles played by the rural nonfarm economic activities (stated in the introduction). The literature on the determinants of participation in and intensity of RNFEA is yet undecided. Though coming up with different signs and magnitude, the majority household and individual level studies identified demographic (age, gender,education, dependency ratio, access to electricity and credit, household size, and etc. as the important determinants Shehu (2015);Koichi, Usami (2009) Atamanov & Van den Berg (2012); Ibekwe et al (2010); Zohonogo, (2011) Abdulai. A. and C. Delgado (1999) ; Abdulai & Delgado, 2010; Shehu, 2015) are elsewhere, and also Asfaw, Simane,

Hassen, & Bantider (2017); Bezu,et al (2012); Block & Webb, 2001; Lemi, 2006, 2009; Weldegebriel, 2017; Yirga, 2012) are studied Ethiopia.

For instance, Abdulai & Delgado.(2010) find that age and household size have positive effects on the participation of non-farm economic activity in Northern Ghana. Sanusi (2011) via using probit model for nonfarm participation and ordinary least square method for intensity. The Author finds access to credit(positive in the participation and negative in the intensity). Also find, for Nigeria, that age (positive) and household size (negative) and have significant effect on non-farm participation. While, these age and household size affect share of nonfarm income(intensity) in significant and insignificant respectively. Such dissimilar effects in participation and intensity are also evidenced by Usami, (2009) via using censored Tobit model in Bangladesh and Escobal, J. (2001) in Peru are elsewhere.

Also mixed results have observed in the study area. For instance, Lemi (2009) and Block & Webb (2001) in Ethiopia by using random effect model find that age has positive effect on the non-farm participation and intensity. While the same variable effects participation and intensity opposite sign and different size (Asfaw et al., 2017; Yirga, 2012). Meanwhile, Lemi (2009) find that Tropical livestock unit has negative effect in both participation and intensity. While, Weldegebriel (2017) via using Tobit and double hurdle model find that livestock ownership have negative effect on participation and positive effect on intensity.

Yirga (2012) by using pool probit for participation and Tobit for intensity, and Girma & Kumbi, (2006) via Heckman two step selection model find that the households head finished primary school have positive and negative effects in participation and intensity respectively, while Bezu et al.(2012) finds that households head finished primary school have negative effect on participation. On other hand, Lemi (2009) finds that land ownership have positive and negative effect participation and intensity correspondingly. Whereas, Asfaw et al (2017) find that the same variable has negative affect household nonfarm participation.

A limited study considered the determinants of off-farm income dynamics. For instance, Lemi (2006) analyzed via quantile regression through the dynamics of off-farm income intensity was the change of income intensity between 1994 and 1997 survey period, and Block & Webb, (2001) also analysis the dynamics of off-farm income and its determinants using LAD regression, they focus only on the drought and famine season.

As par, as the researcher's knowledge, in previous study there is inconclusive results were observed in participation and intensity. Thus, may be happen due to inappropriate methodology, types of data, and locational difference. This study fills those empirical and analytical gaps through incorporate the determinants of non-farm dynamics by using ESS data of waves 2013/14 and 2015/16 in rural Ethiopia to determine non-farm income diversification, intensity and dynamics.

In particular, the study seeks to answer the following research questions:

1. What are the non-farm economy intensity and its dynamics contributions in rural Ethiopia?
2. What factors affect participation and intensity of households in non-farm sector in rural Ethiopia?

1.3. Objective of the study

The main objective of the paper is to identify the determinants of non-farm income diversification in rural Ethiopia.

The specific objectives of the study are: -

1. To identify the contributions of non-farm economy intensity and its dynamics in rural Ethiopia.
2. To investigate the factors that affect households' decision to participate in and intensity of non-farm economy in rural Ethiopia.

1.4. Significant of the study

Ethiopian farmers are suffering from instability of income due to natural and socio-economic factors. Among the major reasons for the poor performance are diminishing, soil degradation, lack of credit facilities, imperfect agricultural markets and poor infrastructure, etc.

To overcome such problems farmers can use working nonfarm as a coping strategy. They have always combined farming enterprises with other complementary economic activities. etc. Ethiopia follows Agricultural Development Led Industrialization (ADLI) with the assumption that there is a linkage between farming and non-farming activities but the linkage is limited. Moreover, little empirical evidence exists on labor supply behavior of farm households in Ethiopia. Yet such information is crucial to any model of economic development formulated to serve as a useful policy prescribing apparatus. Hence the result of the study helps the government identify the different options for intervention if there is a need to make households diversify the ways in which they gain their livelihood. It will serve policy makers and planners to design appropriate rural development policies and strategies to improve the welfare of the farm household in Ethiopia.

Thus, this study will provide information for stakeholders, government and extension services on how to increase the productivity of the income diversification opportunities in non-farming sector and how to use rural non- farm sector as an instrument to reduce rural poverty, food security, and smoothing consumption.

1.5. Organization of the study

Besides this introductory chapter, the paper has the following chapters. Chapter two reviews the most relevant theoretical and empirical studies. Chapter three describes the research methods and conceptual framework of the study. Chapter four contains the results and discussion while chapter five contains conclusions and remarks.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Literature Review

2.1.1. Measurement Issues and Concepts

Several studies on rural income diversification are overwhelmed by vague definitions. Therefore, this sub-section deals with some conceptual issues to develop a common view. Even though, the purpose of this study is not to harmonize these ideas, it is better to clarify concepts related to rural household non-farm income diversification. To begin with measurement issues of income diversification, different kinds of literatures recommend different methods of measuring income diversification.

Studies make use of different terminologies and definitions to refer to rural nonfarm economic activities (RNFE). Terms such as ‘nonfarm’, ‘off-farm’ and ‘non-agricultural’, are used to explain perhaps similar types of activities. Though the term ‘nonfarm’ is used in this paper, no distinction is made between those terms.

Following (Atamanov & Van den Berg, 2012; Evier, Lanjouw, & Lanjouw, 2001; Yirga, 2012), the current study considers rural nonfarm economic activities are all economic activities in rural areas except primary activities crop and livestock production, fishing and hunting. The types of RNFA rural dwellers could get income from and/or complement their agricultural incomes in Ethiopia are quite heterogeneous and may generally of wage employment and self-employments. Woldehanna (2002) identified such wage employment activities as paid community development work or food-for-work, farm work and manual work in construction, masonry and carpentry; and self-employment activities like small trading, transporting goods by pack animals, selling fuel-wood, making charcoal, selling fruits, making pottery and handicrafts and stone mining. In many instances, it is observed RNFA in Ethiopia are highly related with the agricultural sector.

Barrett et al (2001) income-based mechanisms are used as a measure of income diversification. The assumption of this mechanism is that the higher the share of non-farm income the higher income diversification of the household and the less exposure of the household to various idiosyncratic and covariate shocks. Therefore, the share of non-farm income is used as a measure of income diversification. A second approach is a time-based approach. The share of time spent on different activities such as time spent on farm or nonfarm are used as the measure. In this assumption, if the rural household spends more of its time on non-farm income generating activities, then there is more probability of income diversification (Nghiem, 2010). Due to lack appropriate time spent data this study uses the income as the measurement of non-farm diversification.

Livelihood diversification is the process in which the rural household build a diverse portfolio of activities, and social and financial support capabilities in their struggle for survival and in order to better living standard. So, Livelihood is more than income. Income refers to the cash earnings of the rural household and payments in kind that can be decided at market prices. In rural area the cash part of income comprises livestock sales, wages, rents and remittances. On the other hand, the in-kind part of income implies the farm produce which is consumed by the house hold, payment in kind such as food, and transfers of exchange of consumption items which is done between the rural households (Ellis 1998).

The rural nonfarm economy includes all rural economic activity outside of agriculture. It includes: - self-employment, wage employment, full-time, part-time, formal, informal, seasonal, and usually irregular intervals production. Note that nonfarm activity may take place at home, in factories or by place to place works. It includes small and largescale activities of widely varying technological. This diverse collection of seasonal trading, household-based and large-scale agro processing, manufacturing and service activities plays a crucial role in sustaining rural populations, in servicing a growing and modern agriculture, and in supplying local consumer goods and services.

In rural areas the scarcity of land prevails, rural nonfarm activity offers as the major economic alternatives for the rural poor. The non-farm economy is offers opportunities for the rural poor as well as the rich. Poor rural households frequently seek economic refuge through

distress diversification into low-skill nonfarm activities such as basket making, weaving, pottery, small-scale retailing and seasonal labor migration (Haggblade, 2013).

Davis, (2006) non-farm income can come from both agricultural core activities and non-farm agricultural employment. The households generate their income from three major sources: from on-farm employment; non-farm enterprises; and income from the remittance. We can differentiate between income diversification and enterprise. Enterprise diversification activity is a part of both farm and non-farm business activities outside of agricultural core activities. Income diversification is something broader these two parts plus any movement towards non-farm employment. Finally, the third source of revenue is unearned income (such as pensions, dividends and interest), which – while usually ignored can be very substantial in certain cases, and decisions made in this activity may have an important interconnection on such important choices as the time of retirement and intensity of farming.

Also, according to Bryceson, (1996) livelihood comprises both parts of income; cash and in kind, social institutions such as family, kin, village and so on, and property rights that are required to facilitate the standard of living in the rural area. These networks; social and kinship networks are important for smoothing the process of diverse income portfolios.

Similarly, diversity is different from diversification. Income diversity refers to income composition of the rural household at a given time and diversification implies an active social process in which the rural household is observed to participate in portfolios of activities over time (Reardon 1997). Ellis, (2000) articulate income diversification as increasing the range of income generating activities outside farm operations by allocating existing household resource to such activities. The rural households expand its income generating activities in order to increase farm income or cope fluctuating income and consumption of the household.

2.1.2. Motives and Determinants of non-Farm Diversification

2.1.2.1. Push and pull factors of non-farm diversification

Rural households in developing countries engaged in household diversifications due to two main motives such as: pull and push factor. In the under-poverty line areas, the farm households make a choice between on-farm and non-farm through opportunities of rural non-farm economy, taking

into consideration the wage differential between the on-farm and nonfarm sectors and the riskiness of each type of employment.

Rising incomes and opportunities on-farm should reduce the supply of non-farm labour, although this is often a dynamic process due to inter-regional migration. The main push factor that rural household participate in non-farm economy is; population growth, increasing scarcity of arable land, decreasing access fertile land, declining farm productivity and return of farming, lack of access to farm input market, temporary events and shocks, and financial constraint. On the other hand the pull factor such as higher return on labour and investment in rural farm economy, low risk in RNFE as compared to farm, way of cash-generating, economic opportunity, and living in urban for younger people(Davis, 2006)

2.1.2.2.Determinants of non-farm income diversification

Development researchers have focused on to identifying the determinants of vulnerability of sources of livelihood and intensification of livelihood among rural people. This has become much empirical studies of income and activity diversification, articulated various reasons why households simultaneously participate in more than one income earning activities (Reardon et al., 1992; Ellis, 2000).

Ellis (2000) identifies the six major determinants of non-farm participation decisions such as seasonality, risk, labor market, credit market, asset strategies and coping strategies. whereas Atamanov,(2011) using Kyrgyz Republic data shows that the major determinants of off farm income diversifications are individual characteristics (age, gender, marital status and education level), household characteristics (size of the household, dependency ratio, age, gender and education head of the household), household assets(the number of cattle and the size of owned land), location characteristics and access to infrastructure.

Bedemo, *et al.*(2013) studied factors determining the decisions to participate in off-farm work in western Ethiopia. The finding of their study shows that variables on household characteristics, access for credit and size of farm land are major determinants of decisions to participate in off-farm activities. They also noted the importance of off-farm income in reducing the problems of low agricultural productivity in the study area.

Zahonogo, (2011) also examined factors determining participation non-farm activities in Burkina Faso and results of his study indicate that participation in non-farm activities mainly related to farm income, technologies in farm production, age and education of the household head, the number of working individuals in the household and the amount of rainfall. Accordingly, income from farm activities was found to have a negative effect on participation in the non-farm activities; whereas, other variables were found to have positive effects on participation in non-farm activities.

Most studies in the area of non-agriculture business indicated that, demographic characteristic and financial and resource bases of the household are considered as main factors determining the decision of participation in non-farm activities. selected from 40 villages of Southeast Nigeria, Ibekwe et al, (2010) studied the determinates non-farm income diversification. Their findings show that age of the household, education level, farm size and hours spent on farm activities are the most significant variables determining both farm and non-farm income. Specially, the size of farm land is positively associated with farm income whereas negatively correlated with non-farm income.

This indicates that increases in the size of farm land increases farmers' willingness to operate in farm activities than participating in non-farm activities. This may further show the fact that small-sized farmers are driven out of farm businesses in the study areas. Besides, they also found positive association between household size and farm income and negative correlation between age of the household and non-farm income, implying less participation of older farmers in non-farm activities.

On his analysis on factors determining decisions to participate in off-farm activities in Ethiopia, Beyene, (2008) estimated separate models for male and female members of a given farm households. His result indicates that training on off-farm activities and health status of the participant has considerable impact on their participation in off-farm activities. Besides the human capital variables, access to credit and income transfers were also found to have positive impact on off-farm activity participation. Accordingly, trained farmers are more likely to participate in off-farm business. In addition, transfer income and credit have a positive effect on participation in off-farm activities. He also confirmed that female members of households are less likely to participate in off-farm activities because of cultural factors and influences of the household head.

Demeke mulate, (1997) using cross sectional data in one of the most impoverished regions of northern Ethiopia investigates the process of off farm activities. The study finds that farmers diversified in to various types of off farm activities such as traditional crafting, the sale of food and drinks, trading and engagement in wage employment. In this study area, off farm income accounts 59 percent of the total annual cash income of the respondents and off farm activities are viewed as survival strategies rather than as a remunerative source of livelihood. Furthermore, the major determinants of off farm income participation are personal attributes, farm income, farm attributes, food balance (defined as grain sales less grain purchase) and access to markets

2.1.3. Characteristics of the Rural Non-Farm Sector

The rural non-tradable goods and services are generally pictured as low productivity, low income occupations and therefore undesirable. Four general points on the rural non-farm sector in developing countries need to be made (Haggblade. et al, 2007). First, increased labor productivity is substantially due to increased capital input. Thus, the returns are divided between capital and labor. Second, labor markets generally work; when higher returns to labor in another sector are available labor will move (though female labor in Ethiopia is more constrained than is male labor). Third, lower return employment off farms is a first step to developing the skills for movement to higher return occupations.

Fourth, a substantial portion of rural non-farm jobs require education, albeit at lower levels, for example bus conductors, tutors for primary schooling, clerks in retail shops. Thus, jobs are made for the increasingly educated rural youth. Indeed, the elasticity of employment of educated people is elastic with respect to the growth rate of employment (Haggblade. et al 2007).

Production in the rural non-farm sector is highly elastic. That is because there is normally a large supply of underemployed labor, or because labor productivity at very low levels of productivity can be increased with little or no investment. That contrasts with agriculture, which because of the land constraint is inelastic in its supply. In agriculture, production is increased by technological change which shifts the production function. The demand for agricultural output is highly elastic because agricultural goods are tradable including on international markets. Of course, other sources of rural income increase may have a similar multiplier effect on the rural non-farm sector. They are however all very small compared to agriculture (John and Paul 2010).

2.2. Empirical Literature Review

2.2.1. Empirical literature review in Developing countries

The empirical evidence in developing countries suggests that the household diversifies in different livelihood strategies due to the farming inefficient to survival of their means of living. While the rural households are participating in the income diversification: for the smoothing consumptions, survive at shocks and risk period, credit and market failure, and labor allocation to problems. In developing countries in general and sub-Saharan countries, in particular, the households engaged in the no-farm sector ranging from 30-50 per cent due to continuous increasing of non-farm income diversification, and decrease the agriculture source of income. It is evidence that a household who diverse income sources have better living standard. However, a wealthier household have diverse more than poor. There are also pushing factors that makes the rural household engaged in livelihood diversification, for instance, farm output, income distribution and gender effects.(Ellis, 1999) .

Adams (2001) on his study at Egypt and Jordan, find that non- farm income has a greater impact on poverty and inequality. The poor receives almost 60 percent of their income from off farm source in Egypt where as in rural Jordan they receive less than 20 percent. Therefore, even though agriculture is the backbone of rural sub-Saharan Africa, off farm sources of income contribute significantly to overall income of rural households and it is very relevant in the poverty reduction strategies of these economies. As evidenced by Reardon et al. (1994) off farm income on average consists of 42% of the total rural household income in Africa, 32% in Asia and 40% in Latin America.

In the developing countries, the contribution of the non-farm sector is viewed as less productive and producing a low quality output, so the government rely on the other sector than non-farm, but the non-farm sector contributing in the national income growth, and narrow income equality through absorbing the labor force and reducing rural urban migration. In many developing countries the mass of populations lives in the rural area and depends on agriculture, but the sector doesn't absorb the labor force of the population. Hence, The expand non-farm sector through providing of advanced technology is important.(Evier et al., 2001).

Koichi, Usami, (2009) study the determinates of non-farm in Village of Bangladesh via Gini coefficient and Censored Tobit model to identify the role of non-farm on equality and determinates of non-farm sector respectively. The Authors' identify the factor variables: - education, transfer income, access to credit, male and woman worker, landholding, gender and age of the as the determinates of non-farm sector. They find that the male household headed education is significant and positive higher wage employment of non-farm income where as poor land household have more likely to earn income from low wage employment due to the financial constraint.

There are variables such as access to organization, access to formal credit, number of commercial banks, micro finance, and income transfer is not significant impact on the non-farm sector. However, the Authors' only deal about the income from the non-fam sector and its role on the income inequality but they didn't study the probability of participating in the sector.

Using Taiwanese national survey on rice farmers, Chang & Wen (2011) studied the differences in production, efficiency and risks among farmers with and without off-farm income. They estimated separate stochastic production functions for each group of farmers. Their result indicates differential relationships between off-farm incomes and technical efficiency of farmers. For instance, they found an increasing impact of off-farm income on technical efficiency for lower percentiles of the technical efficiency distribution. The authors also argue that lower scores in technical efficiency do not necessarily relate to participation in off-farm activities because of differences in the use of resources among the two groups of farmers. Accordingly, those farmers without off-farm activities were found to be more productive in the use of farm inputs than those with off-farm activities.

This implies that farmers without off-farm activities have better knowledge in use of farm inputs that emanates from their concentration on farm activities. The authors also argue that higher production risks are associated with farmers participating in off-farm activities.

The study in the Nigeria show that the important of the non-farm sector, and in what situation the household engaged in the sector. Sanusi (2011) study the effects of poverty on the non-farm activity in local government of Nigeria via Probit, and OLS regression model. The Autor's identify the determinates of non-farm activities through the participation and earning from the non-farm activities age, year of education, and urban residents is positive effect on participation while,

poverty status, access to credit, size of land, and distance from the markets are negative effects on the participation in the study area.

However, year of education, household asset, and poverty statistically significant and positive for the earning from non-farm activities, but age of the household, size of the land, and distance from the market are the statistically significant and negative to earning from non-farm activities. According Sanusi (2011) credit access, household size, experience, sex, and marital status are not statistical significant for the earning from non-farm activities.

Sanusi (2011) study has limitation in the model choice. The OLS model is biased and inconsistent in case where, the amount of income is truncated from the total income(Wooldridge, 2010). While, the participation and earning from the non-farm is not only determine in static, it is also dynamic one, the seasonality by itself matter the household engage in the participation of non-farm activities(Lemi, 2009).

Evidence from Kyrgyz Republic show that the participation and returns from the non-farm activities via Double hurdle and Heckman model through using the household budget survey in 2006 and 2006. The households are participating in the non-farm activities due to: - incapability of agricultural sector to generate the income, for the smooth consumption, inefficient land size, market imperfection, and inability of cash flow are the main push factors.

Non-farm public employments have low return, but it is secure than agriculture due to this reason the female headed more engaged on it. Education is also the important and positive determent for the household participate in non-farm sector. They categorized the non-farm employment into self, commercialized non-farm salaries and public employment, through determinate age, male headed, marital status, level of education, dependency ratio, household size, owned land number of livestock are factor variables that identified in the study.(Atamanov & Van den Berg, 2012).

Gibson & Olivia, (2010) study the effects of infrastructure access and quality on non-farm enterprise in the Indonesia via Probit model. They find that the infrastructure is the important factor for the household participate in the non-farm enterprise, as the household have access and quality of road the probability to participate in the sector is increase. The households have less probability

to participate in non-farm enterprise when they live in the low quality of road, lack of electricity, and the distance from the market.

Shehu,(2015) study the determinate of farmer participation in the non-farm sector in the rural Nigeria via Tobit regression through national representative level data of first wave in 2011 and finds that gender, education, marital status, health status, household size, and the infrastructure characteristics like closeness to the local market are the significant impact for the engagements of non-farm enterprises.

According to Shehu as the household manage their financial capital and access to social corporations, they tackle the barrier to participate in non-farm enterprises. This study has also some limitation, for instance it considered only the household participation in the enterprise as static, but the participation in non-farm is not only static, but also dynamics one. Tobit model used considered the zero censored value, but it considered household participate in enterprise and earn zero income. However, the household participating in the enterprise, they may earn zero outcome. (Greene, 2012.)

Evidence from Africa in general, and Ethiopia and Nigeria in particular indicate that the performance of non-farm enterprises is significant via spatial autocorrelation in Africa by using the ERSS and Nigeria General household survey in 2011 in Ethiopia and Nigeria respectively. They split the model in to three by starting from OLS, then lag spatial and spatial error in Ethiopia the education is important variable for the performance of non-farm enterprise, when the households are more educated they performed better in non-farm enterprise, also household near to asphalt road better preformed in non-farm enterprise than their counterpart.

Infrastructure is the important determinant for the performance of the non-farm sector in both countries. In general speaking, in developing countries in general and Africa in particular major populations are engaged in farm activities to improve their livelihood. Although they participating in the non-farm 40 per cent of household income. In Africa non-farm is important for generating income and poverty alleviation.(Owoo & Naudé, 2014).

2.2.2. Empirical evidence from Ethiopia

The agriculture sector is holding a largest portion of the Ethiopian economy, but it's productivity is low, poorly performed, and incapable to reducing the level of poverty for a long period of time due to these rural household diversifies their income for the long period.(Loening, Rijkers, & Söderbom). However Kassie, Kim, & Fellizarjr(2017) study the determine the probability that a farm household participates in non-agricultural income diversification activities in Ethiopia by using logit and seemingly unrelated regression (SUR) model. They find that government policies are only focused on on-farm through exclusions the ways of the household to improve their livelihood diversification: - participating in the non-farm and. off-farm activates.

Rural farming systems in Ethiopia are vulnerable to number of challenges, including continued population growth, urbanization, income inequalities, land degradation, highly degraded, rain fed declining farm size and productivity, uncertainty of climatic patterns (Chen et al., 2018). Most of the people living in the rural area are vulnerable for different types of risks like natural disaster, scarcity of irrigation water pump, non-availability of other income sources etc. Although, there are the new sources of income emerged to the rural households, mostly run by rich farmers. Income diversification is one effective and valuable strategy rural households to cope with weather shock since it can reduce the impact of weather disasters, enhance the ability of computing and recovering from drought, make rural households' livelihood system more stable, and provide new idea for rural disaster management (Fentahun, 2018)

Woldehanna (2002) examined the linkages between farm and non-farm activities in northern Ethiopia. His result indicates that non-farm income plays a vital role in reducing credit constraints of poor farmers. However, the impact of non-farm income on farm input was found negative due to unfavorable conditions in the study areas. The author also found that poor households and large families are more likely to participate in off-farm activities than rich households and small sized families. In general, the findings of his study indicate that non-farm income has a positive and significant effect on investments in equipment, livestock and buildings, whereas negative effects on improved seeds and fertilizer.

Many of the previous studies in rural Ethiopia Demeke & Jayne, (1998), Damena & Habte, (2017), Woldehanna, (2000), Tesfaye(2008), Gemechu, (2014) agreed that the number of poor people in rural areas of Ethiopia exceed the capacity of agriculture to provide sustainable livelihood opportunities. Even with a decline of fertility rates, and a slowing down of population growth, this situation is believed not to change significantly. Whilst there is a potential for out-migration, urban centers cannot be assumed to be capable of providing adequate livelihood opportunities.

Gemechu, (2014) using the study data from the 2009 Ethiopian rural household survey collected by International Food Policy Research Institute researched the relationship between off-farm income and technical efficiency of smallholder's farmers in Ethiopia. Thus, empirical results show that size of farm land, household size, off-farm income, gender and education of the household head are the most significant variables determining the value of farm output.

The average technical efficiency of farmers is only 53 percent, implying the existence of wider scope for improvement of their efficiency. In addition, maximum likelihood estimation result indicates that household size, education of the head, soil conservation, extension services and off-farm income are major factors for differences in technical efficiency among farmers. Particularly, the effect of off-farm income on farm output and technical efficiency is positive showing the spillover effects of income from off-farm activities on farm productions. And he suggests that policy makers should focus on increasing opportunities and access of off-farm activities to enhance production, productivity and overall wellbeing of the rural societies.

The Authors' used the uniquely matched household, enterprise and community survey data from four major regions in rural Ethiopia to characterize the performance, constraints and opportunities of nonfarm enterprises. They found that the rural households are more engaged in non-farm sector at the season of low agricultural and the woman participate more in such economic activities.

Bezu (2010) the Author uses the Ethiopia rural household survey panel data for only the aged greater than 15 through excluding the disable who are not participate non-farm activates they found that the education and women headed is the most important factor to engage in sector especially skilled and unskilled respectively. The author used only the household above greater than 15 this may be excluded the children who participate in nonfarm economic activities.

Weldegebriel(2017) investigates the determinants and returns to participate in non-farm diversification using the Ethiopian Rural Household Survey (ERHS) of the 2011/4 and 2013/14 waves by using Tobit and Double hurdle model through distinguishing the activates of off-farm and non-farm. The determine of non-farm diversification are: - education, household size, consumption, and asset holdings implies that the rich households are more participate in non-farm activates.

Using 1994, 1999 and 2004 surveys data to compute two growth rates over five years in Ethiopia to study the nonfarm economy offer pathways for upward mobility. The study find that the household consumption expenditure increase the initial participation of the non-farm, the wealthier, human and physical capital households are determinates for the non-farm income diversification. (Bezu, et al. 2012).

Lemi(2009) studied both participation and intensity of diversification using the Ethiopian Rural Household Survey (ERHS) during 1994 and 1997 via using Panel Tobit and Random effect estimations. According to the Author the participation is affected demographic factor, but the intensity is affected not only the demographic factor, but also other factor such as size of land holdings, value of livestock owned and crop production as well as cash income from crop production. And also, the Author find that the number of female family members, high risk situation and age of household head are increases participation of the diversification. However, increments of crop production and sale of part of production during the main harvest season results households to engage less in the diversification of the non-agriculture than low crop producer households. The authors detect the endogeneity problem via using with and without crop income estimations.

According (Kassie et al., 2017; Tizazu, Ayele, & Ogato, 2018; Yirga, 2012) the empirical study in the household livelihood in the Amhara reginal state, shows that socio-economic and demographical factories affect the household to participate in the different livelihood strategies.

Yirga, (2012) study the effects of poverty on the participation and share of non-farm sector earning in selected area of Amhara regional state by using panel data analysis, data from the Ethiopia socio-economic survey through Probit and censor-Tobit regression, indicates that the average

share of income through participating in non-farm is high for the household under poverty line, and the poverty is important factor for the households to engaged in the non-farm sector.

Damena & Habte, (2017).; Girma & Kumbi, (2006) studied the effects of non-farm on the household livelihood, and the poverty and the non-farm economy with related to the inequality in Oromia, Ethiopia respectively. Damena & Habte, (2017) study the effects of non-farm income on the household livelihood using crosssectional data in the oromiya region through probit and Heckman two step selection model to identify the participation and earning amount of the household in the non-farm sector, indicates that age, family size, credit, livestock holding, education ,marital status , distance to market and main road are the most important variable to participate in non-farm economy, while the non-farm sector is the one means of livelihood in the Oromia region.

Carswell, (2002) study livelihood diversification in southern part of Ethiopia in the adult household. The study finds that the woman households are more diversify and more generate income from the diversification activities than male, while the non-farm and off-farm income more contribution for the poor household. Trading and laborer are the major the latter people worked as laborer's as part of a set of arrangements that enabled them to gain access to key resources.

According to Girma & Kumbi, (2006) the non-farm economy increase equality and reduce the level of poverty. Damena & Habte used the heckman two stege selection model, But the heckman model doesn't conceder the corner solution at the secound stage or it conseder zero earning income as non-participante, but in the real world the household may engage in non-farm, but earned zero income in this case the model (Greene, 2012.).

Astatike & Gazuma, (2019; Gashe, 2016; Nasir, 2014; Yona & Mathewos, 2017) , the two former Autors' study the determinates of non-farm and the latter study the impacts of the non-farm economy in the southern parts of the Ethiopia through cross-sectional data set.

According to Astatike & Gazuma, (2019) the off-farm economy is positive and significant effect on the income of the household with the help of heckman two step selection model. Hence the off-farm economy is one of cricual opportunities for the households to improve their income.

Empirical evidence from in Ethiopia that study only author (Bezu, 2010; Block & Webb, 2001) examined dynamics of income diversification. Block & Webb, (2001) estimated LAD regression of changes in the crop share of income between 1989 and 1994. The regressors included are perceptions about risk factors, initial income and diversification index. Their results suggest that those who believe less off-farm income to be associated with high risk diversified more over time

2.3. Summary of previous research findings

Generally, the empirical study in the non-farm sector is categorized into two the first one is the impacts of non-farm on the household welfare, livelihood food security, and inequality and the second one is the determinates of non-farm sector. For instance, (Astatike & Gazuma, 2019; Bezu, 2010; Gashe, 2016; Koichi, Usami, 2009; Adugna Lemi, 2009; Nasir, 2014; Shehu, 2015; Weldegebriel, 2017; Yirga, 2012; Yona & Mathewos, 2017) are study the determinates of non-farm sector with socio-economic and community variable, while Astatike & Gazuma, (2019 Damena & Habte.; Girma & Kumbi, (2006) Nasir, M. and B. H. (2014). are study the impacts of non-farm economy.

The empirical study in developing countries in general and Ethiopia in particular identify the determinates the household character such age, household size, education, dependency ratio, gender, household asset, poverty, land holding, and the community variable such as access to asphalt, nearest to market are the important determinant variable for the non-farm sector. However, there is no agreement on the sign of those variable.

For instance Lemi,(2009) study the determinates income diversification in Ethiopia, find that dependency ratio is negative effect diversification, but Bezu finds negative. And also, Girma & Kumbi, (2006) studied in the oromia region, find elementary school and non-farm activity is positive correlated, but Bezu finds negative. There is inconclusive idea, this implies that there is no common agreement on those variable this may occur due to the appropriate selection of econometrics model and other factor variable the purpose of this study is identify the determinates and intensity of non-farm diversification in Ethiopia. Panel Probit and Tobit models were used to estimate participation and intensity. Whereas, quantile regression for the intensity dynamics by using second and third waves of Ethiopia Socioeconomic survey

Summary of previous studies

Author, year	Country	Methods	Significant variables
Lemi,(2009)	Ethiopia	Heckman and Standard Tobit	crop income, region dummy, Female headed, dependency ratio
Sendaza (2012)	Ghana	Poisson regression and censored Tobit	Age, education, access to credit and electricity, and market
Yirga ,(2012)	Amhara, Ethiopia	Probit and Censored Tobit	age, household size, poverty, shock
Girma & Kumbi, (2006)	Oromia, Ethiopia	Multivariate Probit	education, household size, age, male headed
Astatike & Gazuma, (2019)	South, Ethiopia	heckman two step	Age, education, gender
Weldegebriel, (2017)	Ethiopia	Tobit and DHM	Market, wealth categories, household size age, access to credit, female headed
Bezu, (2010)	Ethiopia	Random effects regression	Land owned, poverty, distance to town
Koichi, Usami, (2009)	Bangladesh	Geni coefficient and Tobit	education, transfer, access to credit ,male and woman worker, landholding
Escobal (2001)	Peru	Tobit double-censored estimations	access to credit, and roads education

CHAPTER THREE

METHODOLOGY OF THE STUDY

3Theoretical model

The theoretical model for this analysis were starting from the theory of agriculture household model. There are two important roles of this model, those are consumer and producer. In the case of prefect market household choice between the income activities and price within given resource. To maximize their level of utility by choosing between different levels of consumption and leisure given profits (Atamanov & Van den Berg, 2012). But in the case of imperfect market the production and consumption are non-separable. This shows that household maximize their utility depend on the market access, technology and price.(De, Janvry, Sadoulet, Janvry, & Sadoulet, 1996).

The agriculture household model indicates the system of demand and supply function that formulate the allocation of labor decision between agriculture and non-farm activates. The labor allocation to non-farm activates are depends on the incentives and constraints. According to Barrett et al, (2000) the incentives of the household is the level and variability of wage and price for both of non-farm and farm activates.

The price of the activates may differ due to variety of market access, asset endowment and human capital this depends on the household capability to diverse into non-farm economy. The main determinates of the household diverse into non-farm activates are: age, education, household size, asset enduements, access to credit, and other environment and financial capital. With fixed amount of farm assets (land and infrastructure) and household labour time, a household compares the returns and chooses between allocating more labor time to farm work and investing in to non-farm activities.

In practice, the rural livelihood model holds that household makes decisions regarding livelihood diversification subject to different endowments of natural capital (land, water, trees), physical capital (irrigation canals, implements, roads), human capital (education, skills, health), financial capital (income, savings, cattle) and social capital (member of eqqub,). This mainly occurs in regions where successful agricultural; mining and tourism activities make local economies dynamic. The push factors, on the other hand, are income risks resulting from a number of factors, among them climatic risks, scarcity of land and market failures,

2.4. Conceptual framework of the paper

There two important approaches in the livelihood literature:- The first one is household economic mode (Ademan, 2003). Diversification is seen as a function of returns to labour from farm activities compared to off-farm activities. But the household economic models have been criticized due to the exclusion of taking the inter-temporal dimensions of livelihoods into account and for failing to capture survival strategies of livelihoods under stress Ellis (200).

The second one is sustainable livelihood approach on the other hand, takes a more people-centered view on the study of rural livelihoods in different contexts, even under stress. The approach has been widely used in empirical studies of livelihood strategies and adaptation (Ellis 200). The frame work of this paper was designed through the sustainable livelihood approach because the non-farm activities are one part of household livelihood.

Sustainable livelihood analysis defined in terms of the ability of a social unit to enhance its assets and capabilities in the face of shocks and stresses over time. SLA first seeks to identify the important assets in livelihood, their trends over time and space as well as the nature and impacts of shocks and stresses (environmental, economic and social) upon these assets (Morse, Mcnamara, & Acholo, 2009).

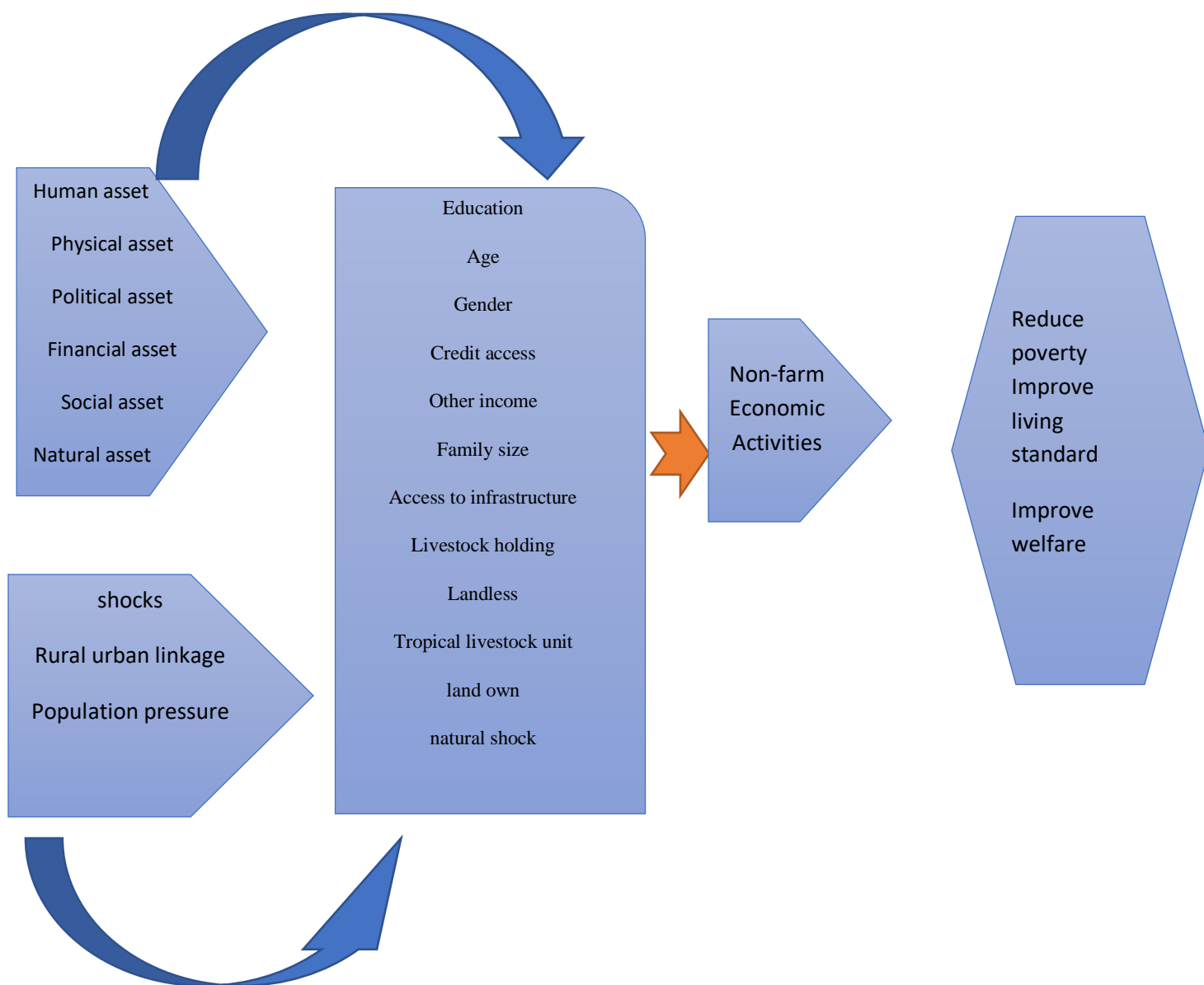


Figure 1. Conceptual framework for the determinants of non-farm income diversification activities.

2.5.Data types and source

The data source for this study are secondary obtained from rural sub-sample of the Ethiopian Socioeconomic Survey (ESS) 2013/14 and 2015/16) which is nationally representative. It was generated with a collaborative project between the Central Statistical Agency (CSA) of Ethiopia

and the World Bank's Living Standards Measurements Study. It covered all regional states. The 2013/14 and 2015/16 surveys collect panel data from rural households as well as small, medium and large town households.

The survey instrument was a questionnaire designed for collecting data at different levels: household, community, agricultural, and non-farm enterprises. The primary sampling unit of the survey was households for the household questionnaire and it was drawn from a population frame that included small and medium, and large town areas in Ethiopia.

For details of sampling procedure, sampling frame, sample size determination, and data quality refer to Ethiopia Socioeconomic Survey (ESS) Wave two and Three 2013/14 and 2015/2016 respectively. The household income aggregate of ESS by FAO's Rural Income Generating Activities (RIGA) project and community based ESS by Rural Livelihoods Information System are used in this study. Nominal income is affected by inflation, and it doesn't reflect the real living standard of household due to this reason, we adjust nominal income through deflator of 2014 and 2016 wave two and three respectively data collected year.

2.6. Methods of data analysis

The analysis of data requires a number of closely related operations such as establishment of categories, the application of these categories to raw data through coding, tabulation, and then drawing statistical inferences. Different types of analytical methods were used to evaluate the studies result and make a sound conclusion for a given survey information. Accordingly, in the study descriptive and econometric models were used. The statistical analysis that will be employed for this study includes descriptive statistics such as mean, frequencies and percentages. Moreover, to test the statistical significance of the variables, t-test and chi2 test were used via using Stata 16 version.

2.6.1. Model specification

When the dependent variable jointly, for instance, participation and share of nonfarm income the appropriate model is double hurdle model. Cragg's specification of the double hurdle model, a number of studies have relaxed the independent error term assumption and opted for specification

of the model with a correlation coefficient of ρ leading to a double hurdle model with dependent error terms.

The choice of explanatory variable to include in each stage of the model tends to be challenging as noted by a number of previous studies who have argued that there is no standard procedure to be followed in variable inclusion and exclusion in each hurdle.

The choice of explanatory variables for the participation and size of non-farm equations in double-hurdle model involves some difficulty since the model is not grounded within any formal choice theory (Pudney, 1989). As a result, there is no theoretical guidance regarding equation specifications for the DHM. Despite this apparent shortcoming of the model, however, some authors have come up with practical ways to identifying parameters.

For instance, Pudney (1989) takes the first-stage or participation hurdle as being primarily affected by non-economic factors than by economic variables such as levels of prices and income. Thus, income and related variables can be excluded from the first hurdle or participation equation. propose imposing exclusion restrictions in DHM since the inclusion of the same regressors in both hurdles can make parameter identification difficult. Cameron and Trivedi (2010) also suggest exclusion restrictions with strong justification for imposing the restriction for more robust identification.

Moreover, adopting the incentives and constrains approach to non-farm diversification, this study reiterates the argument by Reardon et al. (2007) about how these incentives and constraints create paradoxes at the meso and micro-level. This argument indicates the possibility that the same variable that relate to a community or household's characteristics may increase or decrease participation or returns from non-farm activities. Due to this reason we fail to use DHM.

When a data is continuous and censored to zero, we can use Tobit model. The household or individual may participate in non-farm activities due to different factor such in a case of illness, drought, declining of crop production, and other push and pull factors and may earn no outcome, but improve their living standard or detecting the uncertainty for short period of time.

Therefore, in first step, the panel binary Probit model estimates the household decision whether participate to non-farm sector or not. If the household participate in the non-farm activities, they

pass the first stage and estimated in a panel censored Tobit model and this estimate the level of household earning from the non-farm sector, and the model considered the zero value as participant. Finally, the researcher was used the intensity dynamics of non-farm economy via quantile regression.

Model 1: Nonfarm Economic participation and Intensity Model

In the first stage, identify determinates of whether to participate or not in non-farm economy activities through maximum likelihood estimator of binary Probit regression, and in the second stage the maximum likelihood estimator of the intensity (share of nonfarm income) amount is estimated through panel censored Tobit regression. The main advantage of the estimators was to estimate the decision and intensity separately. When the individual decided to participate in the non-farm economy, they may earn some amount from the sector.

In this case, the first-stage refers to the participation decision and the second stage refers to the rate of participation, which is likely to increase the return or share of income earned from participating in non-farm activities

According to Wooldridge (2010), both Probit estimation methods were non-linear estimation techniques which makes it difficult to interpret the raw coefficients of the estimation results. To make interpretation easier, marginal effects were reported where Probit estimation was employed. Columns labeled as marginal report, the response of households for marginal changes in the explanatory variables that is predicted probabilities. Marginal responses for dummy explanatory variables in front of them shows the marginal effects as the dummy variables change from 0 to 1. Some dummy explanatory variables, predicted probabilities are also computed to see the role of these variables in affecting the probability of participation in nonfarm income activities.

The model specification is formed from the pair of latent variables designed to show the utility household derived from of participation NFE and the utility household derived from intensity of NFE (Greene, 2012). The model contains the two equation states as follow:

y_{it}^* is for the determinates of participation decision in RNFE through probit estimation and y_{it}^{**} implies the level of intensity form RNFE through censored Tobit regression

1. Participation equation is estimated through maximum likelihood estimator of panel Probit model

$$\begin{aligned} \text{Pro}[y_{it}^* > 0] &= \varphi(x_{it} \gamma) + U_{it} & \text{dit} &= 1 \text{ if } y_{it}^* > 0 \\ \text{Pro}[y_{it}^* \leq 0] &= 1 - \varphi(x_{it} \gamma) + U_{it} & \text{dit} &= 0 \text{ if } y_{it}^* \leq 0. \\ U_{it} &\sim N(0, 1) \end{aligned}$$

The response variable y_{it} indicate that, if the y_{it} is 1, the household decide to participate in the NFE and 0 otherwise through probit estimation.

2. Intensity equation is estimated through Censored Tobit regression model.

$$E[y_{it}/d_{it}=1] = x_{it}\beta + \delta\mu_{it} + \varepsilon_{it}$$

x_{it} is the explanatory variable of the model.

where the errors ε_{it} and U_{it} are assumed to be independently distributed. In contrast to the 1 due to this reason we estimate probit model for participation and Tobit for share of nonfarm income.

The important note that all required econometric test such as appropriateness tests of pool Tobit vs panel Tobit, and pool probit and panel probit, justified for relevance of the model through maximum likelihood test.

Model 2: Dynamics of non-farm intensity between 2013/2014 and 2015/2016

According to Lemi (2006) the dynamics of off-farm income intensity is the change of income intensity between 1994 and 1997 survey period by using Quantile Regression . Block & Webb, (2001) and also analysis the dynamics of off-farm income and its determinants using LAD regression, they focus on the drought and famine area. Generally, those empirical evidence analysis the dynamics of income share of off-farm income, but this study focusses on the dynamics of non-farm intensity by using ESS data of Ethiopia representative data between 2013/14 and 2015/16 via Quantile Regression, the selection of this estimation, in change of intensity case there may be negative value the Tobit model doesn't consider this value.

Quantile regression is different from the standard OLS model in that the latter is based on the mean and deviations from the mean to calculate the sum of squared errors. Quantile regression is based on median (and other percentiles too) to calculate squared deviations and seems appropriate for such survey data. The other reason for the choice of quantile regression is that, unlike the case in OLS, there is no need to impose the normality assumption of error term (Koenker & Hallock, 2001). For these reasons, quantile regression is used the dynamic models.

$$QR = \frac{\text{Non-farm income}}{\text{Total income}}_{2015/16} - \frac{\text{Non-farm income}}{\text{Total income}}_{2013/14} = \delta_i + x_i\beta + \varepsilon_i$$

Where x_i is the vector of explanatory variables and ε_i is the error term

2.6.2. Hypothesis and variable descriptions

Based on the theory and the empirical studies, the endogenous variable in this study are the determinant of non-farm work participation, intensity, and intensity dynamics of the rural household such as:

Non-farm work participation: is the dependent variable, 1 if the household participate in any of non-farm activities and 0 otherwise.

Non-farm intensity: is the income share of non-farm from total income of the household

Intensity dynamics: is the change of the non-farm intensity between 2013/14 and 2015/16

Female headed: - This dummy variable represents the gender composition between male and female among household members. The value of the variable is 1 if the household head is female than male, 0 if the household head is male. The estimated sign is expected to be positive or negative, which will show that women are more probability to participate in non-farm work. Household headed households are generally expected to increase/decrease their participation in non-farm

earning activities given the rigid and patriarchal agricultural division of labour that limits women's employability in farming rural Ethiopia.

Age of the household head: - it is a continuous variable of households in years. Life – cycle effect on participation in non-farm work. The variable predicted parameter is it will have negative sign to indicate that after a certain age the tendency to participate in non-farm work will decline. Age can have both negative and positive effects on non-farm diversification. This is because as the head or an active member of the household gets older, he or she is likely to be less active. Thus, having more active household members within the economically productive age group (i.e. between 15 and 64) is likely to increase a household's participation into non-farm income generating activities.

Primary school: is one of human capital, 1 if the household head attended any primary education and 0 otherwise, and it is expected to have negative or positive effect on the non-farm economy activities.

Secondary education: 1 if the household head attended any secondary education and 0 otherwise, and expected positive or negative effect on non-farm economy

Other income of the household -This shows that incomes from non- labor activities. The expected sign of the parameter is positive.

Family size of the household- This is the continuous variable which shows the family size of the households. The expected parameter sign is positive. The farm household family size is high expected to be more probability participating in non-farm economy activity.

Availability of credit -This dummy variable is yes/ No, which shows the availability of credit to the farm households. The value of the variable will be 1 if the farm households get the access to credit and 0 when the farm household is otherwise. The expected sign of the parameter is positive. The probability of participating in non-farm economy is more when the households get more access to credit service.

Poverty status household - this is the categorical variable represent the living standard of the rural households. Income/expenditure used to identify whether the household is poor, medium or rich. 1 if the households are poor or low income/expenditure, 2 if the households are rich or high in income/expenditure and 0 the households are medium income/expenditure. The expected sign

will be positive that assume the poor less likely to participate in non-farm working activity as compare to the wealthier one.

Access to electricity: is one of dummy variable, 1 if the households are access to electricity and 0 otherwise. And expected positive effect on the non-farm economy.

Head married: a dummy variable that takes a value “1” and “0” for married and un- married respectively. It expects to that married one was more/less participate in those in non-farm economy.

Livestock holding: Livestock holding is central in smallholder agriculture systems as source of cash, a substitute for credit market and as a store of value. This variable represents the number of livestock owned by households in tropical livestock units (TLU). Livestock holding represents the wealth of the household. It is expected to negative to the NFE because when the household have more livestock the household more participate in the agriculture than NFE.

Land own is continuous variable the hectare of land owned via household

Landless is one of dummy variable, 1 if the households are landless and 0 otherwise. And expected positive effect on the non-farm economy activities.

Input price rise: rural household may face shock at the time harvesting season or in the any season this may affect the participation of the rural household non-farm economy, and expected to positive /negative relationship.

Natural shock: farm households have different degree of risk perception depending on their asset ownership and the degree of variability in weather/ drought condition. Farmers may respond to risk by diversifying farming activities or types of crops and/or by diversifying to other income generating activities. The variables are expected to positive to the non-farm economy because in the case of shock the households are probability to participate in the RNFE.

Food price fall shock: rural household may face that the food price decrement, which is negative or positive effect on the household participating in non-farm economic activities.

Head-ill: rural household may face the health illness, which is negatively affects the household participating and intensity the non-farm economic activities one has to also take into account the role of risk indicators as determinants of non-farm diversification. Thus, risk indicator variables in the form of exposure to shocks of both idiosyncratic (illness of a working household member)) are included in the models

Migrate: in the rural parts of Ethiopia the household may leave his/her original resident through migration this may affect the household participate in the non-farm economic activity negatively or positively.

Dependency ratio is household ratio of nonworking age (less than 15 and more than 64) to working-age people.

2.6.3. Diagnostic tests

Endogeneity test: Assuming exogenous regressors is unrealistic in many situations. This problem is occurred in case where the correlation between one of the explanatory variables and error term in the model. This situation is happened when there is measurement error, omitted variable and Simultaneity Bias. In this study the problem is happen through the suspicion of dependence between the resource of the household like the land ownership, poverty status, livestock unit and the like and the farm activates. The poor households can't engage both farm and non-farm activates at the same time (Adugna Lemi, 2009; Yirga, 2012). They suspected the problem through inclusion and exclusion of crop income and poverty uses the respective authors

According to Trung & Pham (2012), the main econometric problem to estimate the effects of non-farm is endogeneity. First, unobservable factors at the household level such as ability, culture, and parental characteristics that affect nonfarm activity might also affect poverty. Also, reverse causation from poverty to nonfarm activity is very likely. Poverty can affect the probability of participating in nonfarm activity, and the participation may help move out of poverty.

we use control function approach to address the endogeneity problem between nonfarm activity and poverty. We use five measures of community variable to instrument relative poverty status: transfer income, presence of health, microfinance institution, asphalt road, and primary school in community. The regression results indicate that there is existence of endogeneity problem. We

tackle the problem by incorporating the residual from the regression of the poverty status variable on the instruments and other control variables into the nonfarm participation and intensity equations.

To test Multicollinearity Problem variance inflation factor (VIF) will be used. VIF greater or equal to 10 is an indicator for the existence of serious problem of multicollinearity. Contingency coefficients will be calculated to see the degree of association between the dummy variables. Contingency coefficient is a chi-square-based measure of association. Due to multicollinearity Problem, we drop food price rise shock. and distance to road in participation and share dynamics respectively.

Heteroscedasticity test to be detected by using Breusch-Pagan test. But, for likelihood estimators it is difficult to test heteroskedasticity problem. Thus, we assumed the presence of heteroskedasticity and apply robust standard error during analysis to correct the problem.

Likelihood ratio test: used to comparison between panel and pooled estimation. Hence, rho is zero, the panel-level variance component is unimportant, and the panel estimator is not different from the pooled estimator. Therefor panel estimation is best than pooled one because rho is greater than zero.

CHAPTER FOUR

Results and discussion

4.1. Descriptive statistics

In this chapter, the descriptive and inferential statistics of the sample households in the rural Ethiopia of wave 2013/14 and 2015/16 are presented. Household's non-farm economic participation and non-participant rate of rural households through various determinant variables were presented through descriptive statistics for instance: - graphical and tubulation and also presented via econometrics estimations.

The factor that affect household participation and intensity in rural non-farm economy (RNFE) based up on previous studies (Astatike & Gazuma, 2019; Bezu, 2010; Gashe, 2016; Koichi, Usami, 2009; Adugna Lemi, 2009; Nasir, 2014; Shehu, 2015; Weldegebriel, 2017; Yirga, 2012; Yona & Mathewos, 2017).

They finds that socioeconomic and demographical variables (household size, head age, gender of a head, head primary school, and some collage education), location variables (market to town, distance to market, electricity access, distance to nearest asphalt road), financial variable: credit access, risk indicator variable (natural shock, food price increase and decrease shock, input price shock, head illness), asset variable (land holding, tropical livestock unit, landless) and region dummy were found to be the determinants of household participate in RNFE. While, those were presented in participation and intensity and dynamics.

4.1.1. Descriptive statistics for selected variables in study

The majorities of rural households were male-headed; only 24 and 25 percent of household were a female headed in 2014 and 2016 respectively. This implies female headed households are increase by one percent between both years. The age of household head on average 46 and 48 years in 2014 and 2016 respectively. This sample indicate that rural household life expectancy is increase between 2014 and 2016. On average, household have over 5 household sizes. Majority of the households were married which accounts 76 percent of the household head in the sample.

In the sampled from rural parts 41.6 and 34.6 percent of households are Orthodox and Muslim respectively. Majority of shock occurred has natural shock and its increased year to year followed by food price fall shock (see in table 4.1)

Household's average annual real income from non-farm activities is birr 1731.37 and 2416.64 in 2014 and 2016 respectively, in rural part income earned from nonfarm economy in 2014 is less than that of 2016. Real income from other income source is on average birr 309.9 and 83.38 in 2014 and 2016 respectively. This shows that income earned from non-farm economy has higher than that of income from other source.

The share of household income from nonfarm economic activities accounts 12 and 19.9 percent in 2014 and 2016 respectively. Share of nonfarm income in 2014 is less than that of 2016. Therefore, rural households participate in non-farm activities as a mechanism to smooth income or consumption and poverty reduction. On average, households have 3.22 and 2.63 tropical livestock unit in 2014 and 2016 respectively.

On average in the sample, the households owned 0.79 and 1.03 hectares of land in 2014 and 2016 respectively. Because the rapid growth of population, 11 and 6 percent of rural households are landless in 2014 and 2016 respectively. The sample drawn from rural par 23.78 and 22.4 of households are engaged in non-farm economic activity, and 12.7 and 30.34 percent of the rural households have access to electricity in 2014 and 2016 respectively.

The sample drawn from rural of SNNP is 25.4 percent and Amhara region are 21.2 followed by Oromia and Tigray regions which are 19.5, and 10.7 percent respectively, the remaining 23.2 percent of rural household drawn from other region. A rural household have 42.2 percent are poor, 36.8 are medium and only 21.1 percent are rich (see table 4.1 below).

Table 4. 1. Descriptive Statistics

Covariate	2014		2016	
	Mean	Standard dev	Mean	standard dev
Nonfarm participation rate	0.238	0.426	0.224	0.417
Share of nonfarm income	0.129	0.274	0.200	0.331
Nonfarm real income	1731.372	10309.330	2416.646	13107.450
Migrate	0.089	0.284	0.135	0.342
Household size	5.055	2.333	5.149	2.377
Age head	46.261	15.217	48.029	15.226
Head married	0.767	0.423	0.756	0.430
Orthodox	0.416	0.493	0.415	0.493
Muslim	0.346	0.476	0.346	0.476
Female Headed	0.248	0.432	0.252	0.434
Dependency ratio	0.946	0.918	1.125	0.952
Head primary school	0.270	0.444	0.272	0.445
Head college school	0.021	0.143	0.023	0.149
Head ill	0.276	0.447	0.147	0.354
Access to credit	0.281	0.449	0.246	0.431
Natural shock	0.187	0.390	0.412	0.492
Food price fall shock	0.029	0.169	0.039	0.193
Input price rise shock	0.077	0.267	0.149	0.356
Access to electricity	0.127	0.333	0.303	0.460
Landless	0.119	0.323	0.062	0.241
Tropical livestock unit	3.223	4.547	2.635	3.083
Land own	0.799	0.818	1.030	1.195
Tigray	0.107	0.309	0.107	0.309
Amhara	0.212	0.409	0.212	0.409
Oromia	0.195	0.396	0.195	0.396
SNNP	0.254	0.435	0.254	0.435
Other real income	309.918	1576.365	83.552	472.641

Source: Author's computation based on Ethiopian Socioeconomic Survey (ESS) 2014 and 2016 waves.

4.1.2. Rural nonfarm participant and non-participant households

We apply t-test and chi-square test in order to clear picture on the variable's household characteristics, financial constraints, and location and infrastructure characteristics which represent significantly vary between non-farm participant and non-participant groups. Table 4.2 shows mean difference of continuous variables for non-farm participant and non-participant groups.

On average household size from drawn samples are 4.9 and 5 are non-participant in 2014 and 2016 respectively. while, participants are 5.3 and 5.4 in 2014 and 2016 respectively. This implies household having high household sized are more participating in nonfarm economic activities, and dynamics effect between two period is 0.1. Therefore, larger household sized households were positive dynamics effect on nonfarm activities. household head for nonfarm activities nonparticipant sample are found older than participant (see table 4.2).

The mean of dependency ratio participates are .95 and 1.15 in 2014 and 2016 respectively. While, nonparticipants are .96 former and 1.117 latter one. Dependency ratio was a dynamics effect on nonfarm, its mean difference is approximately 1.2 for household's participant. Tropical livestock unit is one of continuous variable that significantly affect the non-farm economic activity.

The mean of tropical livestock unit in participate is 2.74 and 2.26 in 2014 and 2016 respectively. While, nonparticipants are 3.37 in former and 2.71 in latter one. The finding shows that mean difference between the non-farm economic activities participant and non-participant groups. Household having High number of livestock are less participants in nonfarm economic activities.

The table below shows that mean difference between the non-farm activities participant and non-participant groups is significant, and household having high land owned are less participants in nonfarm economic activities. Because, household having more livestock unit and land owned are more invest their time in agriculture than nonfarm due to this reason household having land owned and tropical livestock are less participating in nonfarm economic activities.

Table 4. 2. Continuous variables for non-farm income diversification participants and non-participants.

	2014			2016		
	Non-participant	participant		Non-participant	participant	
Variables	mean	mean	Difference	mean	mean	Difference
Household size	4.96	5.35	-0.39 (-0.097)***	5.07	5.39	-0.31 (0.10)***
Age head	47.21	43.21	3.99 (-0.636)***	48.92	44.91	4.01 (0.65)***
dependency ratio	0.95	0.90	0.05 (0.03)**	1.11	1.15	-0.03 (0.04)
Tropical livestock unit	3.37	2.74	0.62 (0.19)**	2.74	2.26	0.48 (0.13)***
land owned	0.83	0.71	0.12 (0.03)	1.04	0.97	0.07 (0.05)
other income	348.64	535.81	-187.17 (82.88)	125.31	115.93	9.39 (29.79)**

Source: Author's computation based on Ethiopian Socioeconomic Survey (ESS) 2014 and 2016 Waves. **Note:** S.E is standard error. *, **, *** show significance at 10%, 5%, 1% levels respectively. Standard errors in parentheses

Gender of the household head is one of the discrete variables that significantly affect non-farm economic activities. From the total sample in rural households, 21.67 and 20.84 percent of households are participants in rural non-farm economy (RNFE) in 2014 and 2014 respectively. Female headed households are less participant than male headed household (see table 4.3).

From Table 4.3, out of total sample in rural households, 32.48 and 28.54 percent finished primary level educated households are participants in nonfarm economic activities in 2014 and 216 year respectively. whereas 6.49 and 18.99 percent college school households are participant in nonfarm economic activities in year of 2014 and 2016 respectively. The finding shows that as an education level increase household participant rate is decreasing. For instance, household college schooling is less participant than primary schooling. The finding shows that the primary schooled household heads are more participating in non-farm economic activities, and chi-square result indicates that, the education level of the household heads was statistically significant.

Form total sample drawn, 25.31 and 29.4 percent participant households are access to credit in 2014 and 2016 respectively. This shows that the household's access to credit were more participant than the noncredit access. The credit user households were more participate in nonfarm activities. Because access to credit helps to start own business (self-employment) for rural households. The finding shows that access to credit increase participation rate of household (see table 4.3).

The result shows that out of total sample from rural household 37.38 and 28.37 percent of participants households have electricity access in year of 2014 and 2016 respectively. The chi-square result indicates that, household heads electricity access is statistically significant. This shows that the household's access to electricity are more participating in RNFE than the electricity non user specially in 2014 year.

From table 4.3, out of the total sample in rural households, 23.4 and 23.74 percent of the participants households are landless in year of 2014 and 2016 respectively. 16.57 and 20.64 percent of participants are from Tigray in year of 2014 and 2016 respectively. Nonfarm economic activities participation rate in rural area declined from its 24 percent in 2014 to 22 percent in 2016, with significant variation across regions.

For instance, in Oromia region participation rate dropped from almost 22 percent to 18 percent, in SNNP region participation dropped from 27 percent to 23 percent whereas in Amhara region, participation rate remained almost constant over the two years period (see Table 4.3). The difficulty of access to nonfarm activities outside of farmers' residential locality were manifested by the fact that, during both survey years. In this context household participation in nonfarm activities were dynamics affected by regional dummies.

Lastly, based on their consumption expenditure we categorized household poverty status into three which is poor, medium, and rich. 22.54, 24.73, and 24.93 of poor, medium, and rich households are participant in 2014 year respectively. whereas, 19.84, 23.8, and 25.69 of poor, medium, and rich households are participant in 2016 respectively. Overall, in both year rich households are more participating in nonfarm economic activities because they have initial capital to start new nonfarm business.

Table 4.3. Discrete variables that vary between non-farm participant and non-participant groups

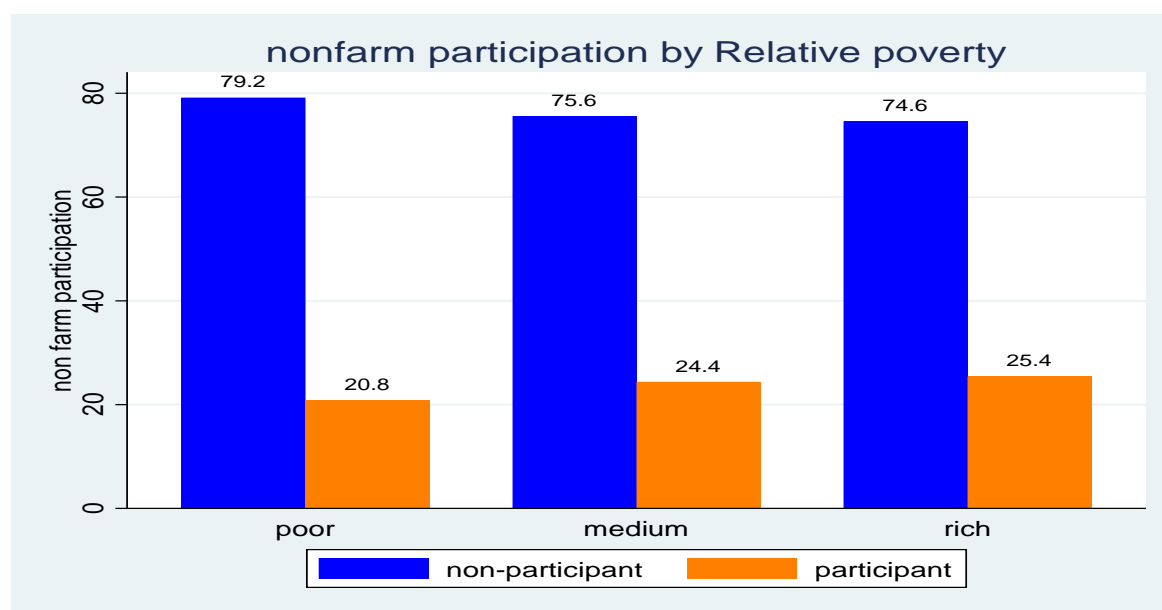
Variables	2014			2016		
	nonparticipant	participant	χ^2	nonparticipant	participant	χ^2
migrate	76.60	23.40	(0.028)	80.00	20.00	(1.78)*
head married	75.22	24.78	(5.33) **	76.85	23.15	(2.72)
Orthodox	76.91	23.09	(0.65)	77.66	22.34	(0.02)
Muslim	76.13	23.87	(0.00)	76.90	23.10	(0.39)
female headed	78.33	21.67	(2.73)*	79.16	20.84	(1.68)
head primary	67.52	32.48	(48.4)***	71.46	28.54	(26.13)***
head college	93.51	6.49	(13.03)***	81.01	18.99	(0.56)
head ill	78.28	21.72	(2.93)**	75.99	24.01	(0.76)
credit access	74.69	25.31	(1.53)	70.57	29.43	(29.51)***
natural shock	77.05	22.95	(0.3)	78.71	21.29	(1.85)
food price fall	71.74	28.26	(1.04)	81.60	18.4	(1.23)
Input price rise	79.27	20.73	(1.39)	83.98	16.02	(13.84)***
electricity	62.62	37.38	(46.9)***	71.63	28.37	(28.23)***
landless	76.53	23.47	(0.03)	76.26	23.74	(0.19)
Tigray	83.43	16.57	(10.92)***	79.36	20.64	(0.73)
Amhara	83.11	16.89	(22.56) ***	82.47	17.53	(12.39)***
Oromia	78.35	21.65	(1.97)	81.27	18.73	(6.26)***
SNNP	72.38	27.62	(8.83) ***	76.67	23.33	(0.48)
Other region	69.14	30.86	(27.07)**	70.04	29.96	(31.93)***
poverty status:						
Poor	77.46	22.54	(2.24) **	80.17	19.83	(9.88)***
Medium	75.27	24.73	(0.79)	76.20	23.80	(1.95)
Rich	75.07	24.93	0.60	74.31	25.69	(4.85)**

Source: Author's computation based on Ethiopian Socioeconomic Survey (ESS) 2014 and 2016 Waves. note Chi-square value in parentheses, and participation and non-participation rate is measured through percentage. *, **, *** show significance at 10%, 5%, 1% levels respectively

4.1.3. RNFE participation rate by Poverty in rural Ethiopia

This part drawn a household participation in non-farm economic activities through relative poverty in the rural parts of Ethiopia. According to the figure 2 the first tercile poor household with compare to their neighbor 20.8% have been participate in non-farm economic activities. And the second tercile medium household with compare to their neighbor 24.4 of the household participate in non-farm economic activities. While the third tercile rich of the household compare to their neighbor 27.8% of household participate in non-farm economic activities. Generally rich household has been observed more participate in the non-farm economic activities than that of their neighbor.

Figure 2. Non-farm participation by relative poverty

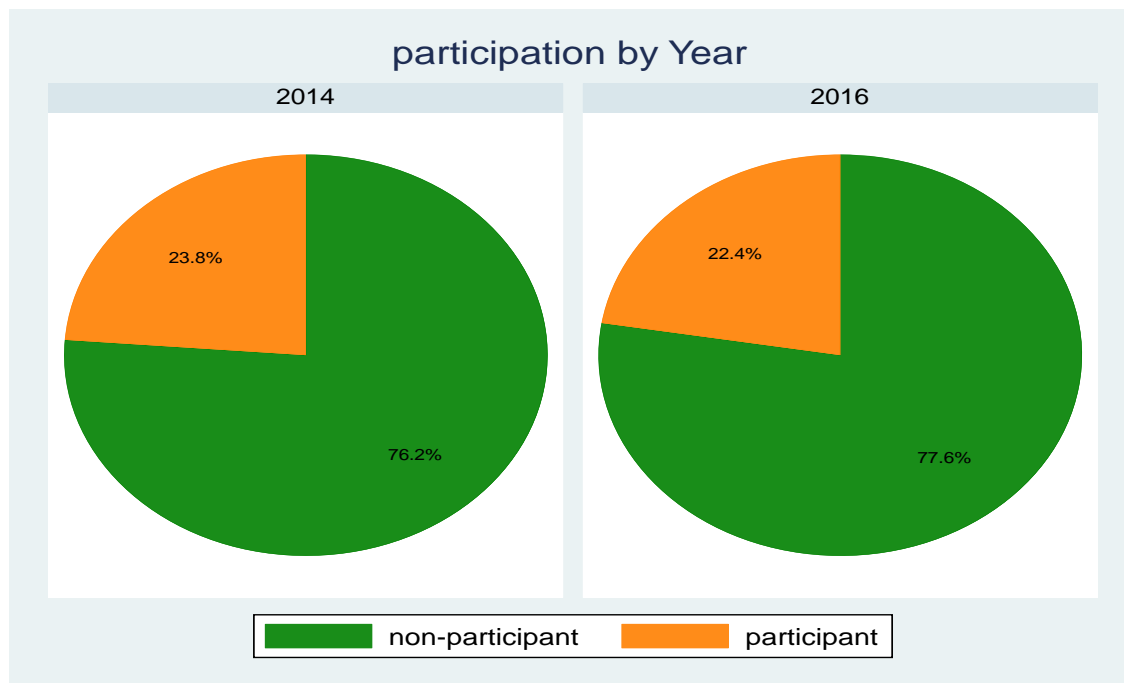


4.1.4. Non-farm economic participation by year

Household in non-farm economic participates were 23.8 percent in 2013/14 and 22.4 percent in 2015/16, this indicate that the participation rate 2015/16 is small than in 2013/14. The finding

show that the change or dynamics of participation rate is may be negative because the participate rate high in 2016. As the household responds for the question why is this enterprise no longer operating 22 percent of the rural part answers there is lack of demand, input, legal problems, lack of credit access and too debit are the major problem for non-participant.

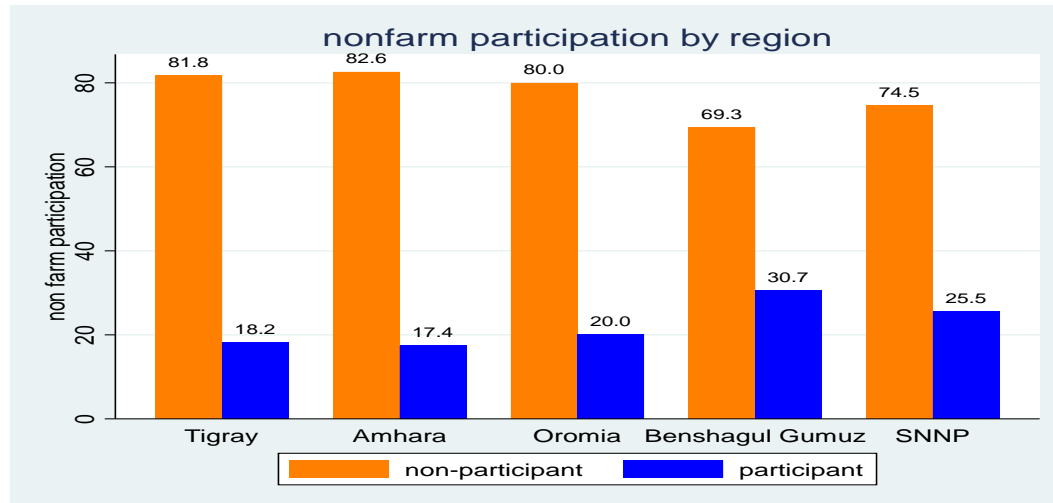
Figure 3. Non-farm participation by Year



4.1.5. Non-farm economic participation by region

A below figure 4.3 represents household participate in the major rural Ethiopia regions with the non-farm economic activities participant and non-participant. Out of the total sampled rural households drawn from SNNP region 25.5 percent of participants and 74.5 percent of non-participants in RNFE, which is followed by Benishangul gumuz 31 participant and 69 non participant. Similarly, 20 percent participants and 80 percent non-participants in RNFE are from Oromia region. While, in Amhara region 20 percent and 80 non participant, whereas 18 percent and 82 non-participants in RNFE are from Tigray region. This shows that there is locational difference to participate in non-farm economic activities.

Figure 4. Non-farm participation by Region



4.2. Econometric Result Analysis

As stated in methodology part, three separate equations were estimated: participation, intensity, and dynamics. For the participation equation, since the dependent variable is the dichotomy yes or no response, panel Probit estimation technique was employed to estimate the determinants of household participant in nonfarm economic activities, and panel censored-Tobit estimation technique was employed to estimate the share of nonfarm economic activities, and quantile regression was used for the dynamics of nonfarm income share..

4.2.1. Determinants of nonfarm economic participation

Statistically significant explanatory variable marginal effects were reported: head married, household head have Muslim religion, head have college school, household have access to credit, input price rise shock and Region dummy Tigray, Amhara and Oromia, household size, age of household head, dependency ratio, tropical livestock unit, and hectares of household land owned were reported in participation equation.

The result shows that other covariates hold constant, married households are less probable to participate in nonfarm economic activities than unmarried counterparts, and the corresponding marginal effect indicates that married headed households are 3 percent less likely than unmarried. This implies that in rural parts married households have more participate in farm activities than nonfarm because our culture by itself pull them to engage in farm activities. Muslim headed households were less likely to participate in nonfarm economic activities by 7 percent than non-Muslim headed household.

Households with college school head have negatively and statistically significant affect nonfarm economic activities. The household head finished college school have less probable to participate in nonfarm economic activities by 26 percent than counterpart. Primary school households head have positive and insignificant impact on household nonfarm participation.

Households having access to credit were positive and statistically significant affect nonfarm economic activities. Households head have access to credit were more likely to participate in nonfarm economic activities more by 32 percent. This finding implies that credit access is one way of initial capital to start nonfarm business. This result is consistence Damena & Habte, (2017).; Girma & Kumbi, (2006).

The other covariate of nonfarm activities is shock, those are natural, food price increase and decrease, and input price increase shock. Among those shock variables only input price shock has negatively and statistically significant affect nonfarm participation rate. Households head faced input price rise shock has less probable to participate in nonfarm economic activities by 6 percent than their counterparts. This result implies that input price rise shock has opposite affect participation: the asset of nonpoor tend to suffer negatively effects from covariant shocks on income from self-employed business than the poor asset. Given that most of the community members tend to suffer from such shocks, due to nonpoor asset who are likely to operate business at a larger scale may have highly affect than the poor asset. This result were consistence with (Kijima, Matsumoto, & Yamano, 2006)

Regional dummies have also included as explanatory variable to capture other factors that create differences in participation decision of households in nonfarm economic activities. Regional dummy such as: - households head having Tigray, Amhara, Oromia, SNNP, and Other region were

incorporate in covariates of nonfarm participation. Among regional dummy variables, household head in Tigray, Amhara, and Oromia were significantly less probable to participate in nonfarm economic activities by 18, 10, and 9 percent respectively than other regions. This result implies that there is existence of regional difference in household to participating in nonfarm economic activities.

Relative poverty status has three categorical and two dummy variables, depending on the household consumption expenditure. The omitted categorical variable in poverty status is poor. Household's expenditure per adult equivalence lies at the second tercile (medium) and third tercile (rich) have more probable to participate in nonfarm activities by 2 and 3 percent respectively. This result were consistence (Bezu, Barrett, & Holden, 2012; Weldegebriel, 2017). This result shows that the rich households are more participate in nonfarm economic activities. Because of risk, insufficient farm income and lack of investment capital for agriculture, the poor may have higher incentive to participate in nonfarm self-employment. But they are also typically less able to choose among alternative of nonfarm activities because of lack of the necessary resources such as skill, access to credit and etc. As a result, the poor households are engaged more in low-return activities. While the relatively rich are far more likely to engage in high-return activities such as wage employment and high-investment self-employment. This result suggests that nonfarm participation might lead to greater expected returns and income for based on prediction better-off households than for the poorest. On the one hand, because the rich are less liquidity constrained and less risk averse than the poor.

Households having large household size were more likely more to participate in nonfarm economic activity by 4 percent the result were consistence with (Lanjouw & Murgai, 2009). Because unemployed members will be actively looking for additional income and non-farm self-employment activity provides the best option for short-term. Since it mostly relates to the supply of labor to the non-farm sector. However, one can argue that household size could be a liability for the overall welfare of the household if the number of labor-contributing members.

The other key demographic indicator that determines non-farm income diversification is age of the household head. The finding of this study shows that for each additional year of household head age is likely to participate in nonfarm income activities This result is consistent with

(Senadza, 2012). This implies that older household heads are less likely to participate and earning less amount in nonfarm economic activities because they cannot substitute their agricultural product with other sources at off agricultural season.

While, dependency ratio has less probable to participate in nonfarm economic activities. The result implies that the dependency ratio is a key demographic variable that negatively and statistically significant affect non-farm economic activity. This implies households under 15 and above 64 aged were labour inactive groups and less capability to participate in nonfarm activities because they are dependent. This finding were consistence (Carswell, 2002; A Lemi, 2010).

High tropical livestock unit and land ownership were one of rural household asset variables which are negatively and statistically significant affect household to participate in nonfarm economic activities. Household having higher number of tropical livestock and land owner were less likely to participate in nonfarm economic activity. This result were consistence with (Weldegebriel, 2017). This implies that nonfarm economy is an optional to smoothing rural household livelihood during agricultural off season. It could also mean that non-farm income is likely to be re-invested into farm activities. For renting in more farm land, purchasing inputs, and livestock units. In the long-run this may have a dynamic effect in creating capital that substitutes for labor, and encouraging participation in non-farm activities. Because rural households having large hectares of land and higher livestock asset were likely to spend much time on the farm. So, that their participations are more to farm than nonfarm activities. The finding were consistence with Lemi (2010) and Yirga (2012).

Table 4.4. Covariates of participation in RNFE in rural Ethiopia: marginal effects after Probit estimation (Dependent variable: Dummy for participation in RNFE by any household member)

Covariate	Marginal effect	
Migrate	-0.01	(0.016)
Household size	0.04***	(0.011)
Age head	- 0.00***	(0.000)
Head married	-0.04**	(0.019)
Orthodox	0.03	(0.029)
Muslim	-0.07**	(0.033)
Female head	-0.01	(0.018)
Dependency ratio	-0.01***	(0.005)
Head primary school	0.02	(0.017)
Head college school	-0.27***	(0.074)
Head ill	0.01	(0.011)
Access to credit	0.03***	(0.011)
Natural shock	-0.01	(0.010)
Food price fall shock	-0.01	(0.026)
Input price rise shock	-0.06***	(0.015)
Electricity	0.01	(0.030)
Landless	-0.02	(0.017)
Tropical livestock unit	-0.01***	(0.003)
Land own	-0.02	(0.007)
Other region Omitted		
Tigray	-0.18***	(0.031)
Amhara	-0.10**	(0.048)
Oromia	-0.09**	(0.023)
SNNP	-0.02	(0.035)
Other real income	5.77	(5.612)
Residual	0.06*	(0.031)
Poverty: poor omitted		
Medium	0.02**	(0.011)
Rich	0.03*	(0.014)

*, **, *** show significance at 10%, 5%, 1% levels respectively (see detail Appendix 3). Standard errors adjusted for clusters in parentheses. SNNP is south nation and nationality region.

4.2.3. Determinants of share of nonfarm income

Table 4.5 gives the censored-Tobit estimation results of the intensity (share of RNFE income) equation. The researcher find that the factors affecting the intensity of RNFS are not necessarily similar to those affecting participation of nonfarm economic activities and this is the same as that in (Koichi, Usami, 2009; A Lemi, 2010; Matshe & Young, 2004; Yirga, 2012).

The researcher estimates share of nonfarm income as endogenous for intensity equations. Since some households have zero income shares from some components due to non-participate or not gaining, these endogenous variables have some censored data. Accordingly, the estimated method here is censored Tobit regression, and marginal effects were interpreted as follow.

Age of household head has negatively and significantly affected the share of nonfarm income. This finding shows that being older for the head less share of nonfarm income. This implies that at older age household lead to decrease the activity rate and mass consumption stage than actively working in any sector. This finding is consistent (Sanusi, 2011).

Dependency ratio of household is negatively and significantly affecting the share of nonfarm income. The finding shows that addition number of dependent households in household member results less share of nonfarm income, other covariates holds constant. This implies lack of labor substituting technologies and the subsistence nature of farming. The condition has long been recognized as an impediment for achieving sustain income in the non-farm sector because they are inactive worker.

Education is one of human capital variable: which incorporate in the study through household head having primary and college school. The primary and college studies have positive and statistically significant affect the household share of nonfarm income. The finding shows that as household head have finished primary and college school, the earning of household share in nonfarm income is more by 0.01 and 0.58 cents respectively. This finding is consistence with (Anang, 2019). This implies that educated household specially business mans are calculating the cost benefit analysis in any sector, nonfarm income by itself needs analyzing for earning any profit. The promotion of education in rural areas were also important in promoting income diversification because

education enhances the human capital by way of skill acquisition and adaptability to different employment opportunities.

Household head faces illness found to less earn from share of nonfarm than their counterpart. The result shows that household head faced illness the share of nonfarm income is less. The main constraint to begin any business in rural part is startup capital. Because most of formal financial institution needs collateral to provide credit for credit users, having this credit accessed household have more earning from nonfarm economic activities than non-users.

Electricity access is one of infrastructure variable, which positively affect both participation and share of nonfarm income. But significantly affect share of NFI. Our result shows that, as household have access to electricity results to increase household share by 0.18 cents. The finding is consistence with previous studies (Gibson & Olivia, 2010). Access to electricity promotes the development of rural industries serving as a fixed input into the production process. On the other side, infrastructural development may lead to the driver of remote rural firms by exposing them to higher market competition.

Tropical livestock unit (TLU) is one of rural household asset. The number of tropical livestock has a negative and significant effect for share of nonfarm income. This is because livestock management needs intensive labor it may compete for the scarce family labor that can allocate to nonfarm activities, hence lowers share nonfarm income. households having more livestock are likely to spend much time on the farm so that their incomes are earn more from farm than nonfarm activities This finding is consistent with the result of (Weldegebriel, 2017).

Regional dummy has also included as explanatory variable to capture other factors that create differences in participation decision of households and share of nonfarm income in rural part. Household having Tigray, Amhara, Oromia, and SNNPR are significantly affect share of nonfarm income. Households head have Tigray, Amhara, Oromia, and SNNP are less share of nonfarm income than those who have other regions. This result implies that there is existence of regional difference also in household share of nonfarm income.

landless household heads have positive and statistically significant affect the share of nonfarm income. Households head have landless the share of nonfarm income is increase by 0.06 cent. This result implies that in formal institution land is collateral for the credit due to this reason landless households have smoothed their livelihood through nonfarm income Landless households head everywhere depend heavily on nonfarm income for their survival. The study revealed that landless households adopted a livelihood strategy which absolutely relied on nonfarm. Due to not having sufficient land for cultivation, many rural labourers were compelled to sell their labour. This sometimes can put them at a disadvantage because of fluctuations in the labour market. Furthermore, the decline in available arable land lowered households' consumption and income in this rural area.

Relative poverty status is statistically significant and positively affect rural household share of nonfarm income. Household expenditure lies in second and third tercile medium and rich respectively, the household share of nonfarm income increases by 0.07 and 0.10 cent respectively as compare to the poor one. Other income is statistically marginal significant impact household share of income. As household earning other source, household share of nonfarm income is increase.

Table 4.5. Covariates of rural nonfarm income share in Ethiopia: results from Panel censored-Tobit estimation (Dependent variable: share of nonfarm income.

Covariate	Marginal Effect	
Migrate	-0.01	(0.031)
Household size	0.04	(0.023)
Age head	-0.00***	(0.001)
Head married	-0.06	(0.039)
Orthodox	0.06	(0.056)
Muslim	-0.06	(0.067)
Female head	-0.01	(0.036)
Dependency ratio	-0.01***	(0.010)
Head primary school	0.10***	(0.035)
Head college school	0.58**	(0.143)
Head ill	-0.07	(0.023)
Access to credit	0.03**	(0.022)
Natural shock	0.05**	(0.021)
Food price fall shock	0.04	(0.050)
Input price rise shock	-0.01	(0.029)
electricity	0.18***	(0.062)
Landless	0.06*	(0.033)
Tropical livestock unit	-0.03***	(0.006)
Land own	-0.03**	(0.014)
Other region: Omitted		
Tigray	-0.23***	(0.054)
Amhara	-0.26***	(0.096)
Oromia	- 0.22***	(0.045)
SNNP	-0.20**	(0.069)
Other real income	8.48	(6.861)
Residual	0.02	(0.065)
Poor omitted		
Medium	0.07***	(0.022)
Rich	0.10***	(0.027)

*, **, *** show significance at 10%, 5%, 1% levels respectively (see detail Appendix 4). SNNP is south nation and nationality region. Standard Error in parenthesis

4.2.4. Share of nonfarm income dynamics

Results from the dynamic model are reported in Table 4.6. The dependent variable for quantile specifications is change in nonfarm share between 2014 and 2016 computed as $[(\text{nonfarm income in 2016}) / (\text{total income in 2016}) - (\text{nonfarm income in 2014}) / (\text{total income in 2014})]$ (Block & Webb, 2001; Adugna Lemi, 2006). The top 25 percent

The dynamic estimation models to investigate the role of initial conditions on nonfarm intensity overtime. ten different covariates are incorporate in the model (market, road, rich medium, tropical livestock unit, transfer income, land owned, age head, household size). The two initial conditions that significantly affect degree of subsequent dynamics diversification in income sources are hectares of land owned and household for the top 25 percent quantiles of household.

Household with large land holding in 2014 tend to less in share of nonfarm income in 2016 the result is in line with (Lemi, 2006). This result is match to static model where more land household have less share of nonfarm income (see in table 4.5). This implies that, return from land or staying on farm provides secured and adequate output for consumption and income source to keep households on farm. The negative coefficient on land holding may also be explained by the strict residency and use requirement to claim user right over the state-owned land. The positive significant coefficient on household size supports the idea that better nonfarm and sending their household to nonfarm activities and earn high amount of share of nonfarm income to sustain their livelihood. The finding implies that households with higher family size in 2014 have higher share of nonfarm income in 2016. This confirms the widely held view in the rural Ethiopia. There is labor shortage at main harvest season of a year. The competition between farm and nonfarm activities during the main harvest season, leads farmers to focus less on nonfarm activities and more on farm activities.

Table 4.6. Covariates of rural nonfarm income share in Ethiopia: results from quantile Regression (Dependent variable: Dynamics share of nonfarm income)

Covariates	Marginal effect	
market	-.000	(.001)
road	-.001	(.001)
land owned	-.03***	(.007)
Tropical livestock unit	.01	(.007)
Transfer income	-3.63	(.000)
Dependency ratio	-.01	(.021)
Age head	.02	(.005)
household size	.05**	(.021)
Medium	.08	(.067)
Rich	.07	(.077)

*, **, *** show significance at 10%, 5%, 1% levels respectively. Standard errors are in parentheses.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

Nonfarm economic activities are important sources of income for rural peoples in Ethiopia. Rural households try to diversify their sources of income through on farm, off farm and nonfarm, but the contribution of non-farm income to total household income (intensity) account only 16 percent. And 23 percent of rural households participate in rural nonfarm economic activities. The study has investigated the determinants of nonfarm participation and intensity (measured as share of nonfarm income) as well as dynamics in rural Ethiopia.

Probit model for participation, censored-Tobit model for intensity and Quantile regression for dynamics are run on a balanced panel data of 6,222 households. Ethiopia Socioeconomic Survey 2014 and 2016 was used as a source of data. A number of control variables are used for participation, intensity and dynamics equations. We tackle the possible endogeneity problem between nonfarm activity and poverty by using control function method. We use five household-level and community-level variables to instrument poverty status: transfer income, presence of health institution, microfinance institution, asphalt road, and primary school in community. The residuals of the poverty statuses are incorporated into nonfarm participation and intensity equations using control function approach to dealing with endogeneity. Estimation of the models using Heckman two-stage model also helps to correct for endogenous selection bias.

The results from participation and intensity equation indicates statistically significant variables: household size, ages of head, head married, head college schooling, access to credit, access to electricity, input price shock, tropical livestock, land owned, relative poverty status and regional dummies were affect non-farm income diversification. Among those access to electricity is found to be significant and positive with its influence limited to determining household's share of nonfarm income, but insignificant affect household participate in nonfarm economy. And access to credit has found to be statistically significant and positive affect both participation and intensity of nonfarm economic activities. However, dependency ratio, head age, and input price rise shock are negatively affecting participation of household in nonfarm economic activities.

Taking jointly, these results may indicate the existence of competition over the major factors of production between farm and non-farm activities, particularly labor. This in turn may reflect the lack of labor substituting technologies and the subsistence nature of farming. This condition has long been recognized as an impediment for achieving sustain income in the non-farm sector. The finding also revealed that human capital, as captured in education, was essential in improving share of nonfarm income of rural household. A household head having primary schooling tended to raise share of non-farm income. Moreover, finishing college schooling enhanced household share of nonfarm income. Household having college schooling was found to be related negatively affect household participation rate of nonfarm economic activities.

The results show relative poverty has a significant and positive effect on household's share of nonfarm income and participation rate. For developing country like Ethiopia where landholding is very small and the population pressure is ever increasing, rural nonfarm economy may offer a way out of poverty and into accumulation for poor rural households. On the other hand, households with more livestock holding are less probable to participate in nonfarm economic activity and with lower share of nonfarm income. While land owners and households with married head have lower share of nonfarm income, those having high household sizes have higher shares of nonfarm income. This result is also consistent with those when the share of nonfarm income dynamics. Households having high household sizes initially (in 2014) have more nonfarm income shares in 2016 while those owning large lands initially have less nonfarm income shares later.

5.2. RECOMMENDATIONS

Since agriculture is still the largest source of livelihood in rural Ethiopia, policy makers need also to pay a great deal of attention to enhancing agriculture through supporting new nonfarm economic activities. This is because farming alone may fail to guarantee a sufficient livelihood for most rural households. Thus, non-farm activities can bridge the gap by directly increasing household income and providing cash that can be invested in farm inputs to increase agricultural productivity. The attention therefore should be to adopt policies that aim to enhance the role of non-farm sector improving rural economy and the welfare of poor rural households.

Nonfarm economic activities are plays very important role on the rural household livelihood specially for poor. Besides, the government and nongovernment agencies should also be providing with low interest rate credit which can help them to enlarge the scale of their nonfarm business, hence could diminish costs related with nonfarm economic activities and make them profitable. We recommend application of appropriate policy that can serve household participation in and share of nonfarm income. For instance, creation of accessible credit systems can facilitate the establishment of non-farm economic activities and promote agricultural development at the same time. Similarly, we recommend provision of physical infrastructure that can increase the accessibility electricity to improve share of nonfarm income. Thus, governments should be promoted by facilitating infrastructure and financial facilities like road, electricity, credit, and others in order to create new nonfarm employments opportunities and make profitable for the existed ones.

Older household heads are less probable to participate in nonfarm economic activities and earn less in case they participate. Thus, the governmental and nongovernmental agencies should sustainability support to old aged household head because they cannot supplement their agricultural produce with other sources, overcome the entry barrier and make it accessible for rural households. Also, nonfarm activities need to be incorporated in economic plans and policies for balanced development between household participation and intensity for all regions. Finally, programs that encourage and improve the educational status of rural households are helpful to enhance nonfarm income sources in the long run.

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APPENDIX

Appendix 1: control function approach

To use control function Approach first we estimate order logistic regression through incorporating instrumental variable for relative poverty. lastly, we predict error term.

Reduced form

Random-effects ordered logistic regression

poverty_status	Coef.	St.Err.	t- value	p-value	[95% Conf Interval]	Sig	
Transfer	0.000	0.000	1.94	0.052	0.000	0.000	*
Health	0.219	0.098	2.23	0.026	0.027	0.411	**
Micfin	0.199	0.065	3.06	0.002	0.072	0.327	***
Road	0.110	0.069	1.61	0.108	-0.024	0.245	
Preschool	-0.037	0.069	-0.53	0.596	-0.171	0.098	
Migrate	0.070	0.092	0.76	0.445	-0.110	0.250	
Hhsize	-0.342	0.019	-17.86	0.000	-0.380	-0.305	***
age_head	-0.004	0.002	-1.98	0.047	-0.008	0.000	**
head_married	0.261	0.108	2.43	0.015	0.050	0.472	**
Orthodox	0.682	0.103	6.62	0.000	0.480	0.884	***
Muslim	0.837	0.105	7.99	0.000	0.632	1.043	***
head_female	0.138	0.105	1.32	0.186	-0.067	0.343	
dep_ratio	0.057	0.032	1.79	0.074	-0.006	0.120	*
educ_hprim	0.387	0.076	5.11	0.000	0.238	0.535	***
educ_hcol	1.927	0.243	7.92	0.000	1.450	2.404	***
head_ill	0.002	0.071	0.03	0.977	-0.137	0.141	
credit_Access	0.086	0.066	1.31	0.188	-0.042	0.215	
shock_natural	-0.019	0.067	-0.29	0.772	-0.151	0.112	
	0.054	0.152	0.35	0.723	-0.244	0.351	
shock_foodpricefa							
ll	-0.006	0.090	-0.07	0.942	-0.182	0.169	

shock_inputpricei

nc

Electricity	0.882	0.076	11.53	0.000	0.732	1.032	***
Landless	0.038	0.109	0.35	0.727	-0.175	0.251	
TLU_total	0.076	0.013	5.89	0.000	0.051	0.102	***
Landown	0.146	0.033	4.42	0.000	0.081	0.210	***
Tigray	-0.383	0.138	-2.78	0.005	-0.653	-0.113	***
Amhara	-1.391	0.117	-11.88	0.000	-1.620	-1.162	***
Oromia	-0.364	0.108	-3.38	0.001	-0.575	-0.153	***
SNNP	-0.906	0.115	-7.86	0.000	-1.132	-0.680	***
otherinc_r	0.000	0.000	1.25	0.210	0.000	0.000	

Mean dependent var	1.773	SD dependent var	0.768
Number of obs	6222.000	Chi-square	867.042
Prob > chi2	0.000	Akaike crit. (AIC)	11647.713

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix 2: instrumental relevance

Test for significance of instrument variable for poverty

(1) [poverty_status]transfer = 0

(2) [poverty_status]health = 0

(3) [poverty_status]micfin = 0

(4) [poverty_status]road = 0

(5) [poverty_status]prschool = 0

chi2(5) = 22.44

Prob > chi2 = 0.0004

Appendix 3: Panel Probit regression result

Random-effects probit regression

Non_farm	Coef.	St.Err.	t- value	p-value	[95% Conf Interval]	Sig	
migrate	-0.045	0.122	-0.37	0.713	-0.284	0.194	
hhsiz	0.280	0.085	3.28	0.001	0.112	0.447	***
age_head	-0.018	0.003	-5.26	0.000	-0.025	-0.011	***
head_married	-0.301	0.146	-2.06	0.039	-0.587	-0.015	**
orthodox	0.239	0.220	1.09	0.277	-0.192	0.670	
muslim	-0.546	0.254	-2.15	0.032	-1.044	-0.048	**
head_female	-0.083	0.137	-0.61	0.545	-0.352	0.186	
dep_ratio	-0.107	0.037	-2.92	0.004	-0.178	-0.035	***
educ_hprim	0.143	0.133	1.08	0.279	-0.117	0.403	
educ_hcol	-2.050	0.573	-3.58	0.000	-3.173	-0.928	***
head_ill	0.065	0.086	0.75	0.452	-0.104	0.233	
credit_Access	0.245	0.084	2.92	0.004	0.080	0.410	***
shock_natural	-0.077	0.080	-0.96	0.337	-0.234	0.080	
	-0.048	0.203	-0.24	0.814	-0.446	0.350	
shock_foodpricefall							
	-0.463	0.115	-4.04	0.000	-0.688	-0.239	***
shock_inputpriceincrease							
electricity	0.056	0.229	0.24	0.806	-0.392	0.504	
landless	-0.150	0.129	-1.17	0.244	-0.403	0.103	
TLU_total	-0.094	0.025	-3.82	0.000	-0.143	-0.046	***
landown	-0.130	0.055	-2.35	0.019	-0.239	-0.022	**
Tigray	-1.375	0.246	-5.59	0.000	-1.857	-0.893	***
Amhara	-0.739	0.373	-1.98	0.048	-1.470	-0.007	**
Oromia	-0.717	0.184	-3.90	0.000	-1.077	-0.357	***
SNNP	-0.186	0.268	-0.69	0.487	-0.712	0.339	
otherincome_r	0.000	0.000	1.56	0.119	0.000	0.000	
ehat	0.430	0.240	1.79	0.073	-0.040	0.901	*

1b.poverty_status	0.000	.	.	.	.	.
2.poverty_status	0.186	0.083	2.24	0.025	0.023	0.348	**
3.poverty_status	0.236	0.104	2.26	0.024	0.031	0.440	**
Constant	-0.780	0.290	-2.69	0.007	-1.349	-0.211	***
lnsig2u	1.349	0.106	.b	.b	1.141	1.556	
<hr/>							
Mean dependent var	0.231		SD dependent var	0.422			
Number of obs	6222.000		Chi-square	216.116			
Prob > chi2	0.000		Akaike crit. (AIC)	5558.027			
<hr/>							
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$							

Appendix 4: Panel Tobit regression result

Random-effects tobit regression

nonfarm_share	Coef.	St.Err.	t- value	p-value	[95% Conf Interval]	Sig	
Migrate	-0.011	0.031	-0.34	0.730	-0.072	0.050	
Hhsize	0.037	0.023	1.62	0.105	-0.008	0.082	
age_head	-0.005	0.001	-5.57	0.000	-0.006	-0.003	***
head_married	-0.059	0.039	-1.49	0.135	-0.135	0.018	
Orthodox	0.065	0.056	1.15	0.251	-0.046	0.175	
Muslim	-0.062	0.067	-0.92	0.359	-0.194	0.070	
head_female	-0.014	0.036	-0.40	0.688	-0.085	0.056	
dep_ratio	-0.010	0.010	-1.03	0.304	-0.030	0.009	
educ_hprim	0.102	0.035	2.91	0.004	0.033	0.170	***
educ_hcol	0.582	0.143	4.06	0.000	0.301	0.863	***
head_ill	-0.068	0.023	-2.99	0.003	-0.113	-0.024	***
credit_Access	0.029	0.022	1.33	0.184	-0.014	0.072	
shock_natural	0.053	0.021	2.50	0.012	0.011	0.095	**
	0.037	0.050	0.73	0.462	-0.061	0.134	
shock_foodpricefa							
ll							
	-0.007	0.029	-0.23	0.817	-0.064	0.050	
shock_inputpricei							
nc							

Electricity	0.184	0.062	2.97	0.003	0.062	0.305	***
Landless	0.057	0.033	1.76	0.079	-0.007	0.121	*
TLU_total	-0.030	0.006	-4.82	0.000	-0.042	-0.018	***
Landown	-0.030	0.014	-2.14	0.032	-0.057	-0.002	**
Tigray	-0.229	0.054	-4.26	0.000	-0.335	-0.124	***
Amhara	-0.257	0.096	-2.67	0.008	-0.446	-0.068	***
Oromia	-0.218	0.045	-4.87	0.000	-0.305	-0.130	***
SNNP	-0.203	0.069	-2.96	0.003	-0.338	-0.069	***
otherinc_r	0.000	0.000	1.24	0.216	0.000	0.000	
Ehat	0.020	0.065	0.30	0.762	-0.108	0.148	
1b.poverty_status	0.000	.	.	.	.	.
2.poverty_status	0.067	0.022	3.08	0.002	0.024	0.109	***
3.poverty_status	0.099	0.027	3.62	0.000	0.045	0.152	***
Constant	-0.012	0.072	-0.16	0.871	-0.152	0.129	
sigma_u	0.444	0.014	30.92	0.000	0.416	0.472	***
sigma_e	0.441	0.010	45.28	0.000	0.422	0.460	***

Mean dependent var	0.164	SD dependent var	0.306
Number of obs	6222.000	Chi-square	552.837
Prob > chi2	0.000	Akaike crit. (AIC)	7707.996

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix 5: Multicollinearity Test

Variance inflation factor

	VIF	1/VIF
orthodox	2.567	.39
SNNP	2.478	.404
muslim	2.476	.404
head married	2.268	.441
Amhara	2.263	.442
head female	2.108	.474
Tigray	1.947	.514
Oromia	1.903	.526
hhsiz	1.534	.652
landown	1.308	.764
educ hprim	1.233	.811
age head	1.224	.817
TLU total	1.207	.829
landless	1.167	.857
shock natural	1.145	.873
educ hcol	1.121	.892
electricity	1.12	.893
shock inputpriceinc	1.081	.925
dep ratio	1.06	.944
credit Access	1.049	.954
head ill	1.035	.966
shock foodpricefall	1.034	.967
migrate	1.025	.975
otherinc r	1.017	.983
Mean VIF	1.515	.

Comparison between the model

When rho is zero, the panel-level variance component is unimportant, and the panel estimator is not different from the pooled estimator. A likelihood-ratio test of this is included at the bottom of the output. This test formally compares the pooled estimator (tobit) with the panel estimator. In this case, we reject the null hypothesis that there are no panel-level effects. In our result rho = .5032. whereas the comparison between pooled probit and panel probit estimator we use likelihood ratio test through rho, and rho= .793. Therefore, we reject the null hypothesis that there are no panel probit-level effects.

Test for significant difference for coefficient for estimator

Wald test for panel probit estimation

- (1) [Non_farm]migrate = 0
- (2) [Non_farm]hhsz = 0
- (3) [Non_farm]age_head = 0
- (4) [Non_farm]head_married = 0
- (5) [Non_farm]orthodox = 0
- (6) [Non_farm]muslim = 0
- (7) [Non_farm]head_female = 0
- (8) [Non_farm]dep_ratio = 0
- (9) [Non_farm]educ_hprim = 0
- (10) [Non_farm]educ_hcol = 0
- (11) [Non_farm]head_ill = 0
- (12) [Non_farm]credit_Access = 0
- (13) [Non_farm]shock_natural = 0
- (14) [Non_farm]shock_foodpricefall = 0
- (15) [Non_farm]shock_inputpriceinc = 0
- (16) [Non_farm]electricity = 0
- (17) [Non_farm]landless = 0
- (18) [Non_farm]TLU_total = 0
- (19) [Non_farm]landown = 0
- (20) [Non_farm]Tigray = 0
- (21) [Non_farm]Amhara = 0
- (22) [Non_farm]Oromia = 0
- (23) [Non_farm]SNNP = 0

- (24) [Non_farm]otherinc_r = 0
- (25) [Non_farm]ehat = 0
- (26) [Non_farm]1b.poverty_status = 0
- (27) [Non_farm]2.poverty_status = 0
- (28) [Non_farm]3.poverty_status = 0

Constraint 26 dropped

Prob > chi2 = 0.0000

Wald test for Tobit regression

- (1) [nonfarm_share]migrate = 0
- (2) [nonfarm_share]hhsz = 0
- (3) [nonfarm_share]age_head = 0
- (4) [nonfarm_share]head_married = 0
- (5) [nonfarm_share]orthodox = 0
- (6) [nonfarm_share]muslim = 0
- (7) [nonfarm_share]head_female = 0
- (8) [nonfarm_share]dep_ratio = 0
- (9) [nonfarm_share]educ_hprim = 0
- (10) [nonfarm_share]educ_hcol = 0
- (11) [nonfarm_share]head_ill = 0
- (12) [nonfarm_share]credit_Access = 0
- (13) [nonfarm_share]shock_natural = 0
- (14) [nonfarm_share]shock_foodpricefall = 0
- (15) [nonfarm_share]shock_inputpriceinc = 0
- (16) [nonfarm_share]electricity = 0
- (17) [nonfarm_share]landless = 0
- (18) [nonfarm_share]TLU_total = 0
- (19) [nonfarm_share]landown = 0
- (20) [nonfarm_share]Tigray = 0
- (21) [nonfarm_share]Amhara = 0
- (22) [nonfarm_share]Oromia = 0
- (23) [nonfarm_share]SNNP = 0
- (24) [nonfarm_share]otherinc_r = 0
- (25) [nonfarm_share]ehat = 0

(26) [nonfarm_share]_Ipoverty_s_2 = 0

(27) [nonfarm_share]_Ipoverty_s_3 = 0

chi2(27) = 552.84

Prob > chi2 = 0.0000