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SMALLHOLDER FARMERS CROP COMMERCIALIZATION, LIVELIHOOD DIVERSIFICATION STRATEGIES AND MULTIDIMENSIONAL POVERTY: WEST GOJJAM ZONE, NORTH WESTERN ETHIOPIA

LIJALEM ABEBAW

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DISSERTATION

SUBMITTED TO FULLFILL THE REQUIREMENT FOR DOCTOR OF PHILOSOPHY IN RURAL DEVELOPMENT

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STATEMENT OF THE AUTHOR

I confirm that the conception, design, analysis and writing of the thesis is done by the author, who take responsibility to the content of the work.

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Approval by the examining board members

This is to certify that the dissertation prepared by Lijalem Abebaw entitled: Smallholder Farmers Crop Commercialization, Livelihood Diversification Strategies and Poverty: West Gojjam Zone, North Western Ethiopia, and submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy (Rural Development) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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BIOGRAPHICAL SKETCH

Lijalem Abebaw was born in Hodansh Kebele, Jabitehnan Woreda, West Gojjam Zone, Amhara Region, Ethiopia in 1984. He went to Hodansh Primary School, FinoteSelam Junior Secondary School, and Damot Senior Secondary School, respectively, for his primary (grades one through six), junior (grades seven through eight), and secondary (grades nine through twelve) education. He earned his BSc in Agricultural Extension and Rural Development from Haramaya University in 2006 and his MA in Regional and Local Development Studies from Addis Ababa University in 2011. Since 2015, he has been working toward a PhD in Rural Development at Addis Ababa University's College of Development Studies.

He began working for the Amhara Agricultural Research Institute in 2006. He was stationed at the Sekota Dryland Agricultural Research Centre from November 2006 to October 2013. He had been working for the Andassa Livestock Research Center from November 2013 to October 2015. He works in the Socioeconomics and Extension research directorate as a junior, assistant, and associate researcher. He coordinated the directorate of socioeconomic and agricultural extension research. He served as the center's director from October 2014 to October 2015.

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GENERAL ABSTRACT

Commercializing crop production is the pathway for economic development. Previous studies examined agricultural commercialization and diversification process; agricultural commercialization and its impact on income and nutrition; determinants of rural poverty; determinants of market orientation and crop output commercialization. However, investigating the association between crop commercialization; livelihood diversification strategies; and poverty is scanty. This study was aimed at investigating the association between smallholder farmers' market orientation, crop output commercialization, livelihood diversification strategies and poverty and determinants of each theme. The study used pragmatism research paradigm comprises quantitative and qualitative research designs used to understand determinants of smallholder farmers market orientation, crop output commercialization, and rural households' livelihood diversification strategies and impact of output commercialization on household poverty in west Gojjam zone, northwestern Ethiopia. Multistage random sampling method was used to sample 405 respondents and a structured interview was conducted. The quantitative data was analyzed using descriptive statistics, one-way ANOVA, Chi-square test, independent sample t-test, zero-inflated beta regression, multivariate probit regression, and endogenous switching regression. Qualitative data were collected using focus group discussion and individual interviews, which were then, analyzed using narration and thematic methods. The results of the analysis revealed education, farmland rental contracts, infrastructure development, and soil fertility improving technologies are needed to increase market orientation. Better farmland allocation for marketable crops, access to technologies, lowering input purchase costs, reducing output market price seasonal volatility promotes output commercialization. Purpose, combined with sector, location, and function, is an important criterion to classify livelihood diversification strategies. Accordingly, rural households' livelihood diversification strategies classified in to on-farm wealth accumulation, off-farm survival, non-farm survival self-employment and non-farm survival wage-employment and non-farm wealth accumulation. Agro-ecology and crop output commercialization enhances rural households' engagement in on-farm and non-farm wealth accumulation livelihood diversification strategies. Finally, crop output commercialization reduces rural households' poverty. The results imply market orientation translates to output commercialization; output commercialization induces rural households' engagement in on-farm and non-farm wealth accumulation livelihood diversification strategies; and reduces household poverty. Therefore, commercializing smallholder farmers' crop production prompts rural households' engagement in wealth accumulation livelihood diversification strategies and improvement of households' welfare.

Keywords: agroecology, commercialization, livelihood diversification strategies, poverty and pragmatism research paradigm

CHAPTER ONE
GENERAL INTRODUCTION

1.1 Introduction

Understanding crop commercialization and analyzing the corresponding livelihood diversification strategies and poverty in the smallholder farmers' context is imperative research agenda of extant literature. To name a few of these researches: Pingali and Rosegrant (1995) studied agricultural commercialization and diversification processes; von Braun (1995) and Carletto et al. (2017) examined agricultural commercialization and its impact on income and nutrition; Bogale et al. (2005) looked at factors that influence poverty; Berhanu and Jaleta (2010) studied determinants of market orientation; and Bekele and Alemu (2015) and Berhanu and Jaleta (2010) looked at the factors affecting output commercialization.

Commercialization is an essential component of economic transformation, which is the process of moving from a subsistence-oriented agrarian society to one with a more market-oriented, diversified and food secure economy (Jayne et al., 2011). Accordingly, crop commercialization is a gradual process that passes from subsistence consumption-oriented farm production to separation of consumption and production decisions (Pingali and Rosegrant, 1995; Timmer, 1997). The initial stage of crop commercialization is subsistence agricultural production, which primarily focuses on meeting household food consumption demand along with imperfect agricultural input and output markets (Pingali and Rosegrant, 1995; Timmer, 1988). In the succeeding stages of commercialization, the market barriers for inputs and outputs of crop production reduce, which leads to the expansion of commercialized crop production (Pingali, 1997; Timmer, 1988, 1997). Crop commercialization understands as necessary competition between staple food crops for household consumption and high value and industrial crops for market, it is in allocation of inputs and participation in output market (Carletto et al., 2017), which is based on market signals and resource endowments. However, commercialization is not limited to market-specific specialization in high-value and industrial crops. The so-called traditional food crops also frequently marketed to a significant extent, while high-value and industrial crops largely retained for domestic consumption (von Braun, 1995; von Braun and

Kennedy, 1994). This implies that the production of traditional, high-value, and industrial crops as well as market decision-making processes are jointly responsible for commercialization.

Crop commercialization can occur on the input side as well as the output side. Input side commercialization is increased use of purchased inputs while output side commercialization is increasing extent of output marketed surplus (Carletto et al., 2017; von Braun, 1995; von Braun and Kennedy, 1994). It is manifested through increase in purchase of traded inputs such as chemical fertilizer, pesticides and herbicides and decline in utilizing non-traded inputs such as traditional herbicides and pesticides (Pingali, 2001; Pingali and Rosegrant, 1995). It is measured as the summation of the ratio of farmland allocation to marketed crops divided by the total crop production weighted by the crop marketability index (Berhanu and Jaleta, 2010). On the other hand, output commercialization refers to the extent of output marketed as the value of marketed crops over the value of the total crop produced (Bekele and Alemu, 2015; Berhanu and Jaleta, 2010; Bernard et al., 2008).

Commercialization is a crutial feature of economic transformation which is a pathway from subsistence agrarian society to a more diversified and food secure economy (Jayne et al., 2011). Commercialization is the joint product of market orientation and output commercialization, thereby leading the smallholder farmers to diversify livelihood strategies. Livelihood diversification is an active social and economic process, by which rural households make a diverse portfolio of activities and social support capability to survive or improve the living standard (Ellis, 1998, 1999). Livelihood diversification is encouraged by pull and push factors (Loison, 2015; Davis et al., 2010; Barrett et al., 2001; Ellis, 1998). An economic growth strategy is a pull factor expands livelihood diversification through strategic complementarities between farm and non-farm economy (Barrett et al., 2017; Barrett et al., 2001). This is explained by the fact that production intensification causes the increased use of factors of production and enhances marketed surplus, thereby input and output market causes farm and non-farm livelihood diversification growth (Barrett et al., 2017; Barrett et al., 2001; Berdegué et al., 2001; Ellis, 1999). As a push factor, livelihood diversification expands as a survival tactic to protect against economic and environmental risks, shocks, and stresses (Ellis, 1998, 1999, 2000; Gautam and Andersen, 2016). Smallholder farmers may experience unfavorable environmental and human-caused shocks and stresses; to deal with these shocks and stresses, smallholder farmers

diversify their livelihoods and employ other strategies to deal with short-term challenges (Reardon, 1997). In order to achieve lower returns, push factors encourage farm households in riskier environments to invest in less sensitive and low-skilled livelihood activities (Kijima et al., 2006; Rijkers and Söderbom, 2013; Rosenzweig and Binswanger, 1993).

Commercialization is thought to hasten agricultural transformation, which then enhances smallholder farmers' well-being (Jayne et al., 2011; von Braun and Kennedy, 1986). With the aid of suitable institutions, markets, and policies, it leads to the diversification of livelihoods and economic growth (Haggblade et al., 2010; Pingali, 1997; Pingali and Rosegrant, 1995; von Braun, 1995; Braun and Kennedy, 1994). On the other hand, studies contend that commercialization may not improve household wellbeing (Mitku, 2014), suggesting that commercialization may not always guarantee the eradication of poverty (Dethier and Effenberger, 2012; Poole et al., 2013).

1.2 Problem statement and research questions

Commercialization is an essential pathway for economic growth and development (Pingali and Rosegrant, 1995; Timmer, 1988; von Braun, 1995). Cognizant to this fact, The Ethiopian economic development policy has focused on smallholder commercialization (Jaleta et al., 2009). It emphasized as the smallholder farmers produce marketed surplus, which is used for input for manufacturing industries, which in turn produce inputs for agricultural intensification. Therefore, the forward and backward linkages of agricultural production are expected to trigger diversification of rural non-farm livelihood activities (Haggblade et al., 2007, 2010; Woldehanna, 1997); and then reduce poverty (Bergh and Nilsson, 2014; von Braun, 1995). However, smallholder farmers surplus production and commercialization is at low stage, and its effects to livelihood diversification strategies and poverty are less known. Moreover, the previous studies are limited to address the association between commercialization, livelihood diversification strategies and poverty. Some of the studies are agricultural commercialization and diversification processes (Pingali and Rosegrant, 1995); agricultural commercialization and its impact on income and nutrition (von Braun, 1995; Carletto et al. 2017); determinants of poverty (Bogale et al.; 2005); determinants of market orientation (Berhanu and Jaleta; 2010); factors affecting output commercialization (Bekele and Alemu, 2015; Berhanu and Jaleta, 2010).

Therefore, this study is trying to answer the research question *what is the association between commercialization, livelihood diversification strategies and poverty in the context of smallholder farmers?* This main question is addressed in chapters from two to five. Each of these chapters are studied and written as stand-alone research papers, with its own specific contribution to the literature.

First, investigating the smallholder farmers market orientation, agro-ecologies and transaction costs associations and its implication for small-scale crop commercialization is vital to comprehend the smallholder farmers commercialization. Previous studies ignored market orientation and works on output commercialization perceiving as synonymous (Abafita et al., 2016; Bekele and Alemu, 2015; Strasberg et al., 1999; von Braun and Kennedy, 1994). On the other hand, market orientation and output commercialization determining factors are not similar (Berhanu and Jaleta, 2010); suggest market orientation and output commercialization are not synonymous. Thereby, investigates market orientation and its determining factors, especially association between agro-ecology and transaction costs is done to comprehend the commercialization process. The research questions are: *1) how market orientation is defined and measured?2) How market orientation is associated with sociodemographic characteristics, access and ownership of resources, access to market and support institutions services, especially agro-ecology and transaction costs?*

Secondly, understanding smallholder farmers crop outputs commercialization and its determinants is important. Because, a large body of literature defines and measures smallholder farmers crop output commercialization differently. First, smallholder farmers produce crops dichotomizing as cash crops, used to generate cash income and food crops, used for household food consumption (de Janvry et al., 1991; Fafchamps, 1992). Then, crop outputs commercialization is calculated as the gross value of cash crops divided by the gross value of all crops (Alemu et al., 2006; Govereh and Jayne, 1999). However, smallholder farmers do not have dichotomous decisions. They produce a mix of food and cash crops, and thus commodities traditionally considered as food crops are marketed (Pender and Alemu, 2007; von Braun and Kennedy, 1994). Second, smallholder farmers are not only sellers but also buyers of crop outputs. Then, crop outputs commercialization is measured as net and absolute market positions (net seller, autarky and net buyer), which is commonly computed as the difference between

percentage of the volume of marketed crop outputs to the summation of the quantity of crop produced, and the percentage volume of crop purchased to the total volume of crop produced (Bellemare and Barrett, 2006; Alemu et al., 2006). However, in the subsistence smallholder production system, purchasing crops for household consumption is non-existent (Pender and Alemu, 2007). Third, smallholder farmers' decisions to market their produce involves selling of diversified agricultural outputs to meet household cash income demand to purchase non-produce commodities and improve household well-being (Carletto et al., 2017). Then, crop outputs commercialization is measured as the ratio of the value of crop commodities sold to the total value of crop commodities produced (Bekele and Alemu, 2015; Strasberg et al., 1999). This suggests that a mix of food and cash crops are produced. As a result, rather than focusing on a single commodity or a few cash commodities, it is essential to consider the mix of commodities to understand the status and factors that influence commercializing smallholder farmers crop outputs. Additionally, sociodemographic factors, access to resource endowments, access to infrastructure, and access to support institutions influence commercializing smallholder farmers' crop output (Abafita et al., 2016; Bekele and Alemu, 2015). However, the effects of landholding size, farmland fragmentation and crop diversification remain unexplored. Therefore, this study focused on investigating the determinants of crop output commercialization incorporating landholding size, farmland fragmentation and crop diversity. The research questions are: *1) how crop output commercialization is defined and measured in the context of smallholder farmers? 2) What is the socio-demographic characteristics, access and ownership of resources, access to market and support institutions services are affecting output commercialization? 3) what is the association between output commercialization, landholding size, farmland fragmentation and crop diversification?*

Third, livelihood diversification strategies comprise a group of varied livelihood activities other than the conventional crop and livestock production. Commonly, sectors, locations, and functions are used to categorize livelihood diversification strategies (Ellis, 1998, 2000; Loison, 2015; Reardon, 1997). However, smallholder farmers use a variety of livelihood diversification techniques to either increase their wealth or ensure their survival. This suggests that understanding livelihood diversification strategies requires including purpose as a classification criterion. Analyzing the impact of agro-ecology and commercialization on smallholder farmers' participation in livelihood diversification strategies is of utmost importance after the appropriate

conceptualization and classification of livelihood diversification strategies. Additionally, factors such as sociodemographic, resource ownership, access, and institutions of support were looked into to determine the choice of livelihood diversification strategies. As a result, this study attempted to examine how commercialization and agroecology influence the selection of livelihood diversification strategies. Therefore, this study tried to analyze the role of agro-ecology and commercialization on the choice of livelihood diversification strategies. The research questions are: *1) what is the definition of livelihood diversification strategy and then, how it is categorized? 2) what is the socio-demographic, resource access and ownership, access to market and support institutions services affect the choice of livelihood diversification strategies? 3) what is the role of agro-ecology and commercialization in choice of livelihood diversification strategies?*

Fourth, poverty in Ethiopia is a persistent and widespread phenomenon (Bogale et al., 2005; Dercon, 1999; Devereux and Sharp, 2003; Kedir and McKay, 2005; Nganwa, 2013; World Bank, 2015). To alleviate the problem of poverty, the government has implemented Agricultural Development Led Industrialization (ADLI) economic development policy focusing on smallholder farmers surplus production and commercialization. Moreover, the empirical evidence show impact of commercialization on poverty is inconclusive (Carletto et al., 2017). For instance, commercialization reduce poverty (Asfaw et al., 2012; Carletto et al., 2017; Muricho et al., 2017; von Braun, 1995); commercialization may not reduce poverty (Dethier and Effenberger, 2012; Poole et al., 2013); and commercialization increase inequality (Pingali and Rosegrant, 1995). These variations might come from the conceptualization and measurement variations of commercialization and poverty in the different contexts; and thus, this study contributes to fill knowledge gap using appropriate conceptualization and measurement of commercialization and poverty in accordance with the smallholder farmers production and market behavior and socio-economic and livelihood wellbeing, respectively. And substantiate the feasibility of economic development policy impact on the rural farm household's wellbeing. Therefore, this study analyzes the impact of commercialization on poverty. The research questions are: *1) what are the diverse underpinnings of poverty? 2) what is the measurement of poverty? 3) what is the definition and measurement of output commercialization? 4) what is the impact of commercialization on poverty?*

1.3 Conceptual framework

Agricultural commercialization is a product choice, input use and output market participation decisions to maximize profit (Pingali, 1997). This creates a process of transforming subsistence agriculture to market-oriented specialized production (Pingali, 1997; Timmer, 1988, 1997). In the lower stages of agricultural commercialization, little specialization exists and market functioning's are imperfect (Timmer, 1997; von Braun, 1995); whereas, in the higher stages of commercialization, market-oriented production expands along with expansion of well-functioning markets (Pingali, 1997). Thereby, the smallholder farmers tend to separate production and consumption decisions (Timmer, 1997; Carter and May, 1999). Commercialization of agriculture creates forward and backward linkages. The backward linkage is about increasing purchasing inputs for intensified production whereas the forward linkage is increasing proportion of marketed surplus to generate income. Consequently, stimulates intensified farm production and remunerative non-farm livelihood diversification (Ellis, 1998; Haggblade et al., 2007, 2010). Consequently commercialization has a potential to increase income, diversify livelihood strategies and consumption portfolio (Ellis, 1998; Ellis et al., 2003; Timmer, 1997).

Smallholder farmers commercialization is affected by endogenous and exogenous factors (Jaleta, et al., 2009; Poole et al., 2013). The endogenous factors are household resource endowments such as farmland size, labor supply, oxen and livestock size etc. The exogenous factors are institutional factors related to policies such as market and trade policies, technology availability and infrastructure development (von Braun, 1995). Moreover, smallholder farmers diversify livelihood strategies either to reduce vulnerability or improve living standard (Blocka and Webb, 2001; Ellis, 2000). The livelihood diversification strategies are determined by resource endowments, institutional and biophysical factors (Ellis, 1998; Gautam and Andersen, 2016).

Resource endowments:- smallholder farmers resource endowments affect commercialization (Poole et al., 2013; von Braun, 1995). Resource endowments that affect commercialization are farmland size, livestock holding size and cash income (Berhanu and Jaleta, 2010; Bernard et al., 2008). Socio-demographic characteristics comprises household head sex, household head age, household head farming experience, and family size affect commercialization (Berhanu and Jaleta, 2010). However, the resource endowments such as farmland size, farmland fragmentation

and socio-economic characteristics real-labor capacity and real-dependency ratio are not investigated in market orientation and output commercialization studies.

Institutional factors: smallholder farmers decision to commercialize is affected by institutional factors (Abafita et al., 2016; Bernard et al., 2008; Jaleta et al., 2009). Development of market and trade are fundamental to commercialization and economic growth (Jaleta et al., 2009; von Braun, 1995; von Braun and Kennedy, 1994). Government investment policy on research, extension service in input supply such as fertilizer, seeds, herbicide and pesticide affect commercialization (Pingali and Rosegrant, 1995; von Braun and Kennedy, 1994). Market access is key element in commercialization (Bernard et al., 2008; Jaleta et al., 2009). Transaction cost constrains market access thereby affects commercialization (Alene et al., 2008; Holloway et al., 2000). Transaction costs are measured through proxies such as access to all-weather roads and market information. Rural credit service, on the other hand, affects commercialization (Abafita et al., 2016; Poole et al., 2013; von Braun and Kennedy, 1994). Moreover, community values and culture affect commercialization (Poole et al., 2013).

Biophysical factors: it comprises technologies, irrigation infrastructure and potential of the study area (agro-ecology). Technologies increase total factor productivity (Timmer, 1997; von Braun, 1995). Technologies comprises irrigation facilities, availability of improved varieties, chemical fertilizer, pesticide and herbicides stimulate commercialization (Barrett, 2008; von Braun, 1995). Massive investment in irrigation development, generation and dissemination of improved varieties and related technologies induce expansion of commercialization (Poole et al., 2013; von Braun and Kennedy, 1994). Moreover, agricultural potential of the area affects commercialization (Bernard et al., 2008). The studies not yet investigated the effect of agro-ecology and cultivated crop diversity on market orientation and output commercialization, respectively.

Factors affecting livelihood diversification strategies

Smallholder farmers livelihood diversification strategies are affected by resource endowments, biophysical and institutional factors (Ellis, 1998; Gautam and Andersen, 2016).

Resource endowments: - smallholder farmer resource endowments such as farm land size, labor, livestock holding size and income affect smallholder farmers livelihood diversification strategies (Barrett et al., 2001; Dercon, 1998; Mentamo and Geda, 2016). Limited access to farm land force the youth in southern Ethiopian, to abandon agriculture and migrate to engage in off-farm livelihood diversification strategies (Bezu and Holden, 2014). Smallholder farmers have relatively low startup capital are less able to engage remunerative livelihood diversification strategies (Amare and Shiferaw, 2017; Babulo et al., 2008). High income enhances smallholder farmers participation in remunerative livelihood diversification strategies (Block and Webb, 2001; Woldenhanna and Oskam, 2001). Moreover, education affects smallholder famers engagement in livelihood diversification strategies (Abdulai and CroleRees, 2001). However, the resource endowments effect on the choice of livelihood diversification is not investigated sufficiently.

Institutional factors: - institutional factors such as market and credit access affect livelihood diversification and wellbeing (Barrett et al., 2001). Market access for input and output market enhances livelihood diversification activities. Rural niche markets are critical for increasing rural livelihood diversification activities (Haggblade et al., 2010). Access to credit service reduces liquidity constraint thereby affects smallholder farmers engagement in livelihood diversification strategies (Abdulai and CroleRees, 2001; Amare and Shiferaw, 2017; Dercon, 1998; Mentamo and Geda, 2016). The other important issue is social network and tie in terms of kinship, and market activities may affect the participation in livelihood diversification strategies. This suggests that understanding social capital effect on livelihood diversification strategies is important to literatures on livelihood diversification strategies.

Biophysical factors: -it comprises access to infrastructure development and agriculture production potential of the study area (agro-ecology). Infrastructure includes access to all-weather roads that create access to input and output market niches. Access to road and improved technologies affect livelihood diversification and wellbeing (Barrett et al., 2001). Households found in far distance areas less likely to participate in non-farm livelihood activities than closer to markets (Abdulai and CroleRees, 2001; Amare and Shiferaw, 2017). However, the role of agro-ecology on the choice of livelihood diversification strategies, not yet investigated.

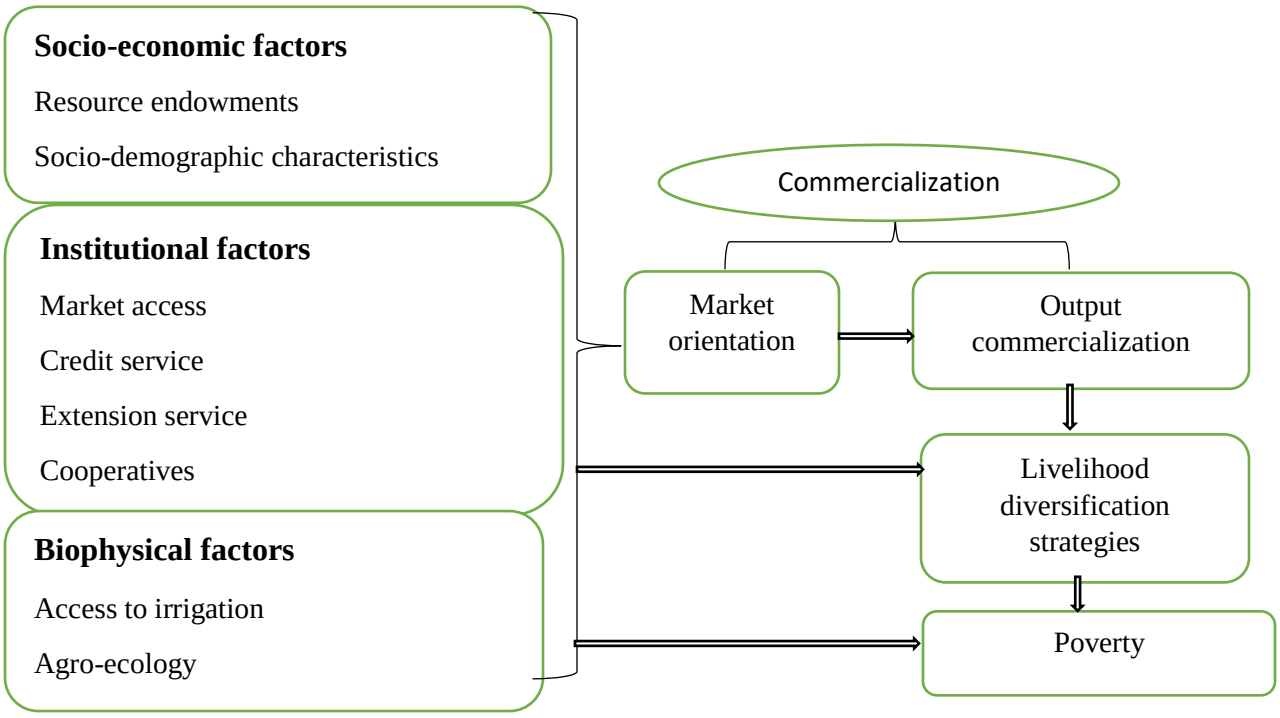

Figure 1: Conceptual framework of commercialization, livelihood diversification strategies and poverty associated with socio-economic, institutional and biophysical factors

1.4 Methodology

1.4.1 Description of the study area

West Gojjam zone is one of Amhara region's 13 administrative zones, located in northwestern Ethiopia, with fourteen woredas (districts) and six town administrations. The total population is 2758806 and the population density is 158.25 persons per square kilometer (CSA, 2008). The rural and urban dwellers are 2,306,999 and 451,807, respectively (ibid). The zone covers an area of 13,311.94 square kilometers. Elevation ranges from 684 to 3656 masl (meter above sea level) (West Gojjam zone plan commission, 2013). Rainfall and temperature ranges from 1057 to 1657 millimeter and 15 to 27.5 degree Celsius, respectively (Amede et al., 2017; Deressa et al., 2010). The area has a favorable environment for the production of different crops and cultivates 612, 297.16 hectare farmland (Amede et al., 2017). The major cultivated crops species are teff, maize, wheat, pepper, millet, barely, potato, onion, faba beans, peans, chickpea, grass pea and

niger seed and vegetables and fruits. The region has also a strong livestock component, dominated by cattle, followed by sheep, goats and equines.

Burie zuria woreda is located with an altitude ranges from 700 to 2350 masl (Ayele et al., 2020). The population is 133307 of which, 66282 and 67025 are male and female, respectively (CSA, 2008). The population density is 138 persons per square kilometer. Temperature ranges from 17-25 degree Celsius and rainfall from 1000 to 1500 millimeter. Burie town is the capital of the woreda, located latitude 10° 42' 0" N and longitude 37° 4' 0" E. It is 410 km distant from Addis Ababa on the other hand, 149kms distant from Bahir Dar. Topography is 76% plain, 10% mountainous, 7% undulated topography and 7% valley. Land use 47% crop cultivation, 20.38% grazing land, 24.07% shrubs and forest land, 8.25% construction and 0.316% water bodies.

Dembecha zuria woreda is located with an altitude range from 1,500 to 2,995 meters above sea level. The total population is 144993 of which 70748 and 74245 are male and female, respectively (west Gojjam zone plan commission, 2013). The population density is 133.08 persons per square kilometer. Dembecha town is the capital of the woreda. It is located a latitude 10°33′N and longitude 37°29′E. The distance from Addis Ababa to Dembecha is 350 kms, on the other hand, 215 kms from Bahir Dar. Topography 60% plain, 30% mountainous and 10% undulated topography.

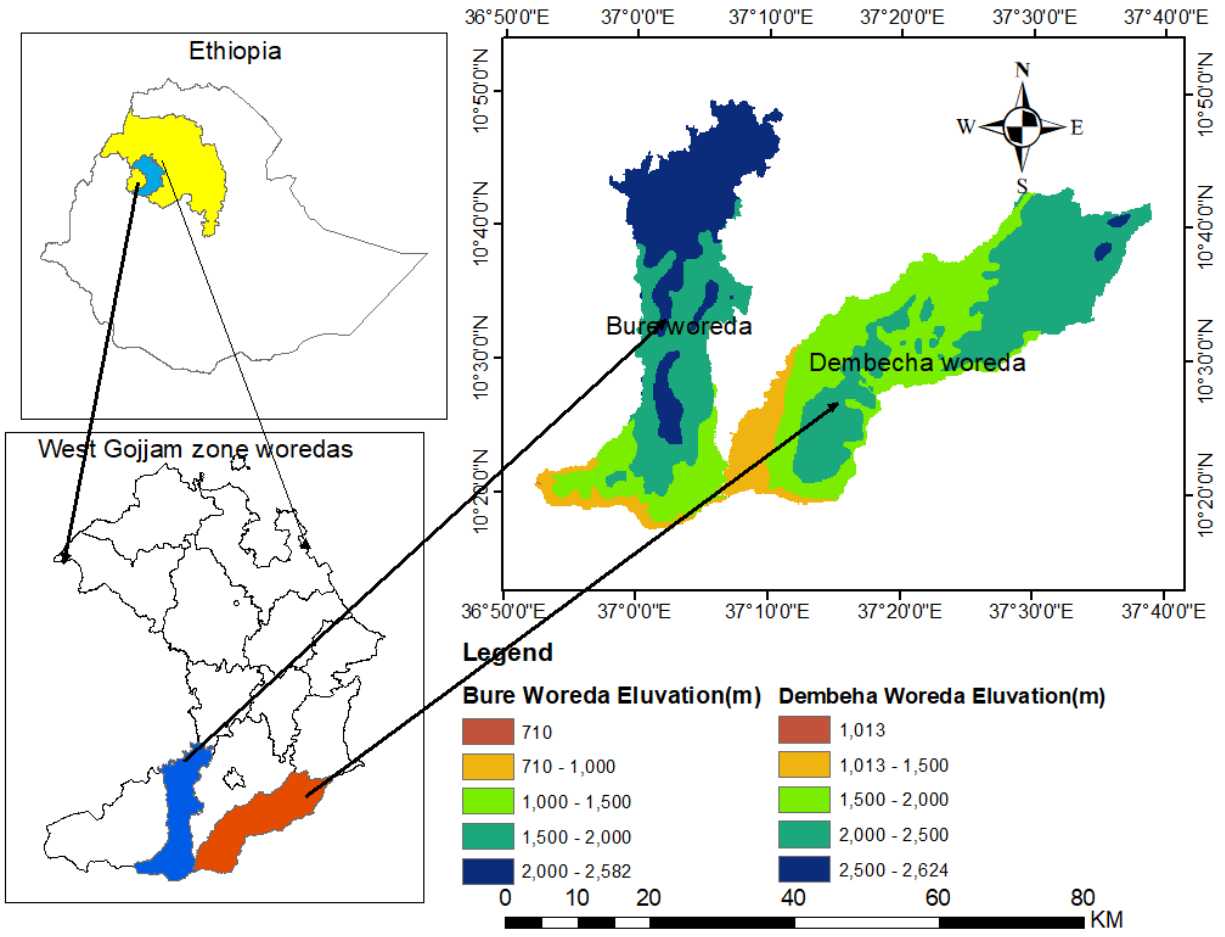

Figure 2: Geographical map of the study area (Source: Ethio-GIS, 2021)

1.4.2 Research paradigm

This study used a pragmatism research paradigm, which holds that reality is observable, measurable, and understandable to some extent, and that reality has multiple explanations based on societal value systems (Graff, 2013). In the context of this study, pragmatism tries to understand the main and specific research questions through measurement and explanation of the association in accordance with smallholder farmers value systems. Pragmatism is the philosophical and/or methodological approach that works best for the investigation of research problem (Johnson and Onwuegbuzie, 2004). Accordingly, pragmatism used to investigate market orientation and its determining factors, commercializing crop outputs and its determining factors, classification of livelihood diversification strategies and its association with commercialization and agroecology, and poverty and its association with output commercialization in accordance

with smallholder farmers crop production and marketing behavior, and livelihood wellbeing. Pragmatism is associated with mixed research design (Creswell, 2009; Howe, 1988). Mixed research design used to conceptualize and measure research problems. This implies the data collection and analysis are done using quantitative and qualitative research design. Deductive and inductive approach is used in reasoning the inquiry. Deductive approach seek to find causes that precede or occurrence at the same time as effect (Graff, 2013). This implies the association between smallholder farmers market orientation and its determining factors; crop output commercialization and its determining factors; livelihood diversification strategies and its association with commercialization and agroecology; and poverty and its association with commercialization had been done using deductive reasoning. The same source explains inductive approach is used to understand market orientation, output commercialization and poverty, and classifications and typologies of livelihood diversification strategies from the perspective of smallholder farmers production and marketing behavior, and livelihood wellbeing. Moreover, inductive reasoning is used to explain the association between outcome and explanatory variables of econometric models' empirical results.

Research design: - Both quantitative and qualitative research designs were used in this study. Quantitative research is used to quantify the resource endowments, biophysical and institutional variables and its association with market orientation, output commercialization, livelihood diversification strategies and poverty. The qualitative research is used to collect qualitative data through individual interview and focus group discussions to conceptualize market orientation and output commercialization; conceptualize and classify livelihood diversification strategies and also, justify why and how the explanatory variables affect the market orientation, output commercialization, choice of livelihood diversification strategies and poverty. Because, a variety of qualitative and quantitative methods give deeper insights and clear picture of the complexity of research problems in the local context (DFID, 1999; Mushongah and Scoones, 2012). Thus, mixing quantitative and qualitative research approach are in-deed compatible in investigating the research problem (Howe, 1988).

Data source and collection method

Primary and secondary data sources are used to inquiry. The primary data is collected from smallholder farmers respondents, focus group discussants, individual interviews and structured interview. Secondary data is collected from published articles and unpublished government documents. Qualitative data is collected through focus group discussion and in-depth interview whereas, the quantitative data is collected through structured interview. Focus group discussions were conducted by the moderator with a group of participants. The participants composition were heterogeneous but the heterogeneity was not too much to elicit important information on the research questions (Ritchie and Lewis, 2003). In-depth key informant interview used to elicit information on the research question (Mack et al., 2005). During in-depth interviews, the interviewee explains the issues to the researchers. The researchers listen and ask questions on issues need further explanation. Structured interview is done using structured questionnaire. The enumerators interview the sampled respondents face-to-face.

Sampling, sample and data collection procedure

The data used in this study were obtained from 405 smallholder farm households from two districts (*woredas)* in west Gojjam through March, May and June 2018. Proportion to size sampling strategy used to determine the sampled households 194 and 211 from Burie Zuria and Dembecha Zuria districts, respectively. In the process of data collection, multistage data collection procedure was employed. In the first stage, the study area, west Gojjam zone was selected purposively based on its agricultural production potential and the institutions responsible in assisting the smallholder farmers in technology generation provide extension advisory and credit services, and supply improved agricultural technologies such as improved seeds, chemical fertilizer, herbicides, and pesticides are installed. Thereby, crop commercialization, livelihood diversification strategies and wellbeing of the rural households could be investigated. In the second stage, among the fourteen woredas administered in the zone, *Dembecha zuria* and *Burie zuria* woredas were selected randomly through lottery method. In the third stage, under the number of kebeles clustered as lowland, midland and highland in each district, six *kebeles*[1] such as *Zeyushewen, Wadera* and *Ambaye* from *Burie* woreda; and

[1] *Kebele* is the lowest administrative unit in the government structure

Astevoch Egziabhierab, Yesheboch and *Gelila* from *Dembecha* woreda selected randomly. Clustering was done by the woredas agriculture offices based on the farming system, altitude, temperature and rainfall. In the fourth stage, sampled farm households selected randomly from the list of farm households registered in the *kebele* agricultural office. The structured questionnaire was developed and pre-tested to customize to the local situation. The survey was conducted through one-to-one structured interview basis administered by five enumerators and one supervisor. Data were collected on household socio-demographic characteristics, household's physical, financial, social, natural and human assets, agroecology, crop production, input-output markets, transaction costs and access to institutions, market price, livelihood diversification activities, livelihood diversification strategies, multidimensional poverty indicators.

Sample size: - the sampled households' size was determined using Cochran sample size determination formula. West Gojjam zone population is large and thus, Cochran is appropriate in large population. Since we do not have much information about market orientation of the population, to get maximum variability we assumed 50% of the population was market oriented, participate in crop output market; diversify livelihood strategies and poor. We want to employ 95% confidence interval with 5 % precision. Then, 385 households were determined however, to alleviate the problem of missing data, we added 20 households.

Cochran sample size determination formula:

$$n_0 = \frac{z^2 pq}{e^2}$$

Where: z is 1.96, p is the estimated proportion of the population who is market oriented (0.5) q= (1- p) =0.5 and e is the precision level (0.05).

Table 1: Sample size by agro-ecology

District	*Kebele*	*Agro-ecology*	*Population*	*Sample size*
Burie Zuria	Zeyushewen	Lowland	696	51
	Wadera	Midland	814	59
	Ambaye	Highland	1238	86
Dembecha Zuria	Astevoch Egziabhierab	Lowland	1160	76
	Yesheboch	Midland	580	43
	Gelila	Highland	944	90
Total			5432	405

Data analysis methods: - quantitative data was analyzed using descriptive and inferential statistics, and econometric models. Descriptive statistics includes mean, frequency and standard deviation and standard errors. Inferential statistics comprises parametric and non-parametric tests such as t-test, f-test, chi-square test. The econometric methods are zero-inflated beta regression was used to analyze the determinants of market orientation and output commercialization, multivariate probit used to analyze determinants of the choice of livelihood diversification strategies and endogenous switching regression to analyze the impact of output commercialization on poverty.

Organization of the thesis

The first chapter introduces the background of the study, problem statement and research question, conceptual framework, description of the study area and research methodology. The second chapter examines determinants of smallholder farmers market orientation. The third chapter investigates determining factors of commercializing crop outputs. The fourth chapter analyzes the smallholder farmers livelihood diversification strategies and its association with determining factors focusing on agroecology and commercialization. The fifth chapter investigates the impact of smallholder farmers output commercialization on poverty. The six chapter contains synthesis of major findings and conclusion.

CHAPTER TWO

DETERMINANTS OF SMALLHOLDER FARMERS' MARKET ORIENTATION FOR SMALL-SCALE CROP COMMERCIALIZATION IN WEST GOJJAM ZONE, AMHARA REGION, ETHIOPIA

Abstract

The study examines the determinants of smallholder farmers' market orientation considering agro-ecology and transaction costs. Multistage sampling procedure was used to collect quantitative data from 405 randomly selected smallholder farmers. Key informant interview and focus group discussions were used to collect qualitative data. Descriptive statistics, one-way ANOVA and zero-inflated beta regression were used to analyze quantitative data while narration data analysis used to analyze the qualitative data. The results have revealed that smallholder farmers in the lowlands and midlands are more market oriented than they are in the highlands. Education increases the probability and proportion of market orientation. Farmland size and farmland rental contracts positively influence the probability of market orientation. Distance from home to nearby markets negatively affect the proportion of smallholder farmers' market orientation. Cellphone possession positively influences the probability of market orientation. Membership to farmers cooperatives enhances extent of market orientation. The findings have suggested that human capital, physical resource endowments and arrangement, transaction costs, cooperatives, and agroecological endowment affect smallholder farmers' market orientation. Therefore, education, farmland rental contracts, infrastructure development, and soil fertility improving technologies are needed to increase market orientation and promote small-scale commercialization.

This chapter is based on Lijalem Abebaw, Worku Tuffa, and Dawit Alemu (2021). Determinants of Smallholder Farmers' Market Orientation for Small-Scale Crop Commercialization in West Gojjam Zone, Amhara Region, Ethiopia. Ethiopian Journal of Economics Vol. XXX No 1

2.1 Introduction

Crop production in Ethiopia has dominant role in the agriculture sector of the economy. It is source of livelihood for large number of populations, which contributes for food and nutrition security, and export earnings. The smallholder farmers cultivate more than 96 percent of the cultivated farmland (Taffesse et al., 2012). This implies commercialization of smallholder farmers crop production have vital role to transform the economy. Cognizant to this fact, Ethiopian government in its Agriculture Development Led Industrialization (ADLI) economic development policy and consecutive Growth and Transformation strategic plans give due attention for smallholder farmers crop commercialization.

Crop commercialization leads to greater market orientation of farm production, which is manifested through increase in purchase of traded inputs and decline in utilizing non-traded inputs and the decline of mixed farming system to specialized production (Pingali, 2001; Pingali and Rosegrant, 1995). Small-scale crop commercialization necessitates product choice and input use decisions, and allocation of resources based on market signals (Abafita et al., 2016; Gebremedhin and Jaleta, 2010; Pingali, 1997; Pingali and Rosegrant, 1995). In other words, it is market-orientation, which can be defined as production decision manifested through a relative choice of crop products and allocation of inputs to meet the market demand. It is higher input allocation for marketable products than households' food products. Consequently, market orientation of smallholder farmers implies decisions towards the production of marketable crop species and the allocation of more agricultural land and other inputs.

Market orientation is commonly affected by socio-demographic characteristics, physical resource endowments, commodities productivity, and input and output markets (Gebremedhin and Jaleta, 2010; Micheels and Gow, 2008; Pingali and Rosegrant, 1995). The resource endowments comprise farm households′ socio-demographic characteristics such as: household head age, education, family size and labor; physical resource endowments contain farmland size and equines; and institutional services includes access to market information, credit and agricultural extension services. Commodity production is affected by agro-ecological endowment (Behera et al., 2007; Eledu et al., 2004). Agro-ecology induces diversity of agroecosystem services, which affects crop types production. Because, certain type of agro-ecosystem services is suitable for

production of specific crop type (Behera et al., 2007). Therefore, agro-ecology affects crop production and revenue (Taffesse et al., 2012). Access to market is affected by transaction costs (Alene et al., 2008; Baraka et al., 2019; Holloway et al., 2000; Olwande et al., 2015; Williamson, 1981). Thus, the transaction cost associated with exchange of input and outputs in markets increases, leading to the inefficiency of input and output markets (Baraka et al., 2019; Alian de Janvry et al., 1991).

The previous literature focuses on the theoretical explanations in factors affecting market-oriented farming with less attention to empirical analysis to smallholder farmers. The exception is the work by Gebremedhin and Jaleta (2010) who analyzed the determinants of market orientation. The previous literature explains agro-ecology affects crop production and revenue; however, it did not reveal its association with smallholder farmers decision in resource allocation to marketable crop types based on market signal. Moreover, the literature employs Ordinary Least Square (OLS) and Tobit regressions, which assume normal distribution. However, the market orientation is an index that has both Bernoulli and beta distributions. Thus, zero-inflated beta regression enables better treatment of beta and Bernoulli distribution. Lastly, from practical point of view, understanding the factors affecting smallholder farmers market orientation focusing on agro-ecology and transaction costs plays an important role in turning smallholder mixed production systems into specialized and market-oriented production thereby enhance small-scale commercialization.

2.2 Literature Review

Market orientation is smallholder farmers production decision manifested through a relative choice of crop products and allocation of inputs to meet the market demand**.** In practical terms, market orientation is decisions towards the production of marketable crop species and the allocation of more agricultural land and other inputs. Resource endowments, the productivity of commodities and output markets are considered important determinants of the market-oriented decision of smallholder farmers (Gebremedhin and Jaleta, 2010; Micheels and Gow, 2008). Resource endowment such as farmland and labour affect crop type choice (Behera et al., 2007; Donovan and Poole, 2014; Hitayezu et al., 2016). The smallholder farmers cultivate multiple crops. The relative allocation of farmland size for mix of crops is affected by farmland size and

farm household labour. Farm household labour constrains cultivation of crop types demand intensive labour for management practices where as larger farmland size encrourages production of marketable crop types (Donovan and Poole, 2014). Commodity productivity and market price, on the other hand, are key criteria for resource allocation (Micheels and Gow, 2008), which is a response to changing market prices, comparative advantage, and economic opportunity (Rosegrant et al., 1995). Farmers' decision on the relative allocation of farmland to the product mix to be produced is often based on considerations that could maximize benefits. In this regard, empirical evidence shows that market-oriented producers consider both the productivity of commodities and the market price to maximize profits (Micheels, 2010; Micheels and Gow, 2008; Suh and Moss, 2018).

On the other hand, crop production varies by agro-ecology, as differences in agro-ecological endowments increase the production of specialized commodities increases (Timmer, 1997). Agro-ecology refers to the interaction of the ecology, agronomy, local knowledge and social settings of a particular community that creates an agro-ecosystem suitable for a local context (Hazard et al., 2017). The agro-ecosystem affects the diversity, interaction and synergy of crop and livestock species (Conway, 1983; Tittonel, 2015). Diverse agricultural systems include diverse agricultural practices, landscapes and species diversity (Kremen et al., 2012). The interaction process stimulates the function of the agro-ecosystem, which increases resource use efficiency and commodity production potential (Tittonel, 2015).

Transaction cost is the cost of carrying out transaction of goods and services between the buyer and seller (Fischer and Qaim, 2012). Transaction cost includes costs for searching of a trading partner with whom goods or services are exchanged; negotiating a price and bargaining with potential trading partner; and transferring the product (Fischer and Qaim, 2012; Holloway et al., 2000). Transaction cost is classified in to fixed and proportional transaction cost (Key et al., 2000). Fixed transaction costs are costs that are invariant based on the volume of traded good or service. While proportional transaction costs are variable costs that differ based on the volume of traded good or service. Markets in developing countries are characterized by poor infrastructure and limited access to information (Ingenbleek et al., 2013). As a result, the transaction cost associated with exchange of input and outputs in markets increases, leading to the inefficiency of input and output markets (Baraka et al., 2019; de Janvry et al., 1991). With this regard,

transaction cost is expected to affect smallholder farmers market orientation but still there is a need to analyze with empirical data.

2.3 Methodology

2.3.1 Description of the study area

West Gojjam zone is one of the 13 administrative zones of Amhara region. It is located in north west of Ethiopia, its capital Finote Selam is 385 km far from Addis Ababa, on the other hand, 171 kms far from the Amhara region capital, Bahir Dar. West Gojjam zone has fourteen woredas and six town administrations. The total population is 2,758,806 and the population density is 158.25 persons per square kilometer (CSA, 2008). The rural and urban dwellers are 2,306,999 and 451,807, respectively (ibid). The zone covers an area of 13,311.94 square kilometers. Elevation ranges from 684 to 3656 masl (meter above sea level) (West Gojjam zone plan commission, 2013).

Crop production unevenly distributed throughout the study area in line with the altitude, soil type and fertility, temperature, rainfall, infrastructure and market access. Altitudes, rainfall, and average temperature ranging from 1700 to 3000 masl[2], 1057 to 1657 millimeter and 15 to 27.5 degree Celsius, respectively (Amede et al., 2017; T. Deressa et al., 2010). The area has a favorable environment for the production of different crops (Amede et al., 2017); consequently, the study area is potential producer of diversified crop types such as cereals, pulses, oilseeds, vegetables and fruits. According to Central Statistical Authority (CSA, 2014), in west Gojjam zone the cultivated farmland size is estimated to be 612, 297.16 hectare covered by teff, maize, wheat, pepper, millet, barely, potato, onion, beans, peans, chickpea, grass pea and niger seed and vegetables and fruits. The annual crops covered more than 93 percent of the total crop cultivated farmlands (Gebremedhin and Jaleta, 2010; Taffesse et al., 2012). To this effect, the study analyzes smallholder farmers annual crop types market orientation. The per capita farmland holding size in the study area ranges from a minimum of less than 0.1 to a maximum of 10 hectares and average of 1.23 hectares. The study area has also a strong livestock component, dominated by cattle, followed by sheep, goats and equines, which supports crop production through providing draft power and market access.

[2] Meter above sea level

Market oriented production to transformation the agriculture sector is the major development strategy in the last more than 20 years, which have effect on smallholder farmers market-oriented production. The institutions responsible in commercial transformation of agriculture are Amhara Region Agriculture Bureau, Amhara Region Agricultural Research Institute (ARARI), Farmers' cooperatives and unions, Amhara Credit and Saving Institute (ACSI). The institutions involve in assisting the smallholder farmers in technology generation, provide extension advisory and credit services, and supply improved agricultural technologies such as improved seeds, chemical fertilizer, herbicides, and pesticides. Thus, the study area is purposively selected as the region is more prone to crop production and there has been efforts by public and private organizations to enhance market-oriented crop production to transform the economy.

2.3.2 Research design

Mixed research design combines quantitative and qualitative research design (Creswell, 2013; Graff, 2013; Howe, 1988). Mixed research design is useful if quantitative or qualitative research approach is inadequate to understand the research problem (Creswell, 2009). In other words, mixed method purpose is triangulation and complementarity (Greene et al., 1989). Triangulation is seeking convergence of research findings using multiple methods. Complementarity is use of different methods to assess different study components or phenomenon. Quantitative research is used to quantify the resource endowments, biophysical and institutional variables and its association with market orientation. The qualitative research is used to collect qualitative data through individual interview and focus group discussions to conceptualize market orientation. and also, justify why and how the explanatory variables affect the market orientation. Because, a variety of qualitative and quantitative methods give deeper insights and clear picture of the complexity of research problems in the local context (DFID, 1999; Mushongah and Scoones, 2012). Thus, mixing quantitative and qualitative research approach are in-deed compatible in investigating the research problem (Howe, 1988).

2.3.3 Sampling procedure, sample size, data collection and analysis

Sampling procedure: - proportion to size and multistage random sampling strategy were employed to select respondent farmers. Accordingly, Dembecha zuria and Burie zuria woredas were selected through lottery method among fourteen woredas administered in west Gojjam

zone. Dembecha zuria and Burie Zuria woreda has 31 and 21 kebeles, respectively. Woreda agriculture offices clustered the number of kebeles as lowland, midland and highland based on their altitude and crop production system. Accordingly, a kebele from each agro-ecology for both districts were randomly selected. Hence, six kebeles[3] namely Zeyushewen, Wadera and Ambaye from Burie Zuria district; and Astevoch-Egziabhierab, Yesheboch and Gelila from Dembecha Zuria district were selected randomly from list of highlands, midland and lowland kebeles, respectively. Proportion to size sampling strategy was employed to select sampled farmers from each *kebele* (Appendix Table 1).

Sample size:- Cochran sample size determination formula was used as the study area has large population size (Israel, 1992). Cochran formula make the sample size 385 and then, we add contingency 5 percent making the total sample size 405 respondents. Since we do not have much information about market orientation of the population, to get maximum variability we assumed 50% of the population was market oriented and also, employ 95% confidence interval with 5 % precision.

$$n_0 = \frac{z^2 pq}{e^2} \qquad \text{[Equation 1]}$$

Where: z is 1.96, p is the estimated proportion of the population who is market oriented (0.5) q= (1- p) =0.5 and e is the precision level (0.05).

Data collection method: Quantitative and qualitative data were collected to analyze the determinants of smallholder farmers market orientation. Quantitative data were collected using structured questionnaires through personal interview. The questionnaire, translated to Amharic, contains farm households' socio-demographic characteristics, physical and financial assets, agro-ecology, crop production, input-output markets, transaction costs and access to institutions. Qualitative data were collected using checklist through individual interview and focus group discussions to substantiate quantitative data, which was moderated by the first author.

[3] *Kebele* is the lowest administrative unit in the government structure

Data analysis: quantitative data analysis is done through descriptive statistics, inferential statistics such as chi-square test, one-way ANOVA and zero-inflated beta regression. Qualitative data was analyzed through thematic method of analysis.

2.3.4 Conceptualizing market orientation

As discussed earlier, market orientation is about smallholder farmers' economic decision-making in the allocation of resources to the mix of crops produced for both household consumption and market. In the livestock-crop mixed farming system of the study area, the farmers produce different types of food and high-value crops both to meet their household consumption and marketed surplus. The annual crops types produced by the farmers, in the study area and used for analysis, are pepper, maize, teff, wheat, millet, barely, faba bean, chickpea, field pea, niger seed, potato, and onion. Market orientation entails people's allocation of farmland to the mix of crop types produced to maximize benefit based on productivity and market price. In this process of farmers decision, the smallholder farmers' want to maximize their expected utility in deciding the allocation of resources to produce both for household consumption and marketable surplus.

Market orientation is calculated as the smallholder farmland allocation to each type of crop cultivated, weighted by the marketability of each crop at farmer level, divided by the total area cultivated per crop. In previous studies, market orientation is calculated as the smallholder land allocation to each type of crop cultivated, weighted by the marketability of each crop in a specific location divided by the total area cultivated per crop (Abafita et al., 2016; Gebremedhin and Jaleta, 2010; Tefera, 2014). This study, however, employs the marketability index of smallholder farmers, which weighs the allocation of land that can measure variability at the farmer level, for fear that the location specific marketability index may overestimate or underestimate the marketability index of the farmer. Therefore, we calculate market orientation as the sum of farmland allocated for each crop cultivated, weighted by the marketability of the same type of crop at the farmer level, divided by the total cultivated land in a given production year. The higher the allocation of farmland for marketable crops, the higher the farmer market orientation index would be. No market orientation means that the smallholder farmer did not market produced crop(s) in a particular production year, while Market Orientation Index (MOI) equals one means that a farmer allocated the total farmland for a single crop production and has

marketed the total quantity produced.

$$MOI_i = \frac{\sum_{i=1}^{n} l_{ji} * M_{ji}}{l_{ti}} \qquad 0 \leq MOI < 1 \qquad \text{[Equation 2]}$$

Where;

MOI_i Market Orientation Index of farmer i

l_{ji} Farmland size (hectare) allocated to crop j by the farmer i

l_{ti} Total farmland size cultivated for crop production by the farmer i

M_{ji} Marketability index of crop j of the farmer i

Marketability index is the amount of crop j marketed divided by the total crop j produced by the farmer i, in a specific production year.

$$M_{ji} = \frac{c_{mji}}{c_{pji}} \qquad \text{[Equation 3]}$$

Where;

c_{mji} amount of crop (quintal) j marketed by the farmer i

c_{pji} amount of crop j produced by the farmer i

M_{ji} marketability index of crop j of the farmer i

2.3.5 Econometric model: application of zero-inflated beta regression

The empirical MOI data is continuous proportion contains zero (0≤MOI<1). Linear regression is not appropriate in the restricted proportional, indexed and rate of dependent variables between 0 and 1 (Ferrari and Cribari-Neto, 2004). This is because, the same source states proportions are asymmetry and the predictions based on normality assumption are misleading. Zero-inflated beta regression assumes the dependent variable has mixed continuous-discrete distribution with a probability of mass at zero (Ospina and Ferrari, 2012). Cognizant to this fact, the empirical MOI contains zero values that made a mixed continuous-discrete distribution. The discrete distribution is Bernoulli distribution at a farmer did not allocate farmland to cultivate crop for market in the production year (MOI=0). The beta distribution parameterized in terms of smallholder farmers' market orientation mean and precision parameter, and Bernoulli distribution is the probability of

farmer that does not allocate farmland to cultivate crop commodity for sale in a production year. Thus, zero-inflated beta regression computes the smallholder farmers market orientation mean and the precision parameter of beta distribution and the probability of smallholder farmers' do not allocate farmland to cultivate crop commodity for sale in the production year. The precision parameter shows the dispersion of the distribution of smallholder households' market orientation index. As the precision parameter increases dispersion of the distribution of smallholder farmers' market orientation (MOI) decreases. Zero-inflated beta regression is specified as the probability and conditional mean function of a response of households' market orientation is:

$$b_{ic}(MOI;\ \alpha, \mu, \phi\ ) = \begin{cases} \alpha & if\ MOI = 0 \\ (1-\alpha) f(MOI; \mu, \phi) & if\ MOI\ \varepsilon(0,1) \end{cases} \quad \text{[Equation 4]}$$

$(1-\alpha)$ is the conditional mean of smallholder farmers market orientation when its value is between zero and one, in a beta density function; α is a probability mass at smallholder market orientation index is zero.

The mean of MOI and its variance is computed as:

$$E(MOI) = \alpha c + (1-\alpha)\mu \quad \text{[Equation 5]}$$

$$var(MOI) = (1-\alpha)\frac{\mu(1-\mu)}{\phi+1} + \alpha(1-\alpha)(c-\mu)^2 \quad \text{[Equation 6]}$$

$E(MOI)$ is the weighted average of the mean of the Bernoulli distribution at c or MOI=0 and beta distribution $B(\mu, \phi)$ with weights α and $(1-\alpha)$ and also $E(y/y\ \varepsilon\ (0,1)) = \mu$; $var\ (y/y\ \ \varepsilon\ (0,1) = \frac{\mu(1-\mu)}{\phi+1}$

Zero-inflated beta regression functional form is the market orientation index as the probability at zero and conditional mean (Pereira and Cribari-Neto, 2010).

The probability of smallholder farmers output commercialization at zero functional form:

$$h(\alpha_t) = \gamma_0 + \gamma_1 z_{t1} + \ \varepsilon \quad \text{[Equation 7]}$$

The output commercialization conditional means functional form:

$$g(\mu_t) = \beta_0 + \beta_1 x_{t1} + \ \varepsilon \quad \text{[Equation 8]}$$

The precision parameter function is

$$b(\phi_t) = \lambda_0 + \lambda_1 s_{t1} + \ \varepsilon \quad \text{[Equation 9]}$$

Where: $h(\alpha_t)$ the probability of household output commercialization at zero function; $g(\mu_t)$ the smallholder farmers output commercialization conditional mean function; $b(\phi_t)$ the households output commercialization precision parameter function. γ_1, β_1 λ_1 Vector of parameters to be estimated. z_{t1} x_{t1}, s_{t1} Vector of explanatory variables. The explanatory variables are socio-demographic characteristics, resource endowments, transaction costs and agro-ecology. ε random errors distributed as normal distribution with zero mean and unitary variance

[Equation 4] to [Equation 6] provides interesting features. The variance of MOI is a function of (α_t, μ_t, ϕ_t) and the consequence of the covariate values (Ospina and Ferrari, 2012). The covariates and the parameters influence the precision of the conditional distribution of MOI. Therefore, zero-inflated beta regression offers the effect of the heterogeneity among market-oriented farmers and nonmarket oriented farmers on extent or probability of market orientation, respectively.

2.3.6 Hypthesized determinants of market orientation

Smallholder farmer's market orientation varies due to heterogeneity in socio-demographic characteristics, resource endowments, transaction costs and access to institutional services. The theoretical and empirical review reveals the association between heterogeneity among smallholder farmers and its influence on market orientation.

Socio-demographic characteristics such as education, sex and dependency ratio could affect market orientation. Education enables the smallholder farmers access to market information and process it (Gebremedhin and Jaleta, 2010). For instance, education increases the ability of the farmer technology and innovation adoption (Admassie and Ayele, 2011; Yigezu et al., 2018), and also, might enable factor inputs optimum allocation for production of marketable crops. Therefore, education is expected to increase resource allocation to produce marketable commodities. Men and women headed farm households have difference in production efficiency and selection of marketable crop types. Teklu (2005) documented that male-headed farm households are more efficient in production than women-headed farm households. This might be due to the cultural taboo women are inappropriate to plough farmland (ibid); and women access

to productive farmland is limited (Ali et al., 2016), which limits allocation of farmland to marketable crops. In addition, women have less access to market information, which affect the allocation of resources for marketable crop types. Thus, male-headed farm households are expected to increase market orientation than their counterparts.

Household consumption demand could affect market orientation. Because, household consumption requirements reduce the investment to improved technologies and make more risk averse. Real-dependency ratio is a proxy for consumption demand, which shows the proportion of unproductive household members over productive household members. It measures the dependency of the household based on labour capacity of the household. Sharp (2003) calculate real dependency ratio as:

$$real\ dependency\ ratio = \frac{family\ size - labor\ capacity}{labor\ capacity}$$

The higher the real-dependency ratio demands a higher amount of food crops for consumption and reduces the income gain and investment on marketable crop types.

Smallholder farmers physical resource endowments and arrangements affect the decision to allocate resources (Poole et al., 2013; von Braun, 1995). These are landholding size, farmland fragmentation and farmland rented contract. In the study area, farmland is undoubtedly the most important input for crop production. Larger farmland size increases the relative allocation of farmland size to marketable crops. Because, the household food consumption demand is expected to be less elastic. Thus, the smallholder farmers allocation of farmland size for marketable crops expected to increase. Land fragmentation refers to the number of parcels of farmlands a farmer owns. Farmland fragmentation increases the production costs and reduce productivity (Latruffe and Piet, 2014) thereby reduces smallholder farmers allocation of resources for marketable crops. In other words, the smallholder farmers try to allocate more farmland for food crop types to meet household food consumption demand while reducing investment on marketable crop. Simpson index takes in to account the number of parcels and the size of the parcel in estimating land fragmentation (Wu et al., 2005). The index increases as the number of parcels increases; it increases when the size of the parcels tends to be similar; it decreases when the plot size increases

$$SI_i = 1 - \frac{\sum_{j=1}^{k} a_{ij}^2}{(\sum_{j=1}^{k} a_{ij})^2} \qquad 0 \leq SI < 1 \qquad \text{[Equation 10]}$$

Where;

SI_i is Simpson land fragmentation index of farmer *'i';*

a_i the area of parcel '*j'* of farmer *'i'* , where *'j'* ranges from *1* to *k;*

$SI=0$ means the farmer have one parcel of land (land consolidation).

As the household owns large farmland fragmentation index, market orientation is expected to reduce.

Scarcity of farmland is an important constraining factor for crop cultivation accompanied by legal prohibition of land selling and buying by the government (Alemu, 2009). To alleviate this, the community have a practice of farmland rental contracts[4] for crop production for specific production seasons (Zeng et al., 2018). The rented farmland increases the cultivated farmland size and thus, the smallholder farmers are expected to allocate large farmland size for marketable crops. Moreover, irrigation enhance cash crop production (Pender and Alemu, 2007); thus, we expect that irrigation would increase smallholder farmers production of marketable crops.

Transaction cost imped market access (Dillon and Barrett, 2017; de Janvry et al., 1991); thereby reduce specialized crop production (Omamo, 1998). Transaction costs are difficult to measure (Alene et al., 2008). Thus, smallholder farmers transaction cost measured in proxies such as residence distance to the all-weather roads and nearby market places and access to Cell phones. Thus, as the smallholder farmer's residence distance from the nearby markets and all-weather roads, the smallholder farmers are expected to reduce allocation of resources to marketable crop types. Moreover, smallholder farmers access cell phone would able to get market information, used for market entry thereby the smallholder farmer allocation of resources for marketable crops enhances.

Last but not least, access to institutional services such as agricultural extension, cooperatives and credit services enhances smallholder farmers access to technologies, market and finance that

[4] Farmland rental contracts is a land tenure arrangement which includes share-in and rented-in farmland sizes cultivated by the smallholder farmer in the crop production season. Rented-in and share in arrangements are made between the landowner and the land renter in cash and in-kind, respectively.

would enhance smallholder farmer's capability in market-oriented production (Timmer, 1997; von Braun, 1995; Woldey and Peck, 2010).

2.4 Result and Discussion

2.4.1 Market orientation and smallholder farmers' characteristics by agro-ecology

Table 3 depicts that the sampled respondents' average market orientation index was 0.150. Among the sampled respondents 18.68% is non-market oriented while 81.32% are market oriented at varied extent. Market orientation significantly varies among the lowland, midland and highland. The lowland is higher than the midland and the midland is higher than the highland. The farm household heads average educational status was grade 1.290. The farm households' average real-dependency ratio was 0.433.

Regarding physical resource ownership and characteristics, the smallholder farmers average landholding size was 1.286. The lowland farmers' landholding size greater than the midlands and highlands; and the midlands farmland holding size is greater than the highlands. Land fragmentation was significantly lower in the lowlands than midlands and highlands. Smallholder farmers average farmland rental contract size was 0.471 hectare. The average farmland rental contract size was significantly larger in the lowlands than midland or highland agro-ecology. It implies farmland rental contract is important for crop cultivation. Moreover, smallholder farmers accessed small-scale irrigation varied among agro-ecologies. The proportion of sampled smallholder farmers accessed small-scale irrigation in the highlands, midlands and lowlands were 45.2, 22.7 and 3.74 percent, respectively. Because, the small streams in the highlands are accessed for small-scale irrigation whereas, in the lowlands rivers flow in the deep gorges makes inaccessible for irrigation.

The smallholder farmers travel on average 42.425minutes to reach the nearby market place. Smallholder farmers' residence from the all-weather road took on average 26.129 minutes. The farmers' residence distance to all-weather road was significantly lower in the lowlands than the highlands. The proportion of cellphone owned farmers was significantly varied among highlands, midlands and lowlands. These suggest the farmers in the lowlands incurred less transaction cost relative to the farmers in the midlands or highlands. The smallholder farmers',

who are members of the cooperatives, accessed public extension services, and accessed formal credit service varied among agro-ecologies.

The results generally indicate that farmers in the lowlands endowed with resources and have access to infrastructures that increase crop productivity and reduce transaction costs. Consequently, smallholder farmers' market orientation in the low land is higher in comparison with their counterparts in the midland and highland agro-ecologies.

Table 3: Market orientation and smallholder characteristics by agro-ecology

Variables	Obs(n)	Total mean (std. Error)	Mean (standard errors) by agro-ecology			F /X^2 test
			Lowland	Midland	Highland	
Dependent variable						
Market orientation index(continuous)	380	0.150(0.008)	0.249 (0.017)[a]	0.144(0.013)[b]	0.077(0.008)[c]	51.83 ***
Socio-demographic characteristics						
Household head sex (dummy=1 male,0 otherwise)	405	0.931(0.014)	0.925 (0.025)	0.898(0.032)	0.957(0.017)	3.1841
Household head education (continuous)	404	1.290(0.123)	1.29 (0.206)	1.136(0.205)	1.388(0.214)	0.78
Real-dependency ratio	402	0.433(0.030)	0.522 (0.0575) [a]	0.381(0.061) [bc]	0.397(0.040) [c]	3.89 **
Physical resource endowment and arrangement						
Cellphone ownership (dummy= 1owned; 0= otherwise)	405	0.683(0.026)	0.794 (0.039)	0.761(0.046)	0.547(0.042)	23.6007***
Landholding size in hectare	405	1.286(0.044)	1.641 (0.095) [a]	1.328(0.070) [b]	0.986(0.050) [c]	28.12***
Land fragmentation index	376	0.571(0.012)	0.526 (0.023) [c]	0.615(0.021) [ab]	0.579(0.02)[b]	2.39*
Farmland rental contract size in hectare	404	0.471(0.036)	0.720 (0.083) [a]	0.504 (0.067) [bc]	0.259(0.032) [c]	16.53***
Access to irrigation (dummy 1 if access; 0 otherwise)	404	0.261(0.024)	0.0374(0.0184)	0.227(0.045)	0.453(0.042)	59.0291***
Transaction cost						
Residence distance from the all-weather road in minutes	405	26.129(2.262)	16.897 (1.749) [c]	28.182(6.980) [bc]	31.935(2.772) [a]	5.54***
Residence from distance from nearby market minutes	405	42.425(1.841)	43.477(3.274)	38.148(3.216)	44.324(3.012)	1.83
Cellphone ownership (dummy= 1owned; 0= otherwise)	405	0.683(0.026)	0.794 (0.039)	0.761(0.046)	0.547(0.042)	23.6007***
Access to services						
Membership to cooperative (1 member; 0 otherwise)	397	0.692(0.0253)	0.729(0.0432)	0.818 (0.041)	0.583(0.042)	17.8488***
Access to credit service (1 accessed; 0 otherwise)	402	0.521(0.027)	0.626 (0.047)	0.489(0.054)	0.460(0.042)	6.7627**
Access to extension service (1accessed; 0 otherwise)	402	0.895(0.017)	0.916(0.0269)	0.955(0.022)	0.842(0.031)	8.6283**
Agroecology (highland =base)						
Midland agro-ecology (dummy = 1 midland; 0 otherwise)	405	0.264(0.024)				
Lowland agro-ecology (dummy = 1 midland; 0 otherwise)	405	0.320(0.026)				

Note: [a,b,c,] shows there is significant variation among the categories; ab, bc and ba shows no significant variation between the two categories. Observation(n) variation is due to unit non-response, the data is missed completely at random (MCAR) and also which is less than 10 percent of the sample size 385, thereby represents the population. Thus, "list wise deletion" of missing data and "complete-case analysis" lead to unbiased parameter estimates (De Leeuw et al., 2003; Howell, 2007; Kang, 2013; Little, 1988; Pampaka et al., 2016) *Standard errors in parentheses, *** significant at 1%, ** at 5%, * at 10%.*

2.4.2 Crop production and marketability by agro-ecology

Table 4 depicts there is significant variations in farmers' all crop types (pepper, maize, teff, wheat, barely, millet, niger seed, fababean, chickpea, field pea, potato and onion) average crop produced value among the three agro-ecologies. The average crop produced value in lowlands (126256.4), midlands (51341.14) and highlands (34641.31) in Ethiopian Birr (ETB) shows the smallholder farmers' average income gain from crop production in the lowlands was larger than the other agro-ecologies. This is in line with the view that agro-ecology affects crop production and revenue (Taffesse et al., 2012). Similarly, the area agricultural production potential affects the smallholder farmers' commercialization (Bernard et al., 2008; Gebremedhin and Jaleta, 2010). Based on the agro-ecologies, crop typies and productions are varied in lowlands, midlands and highlands. For instance, in the highlands, potato, barley and field pea production are higher than midlands and lowlands. In the midlands, almost all crop types are produced and the average production is in between the highlands and lowland productions. Nevertheless, teff (*Eragrostis Teff*) production, in the midlands, excel the other agro-ecological zones production potential. In the lowlands, farmers' average pepper, maize and wheat production are higher than midlands and highlands; whereas, barley and field pea are not produced. This result revealed that potato, barley and field pea accessed better agro-ecosystem service in the highlands than other agro-ecologies; whereas the lowlands agro-ecosystem services are favorable for pepper, maize and wheat production but not favorable for field pea and barley. In line with this, all farmlands are not favorable for all crop species production (von Braun and Kennedy, 1994). This is, therefore; the smallholder farmers' market orientation in the lowlands is greater than the other agro-ecologies (Table 3).

The crop marketability varied among agro-ecologies. The smallholder farmer's average marketability of crops in the lowland is greater than the midland and highland. The proportion of paper, maize and wheat sold in the lowland was greater than in the midland and highlands. However, the proportion of teff and potato sold in the highland is greater than the lowland. Furthermore, the proportion of millet, niger seed, faba bean, chickpea and bean were negligible though there is variation among agro-ecologies. This means that agro-ecology affects the

production of crop species and their marketability, thereby affecting the market orientation of smallholder farmers.

Table 4: Sampled smallholder farmers average crop production (in kilograms and ETB) and marketability by agro-ecology

Crop species	**Crop production: mean (standard errors)**				**Marketability: mean (standard errors)**			
	Highland	Midland	Lowland	F-value	Lowland	Midland	highland	F(p-value)
Crop produced value (ETB)	34,641.31 (3092.317)	51,341.14 (4239.131)	126,256.4 (9165.567)	72.61***	0.324 (0.022)^{a}	0.204 (0.017)^{b}	0.174 (0.015)^{c}	18.98***
Pepper	182.632(42.240)	319.279(58.292)	1168.107(138.53)	39.63***	0.29 (0.0336)^{a}	0.1490 (0.03)^{bc}	0.131 (0.023)^{c}	9.45***
Maize	768.129(47.947)	2027.404(128.184)	4101.639(248.349)	134.49***	0.334 (0.023)^{a}	0.2 (0.022)^{b}	0.046(0.009)^{c}	76.80***
Tef	143.567(12.060)	227.837(23.547)	166.967(19.391)	5.89 ***	0.011(0.005)^{c}	0.071(0.018)^{a}	0.0570(0.014)^{ba}	5.05***
Wheat	128.216(16.975)	343.75(38.809)	1205.738(110.85)	82.07 ***	0.086(0.016)^{a}	0.078 (0.018)^{ba}	0.013(0.004)^{c}	12.00***
Barely	243.86(20.75)	88.942 (21.245)	0((omitted))	51.68***	0(0 omitted)	0.0009 (0.001)	0.007 (0.003)	2.51*
Millet	160.526 (18.55)	270.192(25.513)	37.295(12.785)	27.61***	0(0 omitted)^{c}	0.016 (0.007)^{a}	0.005(0.003)^{ba}	3.70**
Niger	0(omitted)	61.635(12.145)	4.918(2.629)	31.90***	0.002 (0.0023)^{b}	0.087 (0.025)^{a}	0(0 omitted)^{cb}	16.54***
Bean	102.193(10.844)	50.240 (9.927)	100.902(19.854)	3.96**	0.044(0.0172)^{ba}	0.002(0.002)^{c}	0.047 (0.012)^{a}	3.56**
Chickpea	3.509(3.509)	6.25(3.463)	172.336(30.593)	32.76***	0.019 (0.0079)	0(0 omitted)	0.006 (0.006)	2.36
Field pea	5.760 (1.968)	1.442 (1.071)	0(omitted)	3.94**	0(0 omitted)	0(0 omitted)	0.01(0.005)	2.70*
Potato	698.538(70.755)	198.077 (56.603)	36.885(21.342)	37.93***	0(0 omitted)^{cb}	0.028(0.015)^{b}	0.083(0.015)^{a}	11.27***
Onion	30.702(10.535)	17.309(14.681)	0(omitted)	2.45*	0(0 omitted)	0.012 (0.009)	0.012(0.007)	1.05

*N.B Standard errors in parentheses, *** significant at 1%, ** at 5%, * at 10%*

2.4.3 Determinants of market orientation: estimates of zero-inflated beta regression

Prior to zero-inflated beta regression estimation, specification tests were done. Variable inflation factor (VIF-test) showed maximum 2.29 and contingency test depicted the correlation coefficients are less than 0.5. Therefore, there is no multicollinearity among the covariates. Breusch-Pagan / Cook-Weisberg test shows there was heteroscedasticity problem (chi-square, 62.67 and p=0.000); which was alleviated through robust estimation. Market orientation estimated using zero-inflated beta regression shows among 380 (MOI) sampled farmers included in the model, 337 (88.684 percent) were correctly estimated. The link test, *_hatsq* was not statistically significant (p=209), reveals the model is correctly specified. In addition, the precision parameter estimate shows there is significant variation in conditional distribution of market orientation index at 1% significance level.

The results of the zero-inflated beta regression are presented in Table 5. As the results indicate, being male-headed farm households indicates higher probability of market orientation decision with no significant influence in the proportion of market orientation. Indeed, focus group discussion and key informant interview revealed that female-headed farm households are more involved in small businesses, such as the manufacture and sale of *Katikala*[5] and the informal market in onions and potatoes. Similarly, female-headed farm households have greater chance to participate in non-farm activities (Oxfam, 2013). In this way, female-headed farm households make money to cover their living expenses and focus less on income from selling crops that are produced unlike those of their male-headed counterparts.

As expected, educational status of the farm household head increases the extent and probability of market orientation. Similarly, education enhances smallholder farmers market orientation (Gebremedhin and Jaleta, 2010). This suggests that the degree of market orientation requires a good understanding of the separation of production and consumption needs of farm households, and then, helps to allocate more farmland size to marketed crops.

If the smallholder farmers landholding size increase by one hectare, the probability of a farmer to

[5] K*atikala* is a local beverage manufactured from cereal crops, buckthorn (rhamnus prinoides) and water

be marketed oriented increase by 11.99 percent while has not a significant effect on the proportion of market orientation. Because high cost of inputs[6] purchase limit the production of marketable crops in large farmland size. Similarly, farmers have less landholding size apply chemical fertilizer and intensive crop management practices than large landholding size farmers (Pender and Gebremedhin, 2008). On the other hand, high cost of input purchase forces to rented-out their landholding. This suggests there is input market imperfections (Barrett, Bellemare, et al., 2010; Sen, 1962) that increase production costs, forced the farmers to cultivate less marketable crop types (demands less technology package) to meet household subsistence needs.

A one hectare increases in farmland rental contract size increases the probability of the farmer market orientation by 17.8 percent while it did not have a significant effect on the proportion of market-oriented. The smallholder farmers have no or small landholding have a practice of farmland rental contract to meet subsistence household consumption demand; which means produce for household food consumption and marketed surplus to generate cash income for subsistence needs. On the other hand, the smallholder farmers may not afford to buy the recommended quantity of purchased inputs to cultivate marketable crops, which demands improved technology package; thereby, proportion of allocation of farmland size for marketable crops do not increase as the farmland rental contract increases. Similarly, as the farmland size increases the farmers less intensify agricultural production (Pender and Gebremedhin, 2008). This is therefore, farmland rental contract size enables smallholder farmers to allocate small portion of farmland to marketable crops; however, the smallholder farmers unable to allocate more as the rental farmland size increases due to household consumption demand and less affordability of purchased inputs.

Smallholder farmers' access to irrigation positively affects the probability of market-oriented decision while it could not affect the degree of market orientation. Because smallholder farmers use small streams for irrigation and thus, water scarcity affects allocation of large farmland size for marketable crops (Abebaw, 2013).

As expected, smallholder farm households' residence distance from the nearby market place

[6] Inputs are improved crop varieties, chemical fertilizer and labor which are used for intensive crop production.

negatively affects the proportion of market-orientation due to high transaction costs, thus reducing profitability. Owning cellphone positively affects the probability of market-oriented decisions but insignificant on the proportion of market orientation. This suggests market information is quantity invariant transaction cost (Alene et al., 2008).

Smallholder farmers membership to farmers' cooperatives increase the extent of their market orientation. Because, since there is scarcity of chemical fertilizer and improved seeds supply, the members of the cooperatives have the opportunity to access more quantity of chemical fertilizer and improved seed in comparison with non-members of the cooperatives.

The farmers lived in the midland agro-ecological zone relative to highland farmers positively influence the probability farmers market orientation. In the same vein, the farmers farming in the lowlands in comparison with farming in the highlands agro-ecological zone positively affected both the farmer decision and the conditional mean of market orientation. Because, according to the focus group discussants and key informant interviewee, the undulated topography and amount of rainfall in the highland is higher than the midland and lowland and also, the midland undulated topography and amount of rainfall are higher than the lowland. This results severe soil degradation in the highland in comparison with the midland and lowland; and also, the midland soil degradation is higher than the lowland. Thereby, the soil fertility status in the highland, midland and lowland affects cultivated crop types, productivity and production. Accordingly, the empirical analysis in Table 4 states that cultivated crop types, productivity and marketability varied among the highland, midland and lowland agro-ecologies. Therefore, agro-ecology affects the relative farmland allocation to marketable crops. Similarly, agro-ecological resource endowments increase the production of specialized commodities increases (Timmer, 1997).

Table 5: zero-inflated beta regression model of smallholder farmers' market orientation

Dependent	**Market orientation**			
			Delta-method Marginal effects on probability of having value 0	
Explanatory variables	**Proportion**	**Zero-inflate**	**Dy/dx**	**ln_phi**
Socio-demographic characteristics				
Household head sex (dummy=1 male,0 otherwise)	0.0571(0.234)	-1.273**(0.576)	-.1417035	
Household head education (continuous)	0.0900***(0.0202)	-0.212**(0.0913)	-.0236254	
Real-dependency ratio(continuous)	-0.0682(0.0914)	-0.559(0.564)	-.0622544	
Physical resources and arrangements				
Landholding size in hectare(continuous)	-0.0756(0.0752)	-1.078***(0.403)	-.1199557	
Land fragmentation index(continuous)	-0.176(0.240)	0.881(0.888)	.097996	
Farmland rental contract in hectare(continuous)	-0.0459(0.0804)	-1.600***(0.529)	-.178025	
Access to irrigation (dummy 1 if access; 0 otherwise)	-0.103(0.130)	-0.933**(0.402)	-.1038005	
Transaction costs				
Residence distance from the all-weather road in minutes(cont.)	-0.0943(0.00113)	-0.00413(0.00380)	-.0004594	
Residence from distance from nearby market minutes (cont.)	-0.0270*(0.0161)	-0.00760(0.0517)	-.0000845	
Cellphone ownership (dummy= 1owned; 0= otherwise)	0.0281(0.122)	-0.832**(0.358)	-.0925661	
Access to services				
Membership to cooperative (dummy = 1member; 0 otherwise)	0.242**(0.116)	0.538(0.366)	.0599068	
Access to credit service (dummy =1 accessed; 0 otherwise)	-0.0926(0.0994)	0.446(0.354)	.0495836	
Access to extension service (dummy= 1 accessed; 0 otherwise)	-0.0549(0.188)	-0.589(0.498)	-.0654899	
Agro-ecology				
Midland agro-ecology (dummy = 1 midland; 0 otherwise)	0.207(0.142)	-1.749***(0.491)	-.1946032	
Lowland agro-ecology (dummy = 1 lowland; 0 otherwise)	0.820***(0.155)	-1.897***(0.562)	-.2111428	
Constant	-1.744***(0.314)	2.923***(0.865)		2.123***(0.0859)
Observations	337	337		337

Note: highland is the base agro-ecology, robust standard errors in parentheses, *** significant at 1%, ** at 5%, * at 10%

2.5 Conclusion and policy implications

The study has sought to contribute to the understanding of determinants of market orientation by focusing on agro-ecologies and transaction costs. Results from our empirical analysis show physical resource endowment and arrangement, agro-ecological favourability and access to market infrastructure enhance crop production, marketability and reduce transaction costs. The agro-ecologies such as lowland followed by midland are favourable for the high production of crop types relative to the highlands. The crop types marketability is higher in the lowlands followed by midlands and highlands. The lowlands and midlands have better market infrastructure in comparison with the highlands thereby reduce transaction costs in the lowlands and midlands than highlands. Moreover, resource endowments and arrangements such as landholding size and farmland rental contracts are higher in the lowlands followed by midlands and highlands. The econometric analysis shows lowland and midland agro-ecologies enhanced market orientation in comparison with highlands while transaction costs harmed market orientation. On the other hand, landholding size and farmland rental contract size increase the probability of market orientation but not extent of market orientation. This might be due to households' consumption demand and imperfect factor markets that hinder expansion of market-oriented production. Cognizant to these facts, the agro-ecology, infrastructure development and physical resource endowment and arrangement accompanied with imperfect factor markets caused significant variation in smallholder farmers' market orientation.

The result provides pathway to explain the smallholder farmers' market orientation. Though smallholder market orientation is affected by socio-demographic characteristics, physical resource endowments and arrangements, transaction costs and access to institutional services; agro-ecologies and transaction costs are important determinants in the smallholder farmers′ decision. The smallholder farmers′ relative farmland allocation to the mix of crop types to maximize the benefit is varied by agro-ecologies, access to market infrastructure and factor market imperfections. Therefore, investment in smallholder households′ education, developing all-weather roads and interventions in soil fertility improving technologies in the highland and midland that enhance crop productivity and production, are important intervention areas to enhance market orientation thereby prompt small-scale commercialization.

APPENDIX 1

Table 1: Sample size by agro-ecology and kebele

Woreda	Agro-ecology	Selected kebele	Population	Sample size
Burie zuria	Lowland	Zeyushewen	696	51
	Midland	Wadera	814	59
	Highland	Ambaye	1238	86
Dembecha zuria	Lowland	Astevoch and Egziabhirab	1160	76
	Midland	Yesheboch	580	43
	Highland	Gelila	944	90
Total			5432	405

Table 2: Summary of variables description, measurement and expected hypothesis

Explanatory variables	Variable description	Measurement	Expected hypothesis
Socio-demographic characteristics			
Sex	Household head sex	Dummy1 if male; 0 otherwise	+
Education	Household head education	Continuous	+
Dependency	Household real-dependency ratio	Continuous	-
Physical resource endowments and arrangements			
Farmland	Farmland size in hectare	Continuous	+
Farmland fragmentation	Farmland fragmentation index	Continuous	-
Rented-in farmland	Rented-in farmland size in hectare	Continuous	+
Irrigation	Access to irrigation	dummy 1 if access; 0 otherwise	+
Transaction costs			
Distance from all-weather road	Residence distance from the all-weather road in minutes	Continuous	-
Distance from nearby market	Residence from distance from nearby market minutes	Continuous	-
Cellphone ownership	Cellphone ownership	dummy 1 if owned; 0 otherwise	+
Access to institutional services			
Cooperative	Membership to cooperative	dummy 1 if member; 0 otherwise	+
Credit service	Access to formal credit service	dummy 1 if accessed; 0 otherwise	+
Extension service	Access to agricultural extension service	dummy1 if accessed; 0 otherwise	+
Agro-ecology	Highland agro-ecology	dummy 1 if highland; 0 otherwise	+/-
	Midland agro-ecology	dummy 1 if midland; 0 otherwise	+/-
	Lowland agro-ecology	dummy 1 if lowland; 0 otherwise	+/-

Table 3: Variable Inflation Factor (VIF)

Variable	VIF	1/VIF
Lowland	2.10	0.476610
Rainfed farm size	1.71	0.584743
Midland	1.51	0.660121
Farmland fragmentation index	1.40	0.715415
Farmland rental contract size	1.36	0.736336
Access to irrigation	1.26	0.796285
Cellphone ownership	1.23	0.809839
Access to extension service	1.23	0.812999
Household head sex	1.23	0.813280
Member to farmers' cooperative	1.20	0.836021
Distance to all-weather road	1.19	0.838725
Distance to nearby market	1.18	0.849519
Real dependency ratio	1.15	0.872827
Household head education	1.07	0.935046
Access to credit service	1.06	0.941193
Mean VIF	1.32	

Table 4: Contingency coefficient test

	Household head sex	Access to irrigation	Cellphone Ownership	Member to cooperative	Access to credit services	Access to extension service	Midland	Lowland
Household head sex	1.0000							
Access to irrigation	0.1486	1.0000						
Cellphone ownership	0.1873	-0.0589	1.0000					
Member to cooperative	0.1969	-0.0281	0.2380	1.0000				
Access to credit service	0.1213	-0.0014	0.0739	0.0358	1.0000			
Access to agricultural extension service	0.2503	-0.0530	0.2007	0.1923	0.1286	1.0000		
Midland	-0.0832	-0.0552	0.1030	0.1378	-0.0429	0.0635	1.0000	
Lowland	0.0616	-0.3242	0.1584	0.0928	0.1294	0.0956	-0.4027	1.0000

Omitted variable test

Ramsey RESET test using powers of the fitted values of MOI

Ho: model has no omitted variables

F (3, 309) = 8.29

Prob > F = 0.142

Table 5: Model fitness test (linktest)

MOI	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Proportion _hat	0.0326575	0.2540496	0.13	0.038	-0.4670979	0 .5324129
_hatsq	2.870757	0.7226387	3.97	0.209	1.449214	4.292301
_cons	0.0574479	0.0191943	2.99	0.235	0.0196896	0.0952062

CHAPTER THREE

DETERMINANTS OF COMMERCIALIZING CROP OUTPUTS OF SMALLHOLDER FARMERS IN WEST GOJJAM ZONE, NORTH-WESTERN ETHIOPIA

Abstract

Commercializing crop production is the pathway for economic development. Previous studies revealed that crop commercialization is affected by resource endowments, and access to institutions and markets. However, the studies have failed to consider landholding size, farmland fragmentation, and crop diversity. This study was aimed at investigating factors affecting crop outputs commercialization. The study addresses quantitative and qualitative research questions used to understand the determining factors of crop output commercialization in west Gojjam Zone of the Amhara Regional State of Ethiopia. Multistage random sampling method was used to sample 405 respondents and a structured interview was conducted. The quantitative data was analysed using descriptive statistics and zero-inflated beta regression. Qualitative data were collected using a focus group discussion and individual interviews, which were then analysed using narration. The results of the analysis of the data revealed that the average smallholders' crop output commercialization was estimated at 22.7%. Results from the zero-inflated beta regression model revealed that ownership of cell phones, farmland rental contract, and market orientation increased the probability of output commercialization. However, distance of all-weather roads from residence limited the probability of output commercialization. Household head age, household head educational status, farmland fragmentation, crop diversification and market orientation increased the proportion of output commercialization whereas landholding size reduced the extent of output commercialization. Land holding size reduces proportion of output commercialization; farmland fragmentation and crop diversification increases proportion of output commercialization. The results imply that increasing the size of landholding reduces intensified crop production. Farmland fragmentation allows farmers to access favourable agroecological functions for growing marketable crops. The results also imply that crop diversification is a strategy to reduce market risks and promotes output commercialization. Thereby, improving access to technologies, lowering input purchase costs, and reducing output market price seasonal volatility would enhance crop output commercialization.

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3.1 Introduction

Commercializing smallholder farmers is the pathway for rural economic development in sub-Saharan Africa (Olwande et al., 2015). Cognizant of this fact, boosting crop production and enhancing commercialization has received greater attention as part of agricultural transformation process in Ethiopian Agricultural Development Led Industrialization (ADLI) economic development policy, which trickles down in consecutive strategic plans such as Sustainable Development and Poverty Reduction, Plan for Accelerated and Sustained Development to End Poverty, Growth and Transformation Plan I and Growth and Transformation Plan II.

Output commercialization is a process that involves producing and marketing commodities demanded by the market. Thus, production of diversified commodities gradually declines while production of specialized commodity increases (Pingali, 1997; Pingali and Rosegrant, 1995). In the context of smallholder farmers, output commercialization indicates the extent to which crop production by smallholder farmers is market-oriented (Strasberg et al., 1999). In other words, output commercialization differs by the level of cultivation of diversified crop species. In relative terms, cultivation of low mix of crop species is a market-oriented production whereas cultivation of multiple crop mixes is a consumption-oriented production (Pingali, 1997; Pingali and Rosegrant, 1995).

Output commercialization is often considered to be influenced by resource endowments, access to institutional services, and access to input and output markets (Bekele and Alemu, 2015; Key et al., 2000; Olwande et al., 2015; Pingali, 1997; Pingali and Rosegrant, 1995). Resource endowments are household's ownership and access to resources used for agricultural production. It comprises socio-demographic characteristics such as household head, age, education, family size, and labour. Physical resource endowments contain cultivated landholding size, livestock and access to irrigation. It has been argued that the ownership and size of the aforementioned resources influence the commercialization of the crop output (Bekele and Alemu, 2015; Pender and Alemu, 2007). Access to institutional services comprises access to credit and agricultural technology. Access to markets includes access to input and output markets, and transaction costs. The empirical evidence states that the factor and output markets situation and transaction cost affect crop output commercialization (Alene et al., 2008; Bekele and Alemu, 2015;

Boughton et al., 2007).

The contribution of understanding the determinants of smallholders' crop output commercialization is three-fold. First, previous studies examined the factors affecting output commercialization on a specific commodity. Arega et al. (2008), Mmbando et al. (2015), and Adem et al. (2021) analyzed commercialization of smallholder farmers on maize and pigeon pea commodities. The exception is the work by Berhanu and Moti (2010); and Adam and Alemu (2015) who analyzed the determinants of crop commercialization, which comprises all crop types produced and marketed. However, the effects of landholding size, farmland fragmentation and crop diversification remain unexplored. As a result, this study focused on investigating the determinants of crop output commercialization incorporating landholding size, farmland fragmentation and crop diversity. Second, when analyzing the decision to commercialize the output, the previous studies used Tobit regression, which assumes normal distribution and corner zero observations. In this study, it was argued that output commercialization is an index with beta (0, 1) observations and Bernoulli distributions (zero observations). Therefore, zero-inflated beta regression is more appropriate to adequately address the beta and Bernoulli distributions. Third, smallholder farmers, in the study area, cultivate diversified crop types on fragmented farmlands to meet household food consumption and market demand. Cognizant of this fact, from a practical perspective, understanding smallholder farmers output commercialization can serve as the basis for policy making to transform subsistence farming system into market-oriented production system. Therefore, this study investigating determinants of crop output commercialization to fill knowledge gaps and guide appropriate polices for enhancing smallholder farmers outputs commercialization

3.2 Methodology

3.2.1 Description of the study area

West Gojjam Zone in north western Ethiopia has been deliberately chosen. In the area, crop cultivation is overwhelmingly done by smallholder farmers who totally plough 682893 hectares of farmland, which produces 1988044.245 tons of grain (CSA, 2021). Crop production is the major livelihood strategy of smallholder farmers in this area.

The smallholder farmers' individual landholding size, in the study area, ranges from 0.1 to 10 hectares and averages 0.928 hectares (CSA, 2014, 2021). The same source revealed that farmland fragmentation is high in the area. Smallholder farmers in the study area cultivate a variety of cereal crops including maize, teff (*Eragrostis teff*), wheat, barley, and finger millet; pulse and oil crops such as faba bean, field pea, lentil crops and a variety of vegetables and root crops (CSA, 2014).

Burie zuria woreda is located with an altitude range from 700 to 2350 masl. The population is 133307 of which, 66282 and 67025 are male and female, respectively (west Gojjam Zone plan commission). The population density is 138 persons per square kilometer. Temperature ranges from 17-25 degree Celsius and rainfall from 1000 to 1500 millimeter. Topography is 76% plain, 10% mountainous, 7% undulated topography and 7% valley. Land use 47% crop cultivation, 20.38% grazing land, 24.07% shrubs and forest land, 8.25% construction and 0.316% water bodies.

Dembecha zuria woreda is located with an altitude range from 1,500 to 2,995 meters above sea level. The total population is 144993 of which 70748 and 74245 are male and female, respectively (west Gojjam zone plan commission). The population density is 133.08 persons per square kilometer. Topography 60% plain, 30% mountainous and 10% undulated topography.

3.2.2 Sampling procedure and data collection method

Quantitative and qualitative data were collected through a structured questionnaire interview, focus group discussions, and in-depth personal interviews. Proportion to size multi-stage probability sampling method was used to select sample respondents. In the first stage, Dembecha Zuria and Burie Zuria woredas were randomly selected by lottery method among the 14 woredas administered in west Gojjam Zone. In the second stage, kebeles in each woreda were clustered in to lowland, midland and highland based on agro-ecology and agriculture production capacity. A *kebele* is the smallest local administrative unit in Ethiopia. Then, four kebeles from Dembecha Zuria (such as Astevoch, Egziabhierab, Yesheboch and Gelila) and three kebeles (namely Zeyushewen, Wadera and Ambaye) from Burie Zuria woreda were randomly selected from the three agro-ecological zones. Finally, probability proportion to size sampling method was used to

sample 385 respondents.

The total sample size was determined using Cochran sample size determination formula that provides the maximum size to ensure the desired precision, in the case of large population and unknown variability of smallholder farmers crop output market participation, in the study area.

$$n_0 = \frac{z^2 pq}{e^2} \qquad \text{[Equation 1]}$$

Where, z is 1.96, p is the estimated proportion of the population who is commercialized (0.5) q= (1- p) = 0.5 and e is the precision level (0.05).

Qualitative data collection methods such as focus group discussion and individual in-depth interviews were used to understand output commercialization. In both cases, participants were purposively selected through discussions with agriculture experts and development agents. A checklist was prepared to guide the discussion. Totally, two focus group discussions and four in-depth interviews were conducted with eighteen and four farmers, respectively in each of the two woredas.

3.2.3 Methods of data analysis

Quantitative and qualitative methods of data analysis were used to analyse the data. For analysing the quantitative data, descriptive statistics and zero-inflated beta regression were used. For analysing the qualitative data, thematic analysis was used.

3.2.4 Measuring commercialization of crop output

A large body of literature defines and measures smallholder output commercialization differently. First, commercialisation represents the ratio of the gross value of cash crops to the gross value of all crops (Dawit et al., 2006; Govereh and Jayne, 1999). However, smallholder farmers do not have dichotomous decisions. They produce a mix of food and cash crops, and thus commodities traditionally considered as food crops are marketed (Pender and Alemu, 2007; von Braun and Kennedy, 1994). Second, net and absolute market positions (net seller, autarky and net buyer) are commonly computed as the difference between percentage of the volume of

marketed crop outputs to the summation of the quantity of crop produced, and the percentage volume of crop purchased to the total volume of crop produced (Bellemare and Barrett, 2006; Alemu et al., 2006). However, in the subsistence smallholder production system, purchasing crops for household consumption is non-existent (Pender and Alemu, 2007). Moreover, net and absolute market positions are ordered in nature (Bellemare and Barrett, 2006), and thus, clusters net sellers as one group while there are variations in their extent of output market participation. Also, net buyers as they sell cash crops and buy food crops for household consumption through the farmers are too subsistent in nature. Subsistent farmers may be unable to meet their annual food demand by their own production and are hence assisted by other entities. Third, smallholder farmers' decisions to market their produce involves selling of diversified agricultural outputs to meet household cash income demand to purchase non-produce commodities and improve household well-being (Carletto et al., 2017). This conceptualization of output commercialization considers smallholder farmers diversified production system, which aims at meeting both food for household consumption and marketable surplus for cash income generation to buy non-produce commodities. Thus, the ratio of the value of crop marketed over the value of crop produced in a production year is a better proxy to measure the smallholder farmers output commercialization (Bekele and Alemu, 2015; Strasberg et al., 1999; von Braun and Kennedy, 1994). The annual crops produced by the farmers, in the study area and used for analysis were pepper, maize, teff, wheat, millet, barely, faba bean, chickpea, field pea, niger seed, potato, and onion. The index measures the extent to which a smallholder farmer's crop production is market oriented; and the value zero (0) means a household is purely subsistence and the value one (1) means highly commercialized.

$$Output\ commercialization = \frac{Value\ of\ crop\ sales}{Value\ of\ crops\ produced}$$

$$Outputcomm_i = \frac{\sum_{j=1}^{k} P_j S_{ij}}{\sum_{j}^{k} P_j C_{ij}} \qquad \text{[Equation 2]}$$

Where, $Outputcomm_i$ is the level of output commercialization of household 'i'; P_j is the

average price of crop 'j'; S_{ij} is the amount sold by the household 'i' of crop 'j', where j ranges from 1 to k; and C_{ij} is the total volume of crop 'j' produced by household 'i'.

3.2.5 Application of zero-inflated beta regression

Smallholder farmers produce diverse crops, and market crops when they face liquidity constraints to purchase commodities for household consumption and inputs for agricultural production. Thus, output commercialization is an index which contains a continuous proportion of values between 0 and 1 with a probability at zero, which is continuous-discrete distribution (Pereira and Cribari-Neto, 2010). The continuous distribution is described by beta distribution while the discrete is defined by the Bernoulli distribution (Ospina and Ferrari, 2012). In view of this, the zero-inflated beta regression econometric model was employed.

Zero-inflated beta regression is the probability and conditional mean density functions of the farmers' commercialization with respect to the measure generated by the mixture of beta and Bernoulli distribution (Ospina and Ferrari, 2012; Pereira and Cribari-Neto, 2010).

$$\text{bic}(y;\ \alpha,\mu,\phi\ ) = \begin{cases} \alpha & if\ y = 0 \\ (1-\alpha)f(y;\mu,\phi) & if\ y\varepsilon(0,1) \end{cases} \qquad \text{[Equation 3]}$$

Where, bic is zero inflated beta regression, y is farmers' output commercialization index: as the index is zero ($y = 0$), α is the probability of farmers' output commercialization index at zero. Otherwise, the household output commercialization index is between one and zero $y\varepsilon(0,1)$; the beta density of farmers output commercialization conditional mean (μ) and precision parameter ϕ are ($0< \mu < 1\ and\ \phi > 0$).

The mean of output commercialization and its variance are computed as:

$$E(y) = \alpha c + (1-\alpha)\mu \qquad \text{[Equation 4]}$$

$$var(y) = (1-\alpha)\frac{\mu(1-\mu)}{\phi+1} + \alpha(1-\alpha)(c-\mu)^2 \qquad \text{[Equation 5]}$$

$E(y)$ is the weighted average of the mean of the Bernoulli distribution at y =0 and beta distribution $B(\mu,\phi)$ with weights α and $(1-\alpha)$ and also $E(y/y\ \varepsilon\ (0,1)) = \mu$); $var\ (y/y\ \ \varepsilon\ (0,1) = \frac{\mu(1-\mu)}{\phi+1}$ μ and ϕ are parameters of beta distribution

Zero-inflated beta regression functional form is the output commercialization index as conditional mean, the probability at zero and the precision parameter can be given as follows (Pereira and Cribari-Neto, 2010).

The probability of household output commercialization at zero function is:

$$h(\alpha) = \gamma_0 + \gamma_1 z_1 + \varepsilon \qquad \text{[Equation 6]}$$

output commercialization conditional mean function

$$g(\mu) = \beta_0 + \beta_1 x_1 + \varepsilon \qquad \text{[Equation 7]}$$

The precision parameter function is

$$b(\phi) = \lambda_0 + \lambda_1 s_1 + \varepsilon \qquad \text{[Equation 8]}$$

Where, $h(\alpha)$ is the probability of household output commercialization at zero function; $g(\mu)$ is the smallholder farmers output commercialization conditional mean function; $b(\phi)$ is the households output commercialization precision parameter function. γ_1, β_1 λ_1 are Vector of parameters to be estimated. z_1 x_1, s_1 are Vector of covariate variables.

Equation [3] to equation [5] provides interesting features. The variance of output commercialization is a function of (α, μ, ϕ) and the consequence of the covariate values; hence non-constant response variances are naturally accommodated by the model (Ospina and Ferrari, 2012). The parameters and covariates play important role in the model. For example, while output commercialization index is zero $y = \alpha = 0$; γ_1 and z_1 affect the Pr ($y = 0$), β_1 and x_1 control $E\big(y/y\ \varepsilon\ (0,1)\big)$ and λ_1 and s_1 influence precision of the conditional distribution of output commercialization index, given that $y\ \varepsilon\ (0,1)$. Therefore, zero-inflated beta regression offers the effect of the heterogeneity among farmers who don't commercialize their output and those farmers who commercialize their output on probability and extent of output commercialization, respectively.

3.2.6 Hypothesized determinants of crop output commercialization

The review of previous studies uncovers variables hypothesized to affect smallholder farmers' output commercialization. Age of the household head, measuring the farmers' experience in farming, helps the farmer to understand and practice crop management practices and enhance production and productivity (Pender and Alemu, 2007), thereby increasing output commercialization. The educational status of the household head enhances decision-making ability in allocating resources for marketable commodities through analysing the cons and pros of adopting improved technologies and participating in the output market (Yigezu et al., 2018). The real-dependency ratio measures the non-working household members who are dependent on the productive household members' effort (Sharp, 2005). As the real-dependency ratio increases, the demand for domestic consumption increases, hence the farm households are expected to reduce output commercialization.

Smallholder farmers who have larger landholdings have the opportunity to increase crop production through adopting improved technologies and then, enhancing output commercialization (Bekele and Alemu, 2015; Pender and Alemu, 2007). Farmland fragmentation is the parcel of spatially separated farmlands a household owns (Ntihinyurwa et al., 2019). The physical fragmentation of farmland is the state of non-contiguous farmland parcels that are owned and tilled by the household. The fragmented farmlands and increased production costs may hinder smallholder farmers' output commercialization. In order to calculate smallholder farmers' per-capita farmland fragmentation, we used Simpson index. Simpson index takes in to account the number of parcels and the size of the parcel (Wu et al., 2005).

Farmland rental contract is a practice of contracting other farmers' farmland either for sharecropping or/and by cash-rent agreement between the renter and the owner for a limited crop production season (Zeng et al., 2018). The farmland rental may increase crop production and thereby enhance the commercialization of outputs. Livestock is a source of cash income to purchase inputs for crop production (Barrett et al., 2001) and source of traction power to cultivate crops. Thus, livestock ownership is expected to increase farmers' output commercialization. Irrigation increases production of high value crops by enabling smallholder farmers to practice double cropping. Thus, access to irrigation is expected to increase output

commercialization. Moreover, cell phone ownership is used to market outputs thereby reducing transaction costs. Cell phones enable farmers to access market price information either from the broker or the trader. Thus, owning a cell phone may enhance output commercialization.

Transaction cost is a cost incurred in the process of commodity exchange taking place between the seller and the buyer. It reduces profit gains from the transaction (de Janvry et al., 1991). Thus, it affects smallholder farmers' output market participation and quantity of output marketed (Alene et al., 2008; Key et al., 2000). The cause for high transaction costs is the lack of physical and information communication infrastructure (Dillon and Barrett, 2017) and market information asymmetry (Alene et al., 2008). Transaction cost is measured using proxies like measuring the time taken to reach the nearest all-weather roads and market places, and ownership of communication apparatus. The lower the time taken to reach an all-weather road and a market place, the lower the transaction costs. This is expected to increase smallholder farmers' output commercialization.

A farmers' cooperative is a collective action for reducing transaction costs and increasing market access (Holloway et al., 2000). A farmers' cooperative has strong internal institutions, functioning group activities, endowed with a good asset base and members' motivations to enhance access to output markets (Gyau et al., 2014; Latynskiy and Berger, 2016). Though the degree of performances of cooperatives varies, farmers who are members of cooperatives are expected to reduce transaction costs to access input and output markets, thereby increasing their output commercialization. Smallholder farmers have informal contacts and networks with their relatives. The contacts and networks include sharing social and economic costs and benefits with each other and providing gifts and loans for crop production. Remittances affect farmers investment decisions (Rapoport and Docquier, 2005); thus, we expect that remittances are used for increasing purchase of agricultural inputs and enhancing marketing of agricultural outputs. Thus, remittances are likely to increase smallholder farmers' output commercialization.

Agro-ecology is the application of ecology in agriculture (Wezel et al., 2009). Smallholder farmers cultivate diverse crop species is due to accessibility to diversified micro-climates and to cope with agro-climatic and market related risks (Ciaian et al., 2018; Leavy and Poulton, 2007). Subsistence-oriented smallholder farmers diversify crop production for their subsistence needs

and cope with production and market related risks while market-oriented smallholder farmers cultivate less diversified crop species for household consumption and market. Cognizant of this fact, crop diversification is a strategy to increase production of food crops and/or marketable crops. Thus, we expect that crop diversification might be for the purpose of either market or household consumption. Herfindahl-Hirschman Index (HHI) is used to calculate the diversity of crops cultivated by smallholder farmers by considering the number of crop species cultivated and the relative share of farmland size (Malik and Singh, 2002). When the value of the index is one (unity), it is considered a specialized crop production system but when the value approaches zero, it is considered a diversified crop production system.

Market orientation is the relative allocation of resources (land, labour and capital) for cultivation of agricultural produces for market (Gebremedhin and Jaleta, 2010). Market orientation is calculated as the smallholder farmland allocation to each type of crop cultivated, weighted by the marketability of each crop at a farm level, divided by the total area cultivated (Gebremedhin and Jaleta, 2010). When the value of the index approaches one the market orientation increases, and vice versa. The smallholder farmers' market orientation decision is based on analysing the cons and pros of output market. Thus, it would have a positive effect on output commercialization.

3.3 Results and Discussion

3.3.1 Smallholder farmers' characteristics

The analysis of output commercialization included annual crops, namely, pepper, maize, teff, wheat, millet, barely, faba bean, chickpea, field pea, niger seed, potato, and onion (Table 1). The Output Commercialization Index of farmers averaged 0.227, with a minimum of no participation at all and a maximum proportion value of marketed output of 0.987, showing that a significant number of smallholder farmers were entering a commercialized crop production system. Supporting this postulation, Gebre-ab (2006) explains that, if the smallholder farmers output commercialization index is greater than 15%, they are getting in to a commercialized farming system. Among the sampled households, 90.3% were male-headed households. The average household head age was 47.5, the youngest household head age being 25 years and the oldest age being 83 years. On average, heads of households completed grade 1.234 with a maximum of

completing grade 12. The household real-dependency ratio was 0.449 with the maximum dependency ratio being 0.567. The sampled farmers' average livestock ownership was 4.004 TLU (Tropical Livestock Unit), and ranged from a minimum of not having to a maximum of 17.16 TLU. This shows that there is a diverse agricultural production system that includes livestock and crop production in the study area. The average landholding of the farmers included in the sample was 1.238 hectares, and ranged from a minimum of not possessing any land to cultivate to a maximum of possessing four hectares of land. The average fragmentation index was 0.563 with a minimum of having a consolidated farmland to a maximum fragmentation of 0.875. The smallholder farmers' average rented farmland was 0.511 hectares, which ranged from no rented farmland to a rented farmland of 4.5 hectares. About 25.4% of the sampled farmers accessed irrigation. The average distance from all-weather roads to the farmers' residence was 24.501 minutes ranging from zero to 180 minutes. The average residence distance from the main market was 94.707 minutes, with a minimum of zero to a maximum of 360 minutes. The table shows that 67.8% of the sampled farmers were members of farmers' co-operatives. Among the sampled farmers, 7.12% received remittance from their relatives and friends living abroad.

The survey results showed that 51% of the sampled farmers had access to credit. Among the sampled farmers. 86.2% accessed extension advisory services. The average Herfindahl-Hirschman crop diversity index of the sampled farmers was 0.320 with, indicating cultivation of a single crop (specialization). The average market orientation index of the sampled farmers was 0.151, with a maximum of 0.764.

Table1: Descriptive statistics

Variable	Observation	Mean	SD	Min.	Max.
Output commercialization index	385	0.227	0.220	0	0.987
Socio-demographic					
Household head sex (1 male,0 otherwise)	385	0.903	0.296	0	1
Household head age (years)	385	47.532	12.380	25	83
Household head education (grade)	385	1.234	2.191	0	12
Real-dependency ratio	385	0.449	0.245	0	0.567
Resource endowments					
Livestock in TLU	385	4.004	2.667	0	17.16
Cellphone ownership (1 owned; 0 = otherwise)	385	0.669	0.471	0	1
Landholding size in hectares	385	1.238	0.815	0	4
Farmland fragmentation index	376	0.563	0.233	0	0.875
Farmland rental contract in hectares	385	0.511	0.709	0	4.5
Access to irrigation (1 if access; 0 otherwise)	385	0.254	0.436	0	1
Market access					
Residence distance from the all-weather road in minutes	385	24.501	26.744	0	180
Residence from distance from main market in minutes	385	94.707	192.420	0	360
Social capital					
Membership to cooperative (1 member; 0 otherwise)	385	0.678	0.468	0	1
Remittance (1 yes; 0 otherwise)	385	0.0712	0.258	0	1
Access to institution services					
Access to credit service (1 accessed; 0 otherwise)	385	0.510	0.5001	0	1
Access to extension service (1 accessed; 0 otherwise)	385	0.862	0.346	0	1
Herfindahl-Hirschman crop diversity index	380	0.320	0.163	0.142	1
Market orientation index	380	0.151	0.149	0	0.764

Source: Own survey

3.3.2 Determinants of output commercialization: zero-inflated beta regression estimation

Before estimating the Zero-inflated beta regression, diagnostic tests such as multicollinearity, endogeneity, heteroscedasticity, omitted variable test and model fitness tests were performed. The smallholder farmers' market orientation decision is based on analysing the cons and pros of output market. Accordingly, market orientation and output commercialization might have simultaneous endogeneity that constrains the parameter estimates of zero-inflated beta regression. However, the econometric estimate shows the association between market orientation and output commercialization is significant, which suggests simultaneous endogeneity is not a problem; rather market orientation is highly translated to output commercialization. The Breusch-pagan/Cook-Weisberg test shows that there was heteroscedasticity, which was

alleviated through running robust regression. Variable Inflation Factor (VIF) test shows there was no multicollinearity between covariates. The omitted variable test shows that there is no omitted variable (P = 0.214). The link test, *_hatsq* was not statistically significant (P = 0.152), which reveals the model is correctly specified. In addition, the precision parameter estimates show that there is a significant variation in conditional distribution of output commercialization index at 0.01 significance level. From the total 18 hypothesized variables, five variables were found to significantly affect the extent of smallholder commercialization (proportion) and three variables affected the probability of output commercialization (Table 2).

Age of household head increased the proportion of output commercialization, but did not influence the probability of output commercialization. This could be because the age of the household head can help to acquire knowledge and skills about production practices and improved technology, which in turn may increase the marketed surplus. Previous studies have shown that older household heads commercializes their crops more than younger ones (Bekele and Alemu, 2015; Gebreselassie and Laudi, 2007). As expected, household head educational status enhanced the proportion of output commercialization. Similarly, Gebremedhin and Jaleta (2010) found that the training of heads of households increased participation in output markets.

As expected, cell phone ownership increased farmers' likelihood to engage in output commercialization but not the proportion of output commercialization. This is due to the fact that market information is a quantity marketed invariant transaction cost, it does not affect the volume of marketed surplus (Alene *et al.,* 2008; Key *et al.*, 2000). As hypothesized in this study, residence distance to all-weather road limits the likelihood of output commercialization. This is possibly because smallholder farmers' lack of access to all-weather road increases the transaction cost, which in turn, reduces the benefit gained, thereby discouraging them from participating in crop output marketing. Similarly, Ademe et al.(2017); Wudad et al. (2021) found that lack of access to all-weather road hindered the supply of crop produces to the market.

Unlike the stated hypothesis formulated, however, landholding size reduced the proportion, but did not affect the probability of smallholder farmers' output commercialization. This is possibly because smallholder farmers are reluctant to purchase labour, chemical fertilizer, and seeds of improved crop varieties that are required for increased productivity and cultivation of their lands.

The results generated from the focus group discussions and in-depth individual interviews revealed that households headed by elderly persons had larger landholdings than households headed by younger or junior persons. This is possibly because young households establish families inheriting smaller farm lands from their parents. On the other hand, establishing new families causes reduction in labour in households headed by elderly persons. Consequently, the households headed by elderly persons which have larger landholding are challenged by lack of household labour to cultivate their land. Also, smallholder farmers are reluctant to recruit wage labour (Wiggins et al., 2011). The smallholder farmers do not afford to purchase large quantities of chemical fertilizer and seeds of improved crop varieties. Which implies less intensification of crop production, thereby reducing the quantity of marketed surplus. Similarly, farmers possessing smaller landholdings apply chemical fertilizer and intensive crop management practices than those possessing larger landholdings (Pender and Gebremedhin, 2008). On the other hand, due to higher costs of inputs, smallholder farmers holding large farmlands are compelled to rented out and/or share out portions of their farmlands to the landless youths or farmers holding smaller farmlands. This suggests there are input market imperfections (Barrett et al., 2010) that increase production costs, discouraging farmers from intensifying crop production, thereby negatively affecting output commercialization. Farmland rental contracts increase the probability that smallholder farmers participate in the output market but does not affect the proportion of output commercialization. This is because landless youths or farmers holding less farmlands rent in and/or share in to produce crops to meet the subsistence market demand.

The farmland fragmentation increased the household proportion of output commercialization significantly ($P < 0.05$), but did not affect the probability of output commercialization ($P > 0.1$). The results generated from the focus group discussions and individual interviews indicated that a farmer who owns a large number of farmlands is more likely to access different types of agro-ecosystem functions such as physical environment, microclimate, and variations in soil fertility compared to farmers with less fragmented farmland. For instance, an interviewee stated that “we live on the top of the mountain, where pepper is not produced due to low temperature (cold) and reduced soil fertility; however, in the valleys below the mountain, it is warmer and the soil fertility status is higher, which enhances production of pepper, a warm-season crop. This suggests that farmland fragmentation enables the farmers to produce various types of crops types

for markets. Similarly, farmland fragmentation enables the farmers to produce diverse high value crops (Ciaian et al., 2018; Mussema et al., 2015; Di Falco et al., 2010).

Herfindahl-Hirschman crop diversity index reduces the proportion of output commercialization, suggesting that smallholder farmers cultivate diversified crop species to increase the extent of output commercialization; however, it does not affect the probability of output commercialization. Crop diversification is an important strategy for reducing vulnerability to production and market failure risks (Leavy and Poulton, 2007). For instance, perishable horticultural crops such as onion and potato were considered as marketable crops that are highly affected by market inefficiencies and seasonal market price fluctuations. Moreover, in the study area, the production is predominantly subsistence and traditional. So there is no system of technical, managerial, and structural organization for minimizing the perishability of a particular agricultural produces or to prolong shelf life (Pingali and Rosegrant, 1995). As a result, smallholder farmers are encouraged from diversifying their marketable outputs (Gebreselassie and Laudi, 2007).

Smallholder farmers' market orientation was found to increase both the probability and proportion of output commercialization significantly ($P < 0.01$). This is because the household's farmland allocation for marketable crops is based on output market signal (Gebremedhin and Jaleta, 2010).

Table 2: Zero-inflated beta regression estimates of smallholder farmers' output commercialization

Categories	Dependent	Output commercialization			
				Marginal effects (case of zero-inflate)	
	Explanatory variables	Proportion	Zero-inflate	Dydx	
Socio-demographic characteristics	Household head sex (1 male,0 otherwise)	–0.0451(0.204)	0.604(1.071)	0. 0111	
	Household head age (years)	0.00875**(0.00436)	–0.0532(0.0442)	–0. 0009	
	Household head education (grade)	0.0526**(0.0248)	–0.164(0.184)	–0. 003	
	Real-dependency ratio	–0.102(0.0793)	0.714(1.570)	0. 0131	
Resource endowment	Livestock in TLU	–0.0293(0.0249)	0.217(0.267)	0. 004	
	Cellphone ownership(1owned; 0 = otherwise)	0.00934(0.124)	–1.681**(0.837)	–0. 0309	
	Landholding size (hectare)	–0.131*(0.0756)	0.865(1.520)	0. 0159	
	Farmland fragmentation index	0.454**(0.213)	–0.541(2.063)	–0. 01	
	Farmland rental contract (hectare)	0.107(0.0723)	–3.095*(1.640)	–0. 057	
	Access to irrigation (1 if access; 0 otherwise)	0.169(0.106)	–0.530(1.166)	–0. 0098	
Market access	Residence distance from the all-weather road in minutes	0.00130(0.00153)	0.0254*(0.0134)	0. 0005	
	Residence from distance from main market minutes	–0.000347(0.00128)	0.000430(0.000759)	7.92e-06	
Social capital	Membership to cooperative (1member; 0 otherwise)	–0.0806(0.108)	0.171(0.908)	0. 0031	
	Remittance (1 yes; 0 otherwise)	–0.241(0.225)	0.0656(1.213)	0. 0012	
Access to institutional Services	Access to credit service (1 accessed; 0 otherwise)	0.0189(0.0960)	0.119(1.113)	–0. 0022	
	Access to extension service (1 accessed; 0 otherwise)	0.0129(0.150)	-1.410(1.103)	–0. 0259	
	Herfindahl-Hirschman crop diversity index	–1.093**(0.534)	1.892(2.334)	0. -.0348	
	Market orientation index	4.645***(0.478)	-6,762***(893.4)	–-124.41	
	Constant	–1.910***(0.400)	3.509(2.264)		1.811***(0.158)
	Observations	330	330	330	

Note: highland is the base agro-ecology, Robust standard errors in parentheses, *** significant at 1%, ** at 5%, * at 10

3.4 Conclusion and policy implications

The results of this study have demonstrated that the average output commercialization is about 22.7%. The results of this study have demonstrated that age of household heads, household head's educational status, farmland fragmentation, crop diversity and market orientation enhance smallholder farmers' proportion of output commercialization. However, the results revealed that landholding size reduces proportion of output commercialization. On the other hand, cell phone ownership and farmland rental contracts and market orientation increase the probability of output commercialization. However, distance of residence from all-weather roads limits the probability of output commercialization.

Our results help to elucidate pathways to enhance smallholder output commercialization. Output commercialization is affected by a number of factors such as socio-demographic, resource endowment and arrangements, transaction cost and access to institutions, and diversity of agro-ecological functions. Specifically, farmland fragmentation encourages smallholder farmers to commercialize their output. This is because it increases the access to different agroecological functions suitable to cultivate marketable crops. Crop diversification enhances smallholder farmers output commercialization. This is because it is used as an important strategy to reduce market risks. Market risks are the outcome of lack post-harvest technologies and management systems that are important for managing seasonality of surplus production and fluctuation of market prices. Landholding size reduces output commercialization. This is because higher costs of inputs such as seeds of improved crop varieties, chemical fertilizer, and labor compel less intensification of crop production and then, reduce marketed surpluses. Therefore, creating access to technologies (seeds of improved crop varieties and post-harvest technologies), reducing costs of inputs, and enable managing the seasonality of crop output market prices could enhance smallholder farmers' output commercialization.

Furthermore, future studies are important to broaden the existing knowledge on the commercialization of smallholder farmers crop outputs. Because, smallholder farmers crop types production and marketability vary in accordance with diversity in socioeconomic and agroecological factors. Therefore, there is a scope for further studies to understand the factors associated with smallholder farmers output commercialization in different socioeconomic and agroecological situations thereby gives full-fledged understanding of smallholder farmers

crop output commercialization for policy makers and development practitioners.

APPENDIX 2

Table 1: Variable Inflation Factor (VIF)

Variable	VIF	1/VIF
Land holding (hectare)	1.84	0.543884
Livestock in TLU	1.60	0.625801
Farmland rental contract in hectares	1.52	0.656539
Farmland fragmentation index	1.43	0.700205
Household head age (years)	1.41	0.710598
Herfindahl-Hirschman crop diversity index	1.37	0.727980
Residence distance from the all-weather road in minutes	1.28	0.783906
Household head education (grade)	1.27	0.787509
MOI	1.26	0.791011
Access to extension service (1 if accessed; 0 otherwise)	1.26	0.793145
Cellphone ownership (1 if owned; 0= otherwise)	1.24	0.808247
Household head sex (1 if male,0 otherwise)	1.22	0.820062
Membership to cooperative (1if member; 0 otherwise)	1.18	0.847097
Access to irrigation (1 if yes; 0 otherwise)	1.17	0.853955
Residence from distance from main market minutes	1.14	0.875363
Remittance (1if yes; 0 otherwise)	1.11	0.897191
Real-dependency ratio(continuous)	1.11	0.900874
Access to credit service (dummy =1 accessed; 0 otherwise)	1.06	0.941442
Mean VIF	1.30	

Omitted Variable Test

Ramsey RESET test using powers of the fitted values of output_comm

Ho: model has no omitted variables

F(3, 308) = 3.65

Prob > F = 0.214

Table 2: Model fitness test(linktest)

Output comm	Coef.	Std. Err.	Z	P>|z|	[95% conf. Interval]	
Proportion						
_Hat	1.26343	0.1474227	8.57	0.053	0. 9734139	- 1.553447
_Hatsq	-0.4059562	0.2114624	-1.92	0.152	-0.8219546	0.0100421
_Cons	-0.0292372	0.0215163	-1.36	0.745	-0.071565	-0.0130905

CHAPTER FOUR

SMALLHOLDER FARMERS' LIVELIHOOD DIVERSIFICATION STRATEGIES: THE ROLE OF AGRO-ECOLOGY AND COMMERCIALIZATION IN WEST GOJJAM ZONE, NORTHWESTERN ETHIOPIA

Abstract

The study investigates the livelihood diversification strategies of smallholder farmers and identifies engagement factors, with a focus on agro-ecology and commercialization. A mixed research design was used to investigate livelihood diversification strategies and then to analyze the factors that influence farmers to engage in the livelihood diversification strategies. Participatory Rural Appraisal and survey of 405 selected households were used to collect qualitative and quantitative data, respectively, using a checklist and a structured questionnaire. Thematic analysis was used to identify 'purpose' as a criterion for categorizing livelihood diversification strategies as on-farm wealth accumulation, off-farm survival, non-farm survival self-employment, non-farm survival wage-employment, and non-farm wealth accumulation. A multivariate probit estimate reveals that smallholder farmers in highland and midland agro-ecology pursue on-farm and non-farm wealth accumulation livelihood diversification strategies, as well as survival wage-employment livelihood diversification strategy, in comparison to lowland agro-ecology. The estimation further shows that commercialization enables smallholder households to pursue both on-farm and non-farm wealth accumulation livelihood diversification strategies. The results generally suggest that categorizing livelihood diversification strategies combining sector, location, function and purpose is vital to classify livelihood diversification strategies. Highland and midland agro ecologies, because of land degradation compel farm households to engage in survival wage employment livelihood diversification then, the income gain would be used to engage in on-farm and non-farm wealth accumulation livelihood diversification strategies. Crop output commercialization enables the farm households to engage on-farm and non-farm livelihood diversification strategies. Therefore, assisting the farm households in the highland and midlands, and investing smallholder farmers' crop commercialization has paramount importance to induce remunerative livelihood diversification strategies thereby improve farm households' wellbeing.

This chapter is based on Lijalem Abebaw, Worku Tuffa Birru and Dawit Alemu (Submitted). Smallholder Farmers' Livelihood Diversification Strategies: The Role of Agro-ecology and Commercialization in West Gojjam Zone, Northwestern Ethiopia. Development Studies Research

4.1 Introduction

Livelihood is a household and community behaviour that manifests itself in the interaction of asset holding and asset use for productive activities for a living (Barrett and Reardon, 2000; Bebbington, 1999; Scoones, 2009). Livelihood activities are the results of a household's resource holdings, market access, and support institutions, whereas livelihood strategies are the choices and combinations of livelihood activities that people make to achieve their livelihood goals (DFID, 1999; Walelign et al., 2017). This means that a variety of livelihood activities can be classified as livelihood strategies (Walelign et al., 2017). On the other hand, livelihood diversification is a household strategy which includes income-generating activities that are undertaken in addition to the primary household agricultural activities (Hussein and Nelson, 1998).

The literature categorizes livelihood strategies as on-farm, off-farm, or non-farm (Ellis, 1998, 2000; Loison, 2015; Reardon, 1997). On-farm includes crop and livestock production. Off-farm includes wage or exchange labour on other farms in agricultural production, firewood collection, and charcoal production. Non-farm economic activities include manufacturing and service activities that are not related to primary agricultural commodity production. These classifications are based on criteria such as sector, location, and function (Barrett, et al., 2001; Loison, 2015; Reardon, 1997). Sector refers to farm or non-farm economic activities, whereas location refers to smallholder farmers wage-employment on other farmers' farms, migration and work on-farm economic activity. The function is concerned with the relationship of smallholder farmers to their livelihood strategy, which is either self-employment or wage-employment in non-farm economic activities.

Literature identify resource endowments such as physical, financial, social, natural, and human assets, access to input and output, and institutional services influence smallholder farmers' livelihood diversification strategies (Ellis, 2000; Gautam and Andersen, 2016; Walelign et al., 2017). To elaborate further, Walelign et al., (2017) point out that income and asset provide a better understanding of livelihood strategies and household movements between strategies over time; Ellis (2000) states seasonality, risk, labour markets, credit markets, asset, and coping strategies are determinants of livelihood diversification; Gautam and Andersen (2016) further explain involvement in remunerative livelihood activities is determined by various financial, social and human capitals. Yet, the previous litrature missed to consider agro-ecology and commercialization as influencing factors of smallholder

farmers' choice of livelihood diversification strategies. Thus, in addition to the factors mentioned above, agro-ecology and commercialization can influence smallholder farmers' choice of livelihood diversification strategies. Agro-ecology creates agro-ecosystems, and the functioning of agro-ecosystems creates diverse farming systems through interactions among diverse crop and livestock species, as well as ecological, economic, and social potentials (Amekawa, 2011; Lacombe et al., 2018). The interaction of ecological and biophysical matters is referred to as ecological production, whereas socioeconomic production is concerned with the relationship between inputs and outputs in a production system (Amekawa, 2011). As a result of the ecological and socioeconomic interactions, farming systems and smallholder farmers' livelihood activities are established. Favourable agro-ecologies generate labour-intensive, low-start-up-capital requiring livelihood strategies that require educational attainment (Reardon, 1997). Smallholder farmers commercialization, on the other hand, necessitates increased production intensification and market participation. Production intensification entails increasing the use of production factors, which include purchased inputs such as agrochemicals, improved seed, machinery, and labor. This further necessitates an increase in farm and non-farm products and services (Abafita et al., 2016; Barrett et al., 2017; Gebremedhin and Jaleta, 2010). The combined result of production intensification and market participation, in other words, smallholder commercialization increases smallholder farmers' income, which can then be used to diversify livelihood activities (Bekele and Alemu, 2015; Leavy and Poulton, 2007).

Moreover, previous studies classify livelihood diversification strategies based on sector, location and function (Barrettet al., 2001; Loison, 2015; Woldenhanna and Oskam, 2001), paying little attention to the smallholder farmers 'purpose' of engagement in livelihood diversification strategies. The sector considers farm and non-farm livelihood diversification strategies; location classifies on-farm and off-farm livelihood diversification strategies; and function as self-employment and wage-employment non-farm livelihood diversification strategies. However, the present study tries to understand rural households' purpose of engagement in a livelihood diversification strategy. Because, purpose shows the capability of the smallholder farmers combine and transform assets in building of livelihoods either for survival or wealth accumulation (Bebbington, 1999). More specifically, we refine the classification of livelihood diversification in the context of Ethiopian smallholder farmers, in which rural households' engagement in a livelihood diversification strategy has purpose, which used to integrate resources to achieve the intended household wellbeing (either

survival or wealth accumulation).

Therefore, the study tries to fill literature gap by developing purpose as livelihood diversification classification criteria, which is a novelty to the classifications criteria of livelihood diversification strategy and then, analyse the determinants of choice of classified livelihood diversification strategies focusing on the effect of agro-ecology and commercialization rarely taken in to account in previous studies.

Underpinning livelihood diversification strategies

Livelihood diversification strategies are the result of pull and push factors. As a pull factor, livelihood diversification strategy is an economic growth strategy that realizes strategic complementarities between farm and non-farm livelihood strategies (Barrett et al., 2017; Barrett et al., 2001). This is explained by the fact that agricultural output growth is achieved through production intensification, which entails making greater use of factor production and increasing market-oriented production (Barrett et al., 2017). This leads to an increase in input purchases, productivity growth, and marketable surplus; in other words, farm intensification and commercialization expand, causing non-farm livelihood strategies to emerge (Barrett et al., 2017; Barrett et al., 2001; Berdegué et al., 2001; Ellis, 1999). As a driving factor, livelihood diversification expands as a survival strategy to mitigate economic and environmental risks, shocks, and stresses (Ellis, 1998, 1999, 2000; Gautam and Andersen, 2016). It is a risk-aversion strategy, a response to diminishing returns, such as household labor in the presence of farmland constraints, and a response to liquidity constraints (Barrett et al., 2001). Thus, the combined product of pull and push factors indicates that livelihood diversification is a practice in rural households (Davis et al., 2010), implying that smallholder farmers engage in livelihood diversification strategies that need to be explored, categorized, and characterized.

Categorization of livelihood diversification strategies

Existing literature classifies livelihood diversification strategies according to sector and location (Ellis, 2000; Haggblade et al., 2010; Loison, 2015; Reardon, 1997). Sector-based livelihood diversification strategies include on-farm livelihood strategies such as crop and livestock production and non-farm livelihood strategies such as rural non-farm economic activities. It is divided into two categories based on location: on-farm and off-farm livelihood strategies. Off-farm livelihood strategies include wage or exchange labor on other

farms in agricultural production, firewood collection, and charcoal production. Economic activities other than primary agricultural commodity production, such as manufacturing and service, are examples of non-farm livelihood strategies. Non-farm livelihood strategies are further classified according to function (Loison, 2015; Reardon, 1997; Woldenhanna and Oskam, 2001). Non-farm livelihood strategies such as wage-employment and self-employment are considered livelihood strategies under the function criterion. However, purpose does not have classifications of livelihood diversification strategy though it shows the capability of the smallholder farmers combine and transform assets in building of livelihoods either for survival or wealth accumulation (Bebbington, 1999). Therefore, purpose shows the mission that will drive the smallholder farmers engagement in a livelihood diversification strategy i.e., either survival or wealth accumulation. Thus, using purpose as criterion integrate with sector, location and function would have vital importance to the literature of livelihood diversification strategy classifications.

4.2 Methodology

4.2.1 Description of the study area

This study focuses on smallholder farmers characterized as agrarian community, their livelihood is predominantly producing crops and rearing livestock, which is characterized as mixed farming system. Crop production comprises predominantly cereal crops and to some extent horticultural crops. In support of this, (Amede et al. (2017) reports the area has a favorable environment for the production of different crops. The cultivated farmland size is estimated to be 612, 297.16 hectare, which is covered by teff, maize, wheat, pepper, millet, barely, potato, onion, fababeans, peans, chickpea, grass pea and niger seed and vegetables and fruits (CSA, 2014). West Gojjam zone has significant number of livestock population. Livestock production comprises predominantly cattle, sheep, goat, equines and poultry species (CSA, 2021). Cattle mainly used to support crop production as source of draft power to till farmland for crop cultivation. In addition to primary crop and livestock production, the smallholder farmers used to engage in livelihood diversification activities either to improve their living standard or to support their subsistence livelihood wellbeing. On-farm, off-farm and nonfarm livelihood diversification activities are practiced in the study area (Tizazu et al., 2018). On-farm activities are beekeeping, poultry, and *Khat* production. Off-farm activities are agricultural wage labor, migration for agricultural wage labor, charcoal production, and firewood collection. Non-farm activities are blacksmith, weaving, pottery, mat making,

basket and local brewery *(Tela and Katikala),* wage employment in construction works, carpentry, cementing, masonry, metalwork, and woodwork, livestock fattening and trading, crop and livestock trade, petty trade, animal cart transport service, renting house in urban centers and employment in government institutions.

4.2.2 Mixed research method

This study has applied mixed research design which combines both quantitative and qualitative research. Mixed research design is used for the purpose of triangulation and complementarity (Creswell, 2009; Greene et al., 1989). Triangulation is seeking convergence of research findings using multiple methods. Complementarity is use of different methods to assess different study components or phenomenon.

Qualitative data collection method

This study used both quantitative and qualitative methods. The qualitative approach is used to investigate and characterize livelihood diversification activities, and then to categorize the livelihood diversification strategies of rural households. The access of rural households to natural, social, physical, human, and financial assets, as well as their livelihood diversification strategies, varies according to the economic, institutional, and geographic contexts of areas (Gautam and Andersen, 2016). Thus, Participatory Rural Appraisal (PRA) data collection methods such as focus group discussions, in-depth individual interviews and transect walks were used to identify, select, and combine livelihood activities, and then to categorize and characterize livelihood diversification strategies (Chambers, 1994). Accordingly, five focus group discussions with eight to ten participant farmers each, three individual in-depth interviews with two experts working in agriculture and one expert in small and medium enterprise development offices in west Gojjam zone, and first author researcher observation during the transect walk in the study area were carried out. Among the questions posed to PRA participants were: *What are the smallholder farmers diversified livelihood activities? What human, physical, social, financial and natural capital and others are needed to start and execute each diversified livelihood activity? Why they participate or not participate in each diversified livelihood activity? What is the expected output of livelihood diversification activities? What is the purpose of engagement in livelihood diversification activities?* Consequently, the PRA identifies (lists) the smallholder farmers various livelihood activities; then, selects and combines livelihood activities; and finally,

classifies and characterizes livelihood diversification strategies using sector, location, function and purpose as criteria for categorization.

Quantitative data collection method

The quantitative survey method was used to investigate the relationship between explanatory variables such as: human, physical, natural, and social capital, market access, support institution services, commercialization and agro-ecology; and the classified livelihood diversification strategies. 405 sample respondents were chosen using a multi-stage sampling procedure. To this effect, among the fourteen districts administered in the west Gojjam zone, Dembecha Zuria and Burie Zuria were chosen at random by lottery. Based on agro-ecology, farming system, and agriculture production capacity, district agriculture offices categorize *kebeles* as lowland, midland, or highland. Six *kebeles*[7] were chosen at random from a list of highlands, midlands, and lowland kebeles, including Zeyushewen, Wadera, and Ambaye from the Burie district, and Astevoch-Egziabhierab, Yesheboch, and Gelila from the Dembecha district. We developed a structured questionnaire and pre-tested it in order to tailor it to the local situation. Finally, quantitative data on rural households' livelihood diversification strategies, socio-demographic characteristics, human, natural, physical, financial, and social capital, agro-ecology, crop production, and access to market and support institution services were collected.

Classification of livelihood diversification strategies

In addition to sector, location, and function, purpose has been found to be an important factor in classifying livelihood diversification. Participatory Rural Appraisal, which includes focus group discussions and individual interviews, defines livelihood diversification as smallholder farmers' household members participating in a livelihood activity other than conventional crop and livestock mixed farming. The Participatory Rural Appraisal identifies ‘purpose' as a criterion for categorizing livelihood diversification strategies. Because, according to participants in the Participatory Rural Appraisal, smallholder farmers diversify their livelihood activities to meet either subsistence demand or to improve their living standard. Diversifying livelihood activities in order to meet subsistence demand is survival; diversifying livelihood activities in order to improve living standards is wealth accumulation. As a result, participants in the Participatory Rural Appraisal investigate and combine

[7] *Kebele* is the lowest administrative unit of the government structure

livelihood diversification activities into livelihood diversification strategies based on purpose, sector, location, and function criteria. Purpose includes survival and wealth accumulation, demonstrating the motivation of smallholder farmers to engage in a livelihood diversification activity. Furthermore, sector takes into account farm and non-farm livelihood diversification activities, whereas location takes into account off-farm livelihood diversification activities; and function comprises self-employment and wage-employment in non-farm livelihood diversification activities. As a result, five livelihood diversification strategies were developed: on-farm wealth accumulation livelihood diversification strategy, off-farm survival livelihood diversification strategy, non-farm survival self-employment livelihood diversification strategy, non-farm survival wage-employment livelihood diversification strategy, and non-farm wealth accumulation livelihood diversification strategy. Similarly, Al-Qubatee et al. (2017), Ali and Delisle (1999), and Chambers (1994b, 1994a) state that Participatory Rural Appraisal assists rural households in identifying and characterizing livelihood activities, as well as developing criteria for categorization; this combines a complex portfolio of activities into livelihood strategies (Scoones, 2009).

4.2.3 Application of multivariate probit regression

The multivariate probit model is used to investigate the factors that influence the selection of livelihood diversification strategies. In previous research, the Multinomial Logit model, which assumes that livelihood strategies are mutually exclusive, was used to examine the determinants of livelihood diversification strategies (Bezu and Holden, 2014; Gebru et al., 2018; Matsumoto et al., 2006). However, because rural households may use multiple livelihood diversification strategies, a multivariate probit model is used to examine the factors that influence rural households' choice of livelihood diversification strategies. Because multivariate probit uses maximum likelihood to estimate probit regression parameters and the probabilities of livelihood diversification strategy combinations (Bock and Gibbons, 1996). Furthermore, multivariate accommodates linear and non-linear relationships, and the magnitude of the covariant's effect is dependent on the status of the covariant and the magnitude of the estimator coefficient (Hill and Kau, 1973). This is consistent with various economic theories, such as the theory of economic scale. For example, the percentage change in the resource endowment, which may be specified as household landholding size, is affected by the household initial resource endowment. Thus, multivariate probit is used to investigate the factors that influence smallholder farmers' choice

of livelihood diversification strategies.

Multivariate probit is specified (Chib and Greenberg, 1998; Hill and Kau, 1973) as:

$$y_i = 1 \quad if \quad \beta_i x_i + \varepsilon_i > 0 \qquad \text{[Equation 1]}$$

$$y_i = 0 \quad if \quad \beta_i x_i + \varepsilon_i \geq 0 \quad i = 1,2,3,4,5 \qquad \text{[Equation 2]}$$

Where, y_i is choice of livelihood diversification strategies such as: on-farm wealth accumulation livelihood diversification strategy, off-farm survival livelihood diversification strategy, non-farm survival self-employment livelihood diversification strategy, non-farm survival wage-employment livelihood diversification strategy and non-farm wealth accumulation livelihood diversification strategy. If the rural household engage in a livelihood diversification strategy it is one, otherwise zero.

X_i is a vector of explanatory variables.

β_1 β_2 β_3 β_4 β_5 are parameter vectors.

ε_1 ε_2 ε_3 ε_4 ε_5 are random errors distributed as a multivariate normal distribution with zero mean, unitary variance and $n \quad x \quad n$ correlation matrix.

4.2.4 Hypothesized determinants of choice of livelihood diversification strategies

Smallholder farmers' human, natural, physical, financial, and social assets, as well as their social, economic, and agro-ecological environments, determine livelihood diversification strategies (Chambers and Conway, 1991; Gautam and Andersen, 2016; Haggblade et al., 2010). Based on theoretical and empirical reviews, we hypothesize the possible influence of smallholder farmers' resource endowments such as human, natural, physical, financial, and social capital; and agro-ecology and commercialization on choice of livelihood diversification strategies. As to the knowledge of the researchers, agro-ecology and commercialization are new additions to the literature of factors affecting choice of livelihood diversification strategies

Human capital includes the household head sex, age, education, and family size. Household head sex influences access to resources and opportunities (Ellis, 1999). The empirical evidence states women's access to resources like farmland size is limited (Abeje et al., 2019; Ali et al., 2016; Deere and Leon, 2003; Walelign et al., 2017); which enforce to engage in labour-intensive, low-skill, low-entry-barrier nonfarm livelihood strategies (Akampumuza and Matsuda, 2017; Reardon, 1997; Reardon et al., 2000). As a result, women-headed households are expected to pursue survival livelihood diversification strategies. Household head age is associated with household farming experience and resource access (Bezu and Holden, 2014; Woldenhanna and Oskam, 2001). Household head age enhances access to resources such as farmland size (Bezu and Holden, 2014), and also, increases skill and knowledge about agricultural production practices thereby improve farm productivity and income; in turn, used to alleviate entry barriers in remunerative livelihood strategies (Bezu and Holden, 2014; Walelign et al., 2017; Woldenhanna and Oskam, 2001). Therefore, the increasing age of household heads may encourage smallholder farmers to participate in on-farm and non-farm wealth accumulation livelihood diversification strategies. Education improves household economic ability (Admassie and Ayele, 2011; Bilenkisi et al., 2015); as a result, smallholder farmers participate in skill and knowledge demanding remunerative non-farm livelihood strategies (Amare and Shiferaw, 2017; Berdegué et al., 2001; Bezu and Holden, 2014; Gautam and Andersen, 2016; Reardon, 1997). This suggests household head education is expected to increase smallholder farmers' participation in non-farm wealth accumulation livelihood diversification strategy. Household family size reduces marketable surplus as food and non-food consumption increases (Chattopadhyay and Sen, 1988). In support of this, empirical evidence from Ethiopia, smallholder farmers with larger family sizes engage in low capital demanding livelihood diversification strategies (Abeje et al., 2019; Woldenhanna and Oskam, 2001). Thus, we anticipate family size increase participation in off-farm survival, non-farm survival self-employment, and non-farm survival wage-employment livelihood diversification strategies.

Physical capital comprises farm and non-farm equipment. Farm equipment includes livestock barn, modern beehive, water pump, and other miscellaneous items. Non-farm equipment contains animal cart, milling machine, bicycle, motor cycle, and three-wheel car (Bajaj), house in towns and cities, radio, television, and cell phone. Farmers with high levels of physical capital engage in remunerative non-farm livelihood strategies (Amare and Shiferaw, 2017; Berdegué et al., 2001; Bezu and Holden, 2014). Therefore, it is expected that estimated

value of farm and non-farm equipment increase engagement in on-farm wealth accumulation and non-farm wealth accumulation livelihood diversification strategies.

Landholding size is a natural capital whereas farmland fragmentation is farmland arrangement. The landholding size provides an advantage for increased production and marketed surplus. According to the empirical evidence, smallholder farmers with larger cultivated farmland size earn higher incomes and then engage in remunerative non-farm livelihood strategy (Woldenhanna and Oskam, 2001). Farmland fragmentation, on the other hand, causes economic inefficiency and has a negative impact on economic gain (Manjunatha et al., 2013; Todorova and Lulcheva, 2005). Therefore, landholding size is expected to enhance engagement in on-farm and non-farm wealth accumulation livelihood diversification strategies; while farmland fragmentation forces engagement in survival livelihood diversification strategies.

Financial capital includes the livestock size and the estimated value of crops produced. Cash income is generated by livestock size and crop production (Barrett et al., 2001; Ellis and Freeman, 2004; Matanyaire, 1997). Cash income from crop and livestock production is used to purchase raw materials and equipment for remunerative non-farm livelihood diversification strategies (Amare and Shiferaw, 2017). Thus, it is expected that livestock size and crop production increase participation in on-farm and non-farm wealth accumulation livelihood diversification strategies.

Market access for input and output market enhances livelihood diversification activities. Rural niche markets are critical for increasing rural livelihood diversification activities (Haggblade et al., 2010). Because rural towns and cities have a higher population density, they can absorb a greater volume of farm and non-farm outputs; and markets supply raw materials, equipment, and small-scale processing machines for farm and non-farm production. The empirical evidence shows that population growth necessitates increased output, and infrastructure development encourages the expansion of remunerative non-farm livelihood strategies (Amare and Shiferaw, 2017; Reardon, 1997). Access to the market is measured using proxies such as residence distance to all-weather road and distance to town. Empirical evidence reports that residence distance from towns reduces participation in non-farm livelihood diversification strategies (Woldehanna, 1997). Thus, we expect that rural households' participation in on-farm wealth accumulation and non-farm wealth accumulation

livelihood diversification strategies is limited as residence remoteness from all-weather roads and towns increases.

Access to institutional service, which comprises credit and agricultural extension, is referred to as support capability. Access to credit services creates access to finance used to reduce entry barrier to engage in remunerative livelihood diversification strategies (Barrett et al., 2001; Ellis, 2000). Therefore, access to credit service is expected to enhance participation in on-farm and non-farm wealth accumulation livelihood diversification strategies. Agricultural extension service, on the other hand, is critical for encouraging the adoption of improved technologies, increase productivity and income, as well as a means of promoting rural development and economic transformation (Berhane et al., 2018; Dufera, 2018). Accordingly, access to extension services is expected to broaden both on-farm and non-farm wealth accumulation livelihood diversification strategies.

Smallholder farmers' social capital is their network of relatives, friends, community members, and input and output dealers (Mumuni and Oladele, 2016). The social network of smallholder farmers with their migrant relatives is a source of income, knowledge, and skill (Reardon, 1997). Thus, smallholder farmers can engage in capital-intensive on-farm wealth accumulation as well as non-farm wealth accumulation livelihood diversification strategies.

Agro-ecology provides ecological, economic, and social foundations for sustainable agriculture and smallholder farmers' livelihoods (Amekawa et al., 2010). Agro-ecology has an impact on farming systems. The interaction of soil fertility, rainfall, livestock and crop species, temperature, and other biotic and abiotic factors results in farming systems. Land degradation, for example, is a common occurrence in highland agro-ecology as a result of soil erosion; thereby affects agricultural production and livelihood diversification of smallholder farmers (Reardon, 1997; Woldehanna, 1997). Agricultural production and marketability vary across agro-ecology, implying that crop production variation may affect smallholder farmers' participation in various types of livelihood diversification strategies. As a result, highland, midland, and lowland agro-ecologies may have an impact on livelihood diversification strategies.

Commercialization strengthens the link between farm and non-farm livelihood strategies (Barrett et al., 2017). The interaction of farm and non-farm livelihood activities boosts economic growth. Economic growth, in turn, increases the capacity of smallholder farmers to

engage in capital-intensive remunerative livelihood strategies. The commercialization of smallholder farmers is measured using the commercialization index (Alemu and Gebre-Medhin, 2006; Bekele and Alemu, 2015; Jaleta et al., 2009; Strasberg et al., 1999; von Braun and Kennedy, 1994). The commercialization index is the ratio of crop value marketed to crop value produced in a given production year.

$$Output\ commercialization = \frac{Value\ of\ crop\ sales}{Value\ of\ crops\ produced}$$

$$Outputcomm_i = \frac{\sum_{j=1}^{k} P_j S_{ij}}{\sum_{j}^{k} P_j C_{ij}} \qquad \text{[Equation 3]}$$

Where;

$Outputcomm_i$ is the level of commercialization of household 'i'

P_j is the average price of crop 'j'

S_{ij} is the amount sold by the household 'i' of crop 'j', where j ranges from 1 to k

C_{ij} is the total volume of crop 'j' produced by household 'i'

4.3 Result and Discussion

4.3.1 Sampled households' descriptive summary statistics

Smallholder farmers practice livelihood diversification. As a result, on-farm wealth accumulation, off-farm survival, non-farm survival self-employment, non-farm survival wage-employment, and non-farm wealth accumulation livelihood diversification strategies are identified and characterised. As presented in Table 1, the average family size in the sampled households is around 5.4. The average estimated value of farm and non-farm equipment in rural households is 16684.55 (ETB[8]). The average landholding size of the sampled households is 1.22 hectares, ranging from having no farmland to farmers owning four hectares. The average farmland fragmentation index is 0.565, with values ranging from having a parcel of farmland to having highly fragmented farmland (0.875). The sampled smallholder farmers' residence distance to the nearest town takes an average of 42 minutes, ranging from 33.206 to 180 minutes. The average time taken to travel from the sampled households' homes to the all-weather roads is around 39.070 minutes, with a minimum of 25.65 and a maximum of 600 minutes. The average commercialization index of the sampled households is 0.228, ranging from smallholder farmers who have not marketed any of the

[8] ETB is Ethiopian Birr(currency)

crops produced to 98.7percent of crop produced is marketed, in a production year.

Table 1: Descriptive summary statistics

Category	*Variable*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Livelihood diversification strategies	On-farm wealth accumulation (dummy; 1 engage in; 0 otherwise)	405	0.617	0.487	0	1
	off-farm survival (dummy; 1 engage in; 0 otherwise)	405	0.235	0.424	0	1
	Non-farm survival self- employment (dummy; 1 engage in; 0 otherwise)	405	0.116	0.321	0	1
	Non-farm survival wage- employment (dummy; 1 engage in; 0 otherwise)	405	0.054	0.227	0	1
	Non-farm wealth accumulation (dummy; 1 engage in; 0 otherwise)	405	0.331	0.471	0	1
Human capital	Household head sex (1 male,0 otherwise)	405	0.901	0.299	0	1
	Household head age (continuous)	405	47.583	12.406	25	83
	Household head education (continuous)	404	1.233	2.176	0	12
	Household family size (continuous)	405	5.417	1.941	1	11
Physical capital	Farm and non-farm equipment estimated value in Ethiopian Birr (continuous)	404	16684	50373.55	0	383600
Natural capital	Landholding size in hectares (continuous)	405	1.226	0.821	0	4
	Farmland fragmentation index (continuous)	376	0.565	0.232	0	0.875
Financial capital	Crop produced value in Ethiopian Birr (continuous)	398	67318.3	77223.54	0	537000
	Livestock size in TLU (continuous)	404	3.931	2.671	0	17.16
Social capital	Relative living abroad (dummy; 1 yes; 0 otherwise)	405	0.069	0.254	0	1
Market access	Distance from the nearby town (continuous)	405	42.486	33.206	1	180
	Distance from the all-weather road in minute (continuous)	405	39.070	25.649	0	600
Support capabilities	Access to credit service (dummy; 1 accessed; 0 otherwise)	402	0.508	0.501	0	1
	Access to extension service (dummy; 1 accessed; 0 otherwise)	402	0.861	0.347	0	1
Commercialization	Output commercialization index (continuous)	396	0.228	0.220	0	0.987
Agro-ecology	Highland agro-ecology (dummy; 1 highland;0 otherwise)	405	0.425	0.495	0	1
	Midland agro-ecology (dummy; 1 midland; 0 otherwise)	405	0.264	0.442	0	1
	Lowland agro-ecology (dummy; 1 lowland; 0 otherwise)	405	0.311	0.464	0	1
District	Woreda (dummy; 1 Dembecha; 0 Burie)	405	0.524	0.500	0	1

N.B Observation(n) variation is due to unit non-response, the data is missed completely at random (MCAR) and also it is less than 10 percent of the sample size 385, thereby represents population. Thus, "list wise deletion" of missing data and the "complete-case analysis" lead to unbiased parameter estimates (De Leeuw et al., 2003; Howell, 2007; Kang, 2013; Little, 1988; Pampaka et al., 2016).

Source: own survey

4.3.2 Classification and characterization of livelihood diversification strategies

In addition to sector, location, and function, purpose has been found to be an important factor in classifying livelihood diversification. Participatory Rural Appraisal, which includes focus group discussions and individual interviews, defines livelihood diversification as smallholder farmers' household members participating in a livelihood activity other than conventional crop and livestock mixed farming. The Participatory Rural Appraisal identifies 'purpose' as a criterion for categorizing livelihood diversification strategies. Because, according to participants in the Participatory Rural Appraisal, smallholder farmers diversify their livelihood activities to meet either subsistence demand or to improve their living standard. Diversifying livelihood activities in order to meet subsistence demand is survival; diversifying livelihood activities in order to improve living standards is wealth accumulation. As a result, participants in the Participatory Rural Appraisal investigate and combine livelihood diversification activities into livelihood diversification strategies based on purpose, sector, location, and function criteria. Purpose includes survival and wealth accumulation, demonstrating the motivation of smallholder farmers to engage in a livelihood diversification activity. Furthermore, sector takes into account farm and non-farm livelihood diversification activities, whereas location takes into account off-farm livelihood diversification activities; and function comprises self-employment and wage-employment in non-farm livelihood diversification activities. As a result, five livelihood diversification strategies were developed: on-farm wealth accumulation livelihood diversification, off-farm survival livelihood diversification, non-farm survival self-employment livelihood diversification, non-farm survival wage-employment livelihood diversification, and non-farm wealth accumulation livelihood diversification. Similarly, Al-Qubatee et al. (2017), Ali and Delisle (1999), and Chambers (1994b, 1994a) state that Participatory Rural Appraisal assists rural households in identifying and characterizing livelihood activities, as well as developing criteria for categorization; this combines a complex portfolio of activities into livelihood diversification strategies (Scoones, 2009).

(1) On-farm wealth accumulation livelihood diversification strategy: marketed surplus and selling livestock species are the main sources of income for those who engage in on-farm wealth accumulation livelihood diversification strategy. On-farm livelihood activities such as beekeeping, poultry, and *Khat* production[9]are part of the livelihood strategy. These are remunerative livelihood activities in which smallholder farmers participate in order to increase their income and wealth. The livelihood activities necessitate a large initial investment in order to purchase chicken, build poultry and honey bee houses, purchase bee

[9] Beekeeping contribute to household income and poverty alleviation (Fikru, 2015); *Khat* and Poultry production is essential source of income for smallholder farmers (Cochrane and O'Regan, 2016; FAO, 2019).

hives, and establish a honey bee colony. Natural and physical capital, such as farmland, irrigation reservoirs, motor pumps, irrigation canals, farming equipment, and housing, are required for livelihood diversification activities; human capital such as skilled labor for production intensification and access to input and output markets is needed. Egg, chicken, khat, honey bee colony, and honey are the products. Smallholder farmers earn money by selling their produce. The primary goal of engaging smallholder farmers in diversification is to increase their wealth. These smallholder farmers are better off, who engage in on-farm wealth accumulation livelihood diversification strategy. The smallholder farmers who participate in this livelihood diversification strategy stated that they do so for the purpose of *"lelejochachin terit benetewelachew belen new,"* which translates as "we need to accumulate wealth for the livelihood wellbeing of our children after we die." This is a livelihood strategy used by 61.73 percent of the sampled households.

(2) Off-farm survival livelihood diversification strategy: agricultural wage labour, migration for agricultural wage labour, charcoal production, and firewood collection activities are all part of the livelihood diversification strategy. These livelihood diversification activities necessitate unskilled labor and a low capital investment, and the return is low. Wage-employed workers work in crop cultivation, particularly during the planting and harvesting seasons, when labor demand is high. Workers are poor and work in better-off farmer farms during crop planting and harvesting seasons, migrating from highlands (where labor is plentiful) to lowlands (where labor is scarce). During the planting season, wage laborers plant their farms early and migrate to the lowlands, and then return to manage their own crop-cultivated farm. Similarly, during the harvesting season, laborers migrate to the lowlands to earn a living, then return to their home to harvest their crop. It is seasonal work as wage labor in other agricultural farms (Barrett et al., 2001; Reddy et al., 2014). In comparison to other livelihood diversification strategies, this one requires less capital (for example, transportation costs). The smallholder farmers who participated in this livelihood diversification strategy identified as "poor" and work for *"beleto lemader,"* which translates as "meeting subsistence food demand." These smallholder farmers do not produce enough agricultural products to meet their household consumption demand, so they engage in this livelihood diversification strategy to meet their household's food and non-food consumption demand. 23.46 percent of the sampled households practice off-farm survival livelihood diversification.

(3) Non-farm survival self-employment livelihood diversification strategy includes rural traditional livelihood activities such as handicraft works such as blacksmith, weaving, pottery, mat, basket and local brewery (*Tela and Katikala*). The survival strategy

necessitates intensive labour and little physical capital. Handicraft production requires equipment such as weaving machines, pottery, and other miscellaneous materials. Indigenous knowledge and skills learned from parents and the community are essential for producing handicrafts. The products have market demand and development potential; however, there is a lack of skill and knowledge used to improve the quality of the goods and market the products. As a result, the return on investment for non-farm survival self-employment is low. This livelihood diversification strategy aims to meet household food and non-food consumption demand. 11.6 percent of the sampled households used a non-farm survival self-employment livelihood diversification strategy.

(4) Non-farm survival wage-employment livelihood diversification strategy includes wage employment in construction works, carpentry, cementing, masonry, metalwork, and woodwork, among other things. These require skilled labor and are located in rural towns as well as urban areas. In recent years, this livelihood diversification strategy has grown in popularity. Smallholder farmers participate in livelihood diversification activities in nearby rural towns and urban centres. Farm household members work for a wage. Skilled labor is required for livelihood diversification activities. The majority of the workers are youth who attend primary, secondary, and technical and vocational schools. After a lengthy apprenticeship, wage-employed workers learn on-the-job skills during the course of their work (Woldehanna, 1997). As a result of a lack of job opportunities for youth, there is more surplus labor, which undervalues the work of wage-employed workers. The wage income is then low. Smallholder farmers who participate in this livelihood diversification strategy must meet the household's food and non-food consumption demands. 5.43 percent of the sampled households engage in non-farm wage-employment livelihood diversification strategy.

(5) Non-farm wealth accumulation livelihood diversification strategy encompasses livelihood activities such as livestock fattening and trading, crop and livestock trade, petty trade, owning animal cart and providing transport service, owning and renting a house in urban centres and employment in government institutions. This strategy of livelihood diversification necessitates skill and knowledge of fattening practices, crop storage, and crop and livestock marketing and demands high start-up and running capital. Physical resources include a house, weighing machine, livestock barn, and storage facility; human capital includes knowledge of fattening practices, business management, and a network of input and output traders. In comparison to other methods of income diversification, the investment return is high. Similarly, skilled non-farm and full-time income strategies outperform (Barrett et al., 2005). The smallholder farmers who participate in this livelihood

diversification strategy are known as “better-off” smallholder farmers. They participate in a non-farm wealth accumulation livelihood diversification strategy to accumulate wealth for social security, at the time of livelihood retire age and for the livelihood wellbeing of their children. Among the sampled households, 33.09 % are better-off smallholder farmers who engage in non-farm wealth accumulation livelihood diversification strategy.

These categorizations and characterisations of livelihood diversification strategies clearly demonstrate the extent to which smallholder farmers consider the purpose of livelihood diversification strategies in their engagement decision. Participants of off-farm survival, non-farm survival self-employment and non-farm survival wage-employment livelihood diversification livelihood strategies stated that the motivation for their participation is *"beleto lemader,"* which translates as "meeting subsistence food demand," which is a survival purpose. The participants are poor, and the goal of the engagement is to generate additional income to meet household subsistence food and non-food consumption demand; in other words, the goal of the engagement is survival. Similarly, the rural poor diversify their livelihoods to low-return non-farm livelihood diversification strategies, which contribute insignificantly to well-being (Gautam and Andersen, 2016; Haggblade et al., 2010). As a result, the poor smallholder farmers' goal is to meet subsistence demand, i.e., to survive.

On the other hand, smallholder farmers engaged in on-farm and non-farm wealth accumulation livelihood strategy state that *“lelejochachin terit benetewelachew belen new”* translated as: “we need to accumulate wealth for our children's sustainable livelihood wellbeing” suggests smallholder farmers engage in a livelihood diversification strategy to accumulate wealth. Furthermore, participants in on-farm wealth accumulation and non-farm wealth accumulation livelihood diversification strategies are referred to as *“habtamoch,”* which translates as “better-off” smallholder farmers. Similarly, better-off smallholder farmers diversify not for survival but for wealth accumulation, so that they can engage in profitable livelihood diversification strategies (Gautam and Andersen, 2016; Woldenhanna and Oskam, 2001). As a result, the goal of better-off smallholder farmers is to accumulate wealth and improve living standards. The motivation is to achieve social security at the time of livelihood retire age, as well as children's sustainable livelihood wellbeing during their parents illness. As a result, we can conclude that the purpose of livelihood diversification for poor smallholder farmers is survival, whereas the purpose of livelihood diversification for better-off smallholder farmers is wealth accumulation. This is in line with the empirical work of (Gautam and Andersen, 2016).

4.3.3 Determinants of livelihood diversification strategies: estimates of multivariate probit

Specification tests were performed prior to performing Multivariate probit estimation. The Variable Inflation Factor (VIF) multicollinearity test (the maximum VIF value was 2.54) reveals that there is no multicollinearity among the covariates. Smallholder farmers' choice of livelihood diversification strategy(ies) is estimated using Multivariate probit, which shows that 360 (88.89 %) of the 405 sampled households included in the model are correctly estimated.

Table 2 depicts the relationship between explanatory variables such as human, physical, natural, financial, and social capital, market access, commercialization, and agro-ecology and the choice of livelihood diversification strategies in the context of smallholder farmers.

Household head sex, age, and education all have an impact on the choice of livelihood diversification strategies. Men-headed households are more likely than women-headed households to engage in on-farm wealth accumulation, off-farm survival, and non-farm wealth accumulation livelihood diversification strategies. Because men-headed households have better asset access than women-headed households (Abeje et al., 2019) and thus, men-headed households are more likely to engage in resource-demanding and high-return livelihood diversification strategies. However, as previously explained, off-farm survival livelihood diversification strategy is wage-employment in other farmers' farm activities; this suggests that it is a livelihood diversification strategy that engages men-headed households in comparison to women-headed households.

As expected, household head age limits smallholder households' participation in off-farm survival and non-farm survival self-employment livelihood diversification strategies. These livelihood diversification strategies demand less resources to participate; however, age enhances the smallholder farmers access to resources used to engage in remunerative livelihood diversification strategies (Bezu and Holden, 2014). Moreover, the focus group discussants revealed that as the age increases, the labor productivity decreases therefore, agricultural farm employers hire relatively young people, whose labor productivity is higher than that of elders. Therefore, off-farm survival and non-farm survival self-employment livelihood diversification strategies are labor-intensive, making it a job for youths.

Household head education increases household participation in non-farm survival wage-employment livelihood diversification strategy. Similarly, education is associated with a higher likelihood of choosing non-farm wage-employment (Abdulai and CroleRees, 2001; Bezu and

Holden, 2014). Because, non-farm survival wage-employment livelihood diversification strategy require a minimum level of education to be successful (Canagarajah et al., 2001), employers in non-farm livelihood diversification activities recruit educated youths who migrate from rural to urban areas.

Farm and non-farm equipment are examples of physical capital. The estimated value of owned farm and non-farm equipment limits smallholder farmers' participation in non-farm survival wage-employment livelihood diversification strategy; however, smallholder farmers are encouraged to engage in non-farm wealth accumulation livelihood diversification strategy. Similarly, Physical assets increase smallholder farmers' participation in remunerative non-farm livelihood strategies (Adi, 2005; Khatun and Roy, 2012; Reardon et al., 2001). Furthermore, the size of a natural resource such as landholding encourages smallholder farmers to engage in non-farm wealth accumulation livelihood diversification strategy. According to comparable empirical evidence, farmland-rich smallholder farmers engage in remunerative livelihood activities such as trades and skill-demanding livelihood activities (Barrett et al., 2005). Because larger farmland sizes may produce a marketable surplus sufficient to cover the household consumption demands. In general, physical resource poor smallholder farmers are less able to engage in remunerative livelihood diversification strategies, whereas resource rich smallholder farmers can overcome entry barriers and then participate in remunerative livelihood diversification strategies (Barrett et al., 2001).

Financial capital is made up of the estimated value of crop production and the livestock size (TLU). Crop production boosts smallholder farmers' participation in non-farm wealth accumulation livelihood diversification strategy. The reason for this could be that crop production increases the financial capacity of smallholder farmers (income). As a result, smallholder farmers may be able to invest in high-risk start-up capital-demanding non-farm wealth accumulation livelihood diversification strategy. This is consistent with smallholder farmers earning more money from crop production and diversifying their income through alternative income-generating activities (Block and Webb, 2001). Higher crop production, on the other hand, reduces household participation in off-farm survival livelihood diversification strategy. Smallholder farmers' livestock size improves on-farm wealth accumulation livelihood diversification strategy while limiting participation in off-farm survival livelihood diversification strategy and non-farm survival wage-employment livelihood diversification strategy. Similarly, livestock contributes significantly to non-farm income diversification (Block and Webb, 2001). Because livestock is a source of cash income, it may alleviate smallholder farmers' liquidity constraints when purchasing farm and non-farm equipment such as motor pumps, house construction, bees and bee-hives, and khat planting materials for on-farm wealth accumulation livelihood diversification strategy. This demonstrates that asset-rich

smallholder farmers engage in remunerative livelihood diversification strategies, while asset-poor smallholder farmers engage in off-farm survival livelihood diversification strategy and non-farm survival wage employment livelihood diversification strategy (WeldeGebriel et al., 2015; Barrett et al., 2005).

Social capital is the household relative who lives in another country. Smallholder farmers' relatives who live in foreign countries are pursuing non-farm wealth accumulation livelihood diversification strategy. Because, smallholder farmers who have extended kinship abroad secure income from various sources such as remittances (Ellis, 2000; Smith et al., 2001). Then, non-migrant smallholder farmers who receive remittance, able to access education and financial capital, used to engage in non-farm wealth accumulation livelihood diversification strategy.

The smallholder farmers' residence distance from town increases their chances of participating in a non-farm survival wage-employment livelihood diversification strategy. Because, as the focus group participants explains household members, particularly youths from the highlands, migrate to and work in rural towns and urban centres, where non-farm livelihood diversification strategies are expanding.

Access to credit service is one of the support capabilities. Access to credit had not been linked to smallholder farmers' livelihood diversification strategies. The most important reasons, according to focus group participants and individual interviewees, are high interest rates, group collateral, and low financial literacy. According to participants, Amhara Credit and Saving Institute (ACSI) is the dominant credit service provider in the study area. ACSI offers a loan with an interest rate of 18 percent using group collateral. Assets of smallholder farmers, such as farmland and oxen, are used as collateral. If there is a defaulter in this case, the group members are forced to repay the loan collectively otherwise, ACSI sells their owned assets such as corrugated iron sheet and livestock. Because of their lack of financial literacy, smallholder farmers are hesitant to borrow and invest in livelihood diversification strategies. This is consistent with empirical evidence indicating that credit markets in rural Africa are severely underdeveloped (Barrett et al., 2005). As a result, access to credit had no discernible impact on the selection of livelihood diversification strategies.

Commercialization as measured by output commercialization increased smallholder farmers' participation in on-farm and non-farm wealth accumulation livelihood diversification strategies while limiting households' participation in non-farm survival wage-employment livelihood diversification strategy. Because commercialized smallholder farmers have access to financial capital, they can overcome entry barriers and participate in wealth accumulation livelihood

diversification strategies. Similarly, access to financial, social, physical, natural, and human capital enable to overcome entry barriers in order to engage in profitable livelihood diversification strategies (Barrett et al., 2001; Ellis, 2000; Gautam and Andersen, 2016).

In comparison to their lowland counterparts, smallholder farmers in the highlands engage in on-farm wealth accumulation, non-farm survival wage-employment, and non-farm wealth accumulation livelihood diversification strategies. Furthermore, midland smallholder farmers engage in more on-farm wealth accumulation, non-farm survival wage-employment, and non-farm wealth accumulation livelihood diversification strategies than lowland farmers. Because, in comparison to the lowlands, the highland and midland agro-ecology is characterized by population pressure and severe land degradation (Zaitchik et al., 2012); thereby crop varieties and management strategies and then, production and marketability varies across agro-ecologies (Amare et al., 2018). Moreover, the focus group discussants and individual interviews in the highland and midland agro-ecologies revealed that young youths engage in non-farm survival wage-employment livelihood diversification strategy, while adult youths engage in on-farm and non-farm wealth accumulation livelihood diversification strategies, suggests household members engage in low return and high return livelihood diversification strategies. Similarly, empirical evidence indicates that smallholder farmers in areas with low agricultural potential are more likely to engage in either survival or wealth accumulation livelihood diversification strategies (Matsumoto et al., 2006). Smallholder farmers in the lowland, on the other hand, outperform those in the highland and midland agro-ecologies in terms of crop production. Because of its advantage in agricultural production potential, smallholder farmer household members spent the majority of their time engaged in crop and livestock production. Similarly, empirical evidence indicates that agricultural production potential areas rely on crop and livestock production rather than diversifying to non-farm livelihood strategies (Adi, 2005). Last but not least, smallholder farmers in Dembecha woreda, as opposed to Burie woreda, practice non-farm wealth accumulation livelihood diversification strategy.

Table 2: Multivariate probit estimates of smallholder farmers livelihood diversification strategies

		Livelihood diversification strategies				
Access to resources	***Explanatory variables***	***On-farm wealth accumulation***	***Off-farm survival***	***Non-farm survival self-employment***	***Non-farm survival wage-employment***	***Non-farm wealth accumulation***
Human capital	Household head sex (dummy=1 male,0 otherwise)	0.588**(0.257)	0.563*(0.303)	-0.148(0.359)	0.024(0.476)	0.803**(0.350)
	Household head age (continuous)	-0.003(0.007)	-0.029***(0.008)	-0.029***(0.011)	-0.006 (0.013)	-0.003 (0.007)
	Household head education (continuous)	-0.018(0.037)	0.006(0.041)	-0.135(0.084)	0.108**(0.051)	0.052(0.038)
	Household family size (continuous)	0.033(0.044)	0.098*(0.053)	-0.111(0.08)	0.103(0.076)	-0.039(0.048)
Physical capital	Farm and non-farm equipment estimated value (continuous)	9.48e-07(1.55e-06)	-5.28e-06*(3.04e-06)	-9.42e-08(2.98e-06)	-1.79e-05(1.75e-05)	1.27e-05***(2.84e-06)
Natural capital	Landholding size in hectares (continuous)	0.115(0.126)	0.054(0.158)	-0.120(0.236)	0.227(0.216)	0.235*(0.137)
	Farmland fragmentation index (continuous)	-0.387(0.350)	-0.048(0.394)	-0.716(0.518)	0.195(0.628)	0.072(0.386)
Financial capital	Crop produced value (continuous)	8.95e-08(1.14e-06)	-3.99e-06**(1.80e-06)	-5.89e-06(5.25e-06)	-2.67e-07(2.85e-06)	2.26e-06*(1.21e-06)
	Livestock holding in TLU (continuous)	0.06*(0.036)	-0.123**(0.048)	0.046(0.071)	-0.129*(0.077)	-0.008(0.041)
Social capital	Relative live abroad (1 yes; 0 otherwise)	0.268(0.284)	-0.597(0.391)	-5.042(95.13)	-0.650(0.606)	0.679**(0.282)
Market access	Residence distance from the nearby town in minutes (continuous)	0.002(0.003)	-0.005(0.003)	0.0002(0.004)	0.008*(0.004)	-0.004
	Residence distance from the all-weather road in minutes (continuous)	-0.003(0.003)	-0.002(0.004)	-0.002(0.005)	-0.003(0.005)	-0.004(0.004)
Support capabilities	Access to credit (1 accessed; 0 otherwise)	0.053(0.149)	0.109(0.173)	0.330(0.245)	0.365(0.268)	-0.101(0.163)
	Access to extension (1 accessed; 0 otherwise)	0.125(0.231)	-0.141(0.263)	0.122(0.322)	0.474(0.445)	0.102(0.264)
Commercialization	Commercialization index (continuous)	0.896**(0.391)	-0.486(0.445)	-1.810**(0.828)	0.452(0.662)	0.848**(0.418)
Agro-ecology	Highland agro-ecology (1 highland;0	0.632***(0.229)	0.033(0.258)	6.025(3,344)	0.837*(0.469)	0.602**(0.254)

(lowland is base agro-ecology)	otherwise)					
	Midland agro-ecology (1 midland; 0 otherwise)	0.485**(0.222)	-0.212(0.268)	6.267(3,344)	1.126**(0.490)	0.679***(0.244)
District	Woreda (dummy, 1 Dembecha; 0 otherwise)	0.128(0.175)	-0.310(0.206)	0.465(0.291)	-0.497(0.333)	0.370*(0.193)
	Constant	-1.311***(0.487)	0.900(0.555)	-4.548(3,344)	-3.421***(1.024)	-2.231***(0.571)
	Observations	360	360	360	360	360

Likelihood ratio test of rho21(off-farm survival, on farm wealth accumulation) = rho31(non-farm survival self-employment, on-farm wealth accumulation) = rho41(non-farm survival wage-employment, on-farm wealth accumulation) = rho51(non-farm wealth accumulation, on-farm wealth accumulation) = rho32(non-farm survival self-employment, off-farm survival) = rho42(non-farm wage-employment, off-farm survival) = rho52(non-farm wealth accumulation, off-farm survival) = rho43(non-farm survival wage-employment, non-farm survival self-employment) = rho53(non-farm wealth accumulation, non-farm self-employment) = rho54(non-farm wealth accumulation, non-farm wage-employment) = 0: chi2(10) = 8.02196 Prob > chi2 = 0.6267. Lowland is the base agro- ecology, standard errors in parentheses, *** significant at 1%, ** at 5%, * at 10%. Source, own survey

4.4 Conclusion and policy implications

The study aimed to improve understanding of smallholder farmers' criteria for identifying and characterizing livelihood activities, categorizing livelihood diversification strategies, and then analysing determinants of smallholder farmers' choice of livelihood diversification strategies with an emphasis on agro-ecology and output commercialization. Smallholder farmers' livelihood diversification strategies were characterised and classified based on purposes such as survival and wealth accumulation, sectoral as on-farm and non-farm, location as on-farm and off-farm, and function as wage-employment and self-employment classification criteria. This was accomplished through the use of data collection and analysis techniques used in Participatory Rural Appraisal. As a result, in accordance with the study population's socioeconomic and livelihood circumstances, on-farm wealth accumulation, off-farm survival, non-farm self-employment, non-farm survival wage-employment, and non-farm wealth accumulation livelihood diversification strategies were identified and characterised. On-farm wealth accumulation livelihood diversification strategy and non-farm wealth accumulation livelihood diversification strategy are remunerative livelihood strategies, whereas off-farm survival, non-farm survival self-employment, and non-farm survival wage-employment are less remunerative livelihood diversification strategies. The multivariate probit estimation reveals male-headed households, landholding size, estimated value of farm and non-farm equipment, livestock holding size, estimated value of crop production, commercialization, highland and midland relative to lowland agro-ecology enhance the smallholder farmers engagement in on-farm wealth accumulation and non-farm wealth accumulation livelihood diversification strategies. The higher the estimated value of farm and non-farm equipment, the estimated value of crop produced, livestock holding size, and commercialization are associated with the lower the likelihood of participation in off-farm survival, non-farm survival wage-employment, and non-farm survival self-employment livelihood diversification strategies. This implies that, first, resource endowment increases rural households' participation in wealth accumulation livelihood diversification strategies. Second, agro-ecologies are the interactions between agro-ecosystems and socioeconomic circumstances that affect crop and livestock production consequently, affects choice of livelihood diversification strategies. Third, commercialization increased smallholder farmers' participation in wealth accumulation livelihood strategies, implying that commercialization creates a backward and forward link between agricultural production and

nonfarm livelihood diversification strategies. These implies, in the absence of perfect credit markets, smallholder farmers' ability to participate in capital-intensive and remunerative livelihood strategies increases with their wealth (Reardon et al., 2000). Credit and extension services, for example, play no significant role in survival or wealth accumulation livelihood diversification strategies. On the contrary, in theory (at least according to policy documents), the government works aggressively to create farm and non-farm job opportunities for unemployed youths. This suggests that there is a misalignment between government policy documents and reality on the ground.

The outcome demonstrates pathways for explaining smallholder farmers' livelihood diversification strategies. Household head sex, landholding size, estimated value of farm and non-farm equipment, livestock holding size, estimated value of crop production, agro-ecology, and commercialization are all determinants of livelihood diversification strategies. Endowments of resources and commercialization encourage smallholder farmers to engage in wealth accumulation livelihood diversification strategies. Because densely populated and resource-depleted agro-ecologies limit agricultural production potential, household members engage in diversified livelihood diversification strategies in accordance with their ability. Recognizing this, Amare and Shiferaw (2017) report that in the early stages of agricultural commercialization, livelihood diversification strategies are critical in areas with high population density and low agricultural potential to absorb surplus labour. Commercialization of smallholder farmers increases household participation in wealth accumulation livelihood diversification strategies. As a result of the pulling effect, the backward and forward linkages between agricultural production and livelihood diversification strategies are strengthened. Therefore, facilitating commercialization would improve the forward and backward linkage between agricultural production and wealth accumulation livelihood diversification strategies. Furthermore, by removing entry barriers to wealth accumulation livelihood diversification strategies through a functioning credit service, smallholder farmers may be encouraged to engage in wealth accumulation livelihood diversification strategies. Finally, agro-ecological technological intervention and commercialization result in agricultural surplus production, which increases investment in wealth accumulation livelihood diversification strategies, thereby improving the welfare of smallholder farmers.

CHAPTER FIVE

THE IMPACT OF SMALLHOLDER FARMERS' COMMERCIALIZATION ON HOUSEHOLD MULTIDIMENSIONAL POVERTY: EVIDENCE FROM WEST GOJJAM ZONE, NORTH-WESTERN ETHIOPIA

Abstract

Using data from 405 sampled households from the west Gojjam zone of northwestern Ethiopia, endogenous switching regression was used to examine the impact of commercialization on poverty. The findings revealed that among commercialized smallholder farmers, household head age and education reduced multidimensional poverty. The estimated value of farm equipment and the cultivation of diverse crop species reduce multidimensional poverty among commercialized and non-commercialized smallholder farmers. Finally, smallholder farmers' commercialization has a significant and positive impact on reducing multidimensional poverty in households. Overall, the results demonstrate that smallholder farmers' commercialization is an essential path to improve household welfare.

5.1 Introduction

The world economic growth and development history illustrates the commercial transformation of agriculture is an indispensable pathway to economic growth and development for developed and developing nations (Norton and Alwang, 2010; Timmer, 1997). Commercialization is a process that passes from subsistence to semi-commercial and commercial production systems (Abdullah et al., 2019; Pingali, 1997; Pingali and Rosegrant, 1995). Commercialization demands the increment of market integration of subsistence agriculture, technological change, rural non agriculture sector growth, and rapid urbanization (von Braun, 1995; von Braun and Kennedy, 1986). This results improvement of factor and output market efficiency and trade expansion (Pingali, 1997; von Braun and Kennedy, 1994; Weinberger and Wickramasinghe, 2013). To this effect, commercialization of agriculture expands, which is fundamental to increase income and improve the welfare of rural households (Abdullah et al., 2019; Timmer, 1997; von Braun and Kennedy, 1986).

On the other hand, poverty is defined and conceptualized differently by different scholars. The difference affects the dimensions of poverty. Utilitarian welfare economists defined poverty as lack of income or shortfall of consumption expenditure to meet basic needs such as food, cloth, and shelter (Bogale et al., 2005; Sen, 1981). This implies lack of income to purchase basic needs is poverty. The development economists and sociologists underpins poverty as people's deprivation in capability and freedom to function (Robeyns, 2005; Sen, 1999). The deprivation capability and lack of freedom to function makes the individuals unable to be well-nourished and sheltered, to lead healthy lives, to be educated, to access public facilities and social care services, and to participate in public events (Robeyns, 2005; Sen, 1985, 1999, 2005; Terjesen, 2004). This implies poverty, is beyond shortfall of income, which is multidimensional. Therefore, this study understands farm households' poverty is deprivation in capability and freedom to function, which is multidimensional by nature.

Empirical evidence reports that poverty is a persistent and widespread phenomenon in Ethiopia (Bogale et al., 2005; Dercon, 1999; World Bank, 2015). Multidimensional poverty incidence in Ethiopia (88.2%) is high in comparison with Somalia (81.2%), Rwanda (80.2%), and overall in sub-Saharan Africa (64.7%) (Alkire and Santos, 2014). To overcome the widespread poverty and bring economic development, smallholder farmers' commercialization through agricultural

technology utilization is the nucleus of the economic development policy of Ethiopia (MOFED, 2003; Ohno, 2009); because agricultural technology and commercialization are complementary stimulators of rural economic growth (von Braun, 1995). There are two main underpinings for why smallholder farmers commercialization is vital to improving household welfare in rural areas (Asfaw et al., 2012; Barrett, 2008). First, commercialization is producing commodities that have comparative advantage and trade their surplus to buy goods and services which have less comparative advantage to produce. Second, commercialization allows to achieve greater economies of scale, diversification of non-farm livelihood activities and use of technologies thereby improve total factor productivity (Barrett, 2008; Timmer, 1988).

However, the previous studies on the impact of commercialization on poverty have ambiguous conclusions (Carletto et al., 2017). For instance, while Asfaw et al.(2012); Carletto et al.(2017); Muricho et al.(2017); von Braun (1995) argue that commercialization reduces poverty; Dethier and Effenberger (2012); Poole et al.(2013) contend commercialization may not reduce poverty. The discrepancy might be originated from the conceptualization and measurement of commercialization and poverty. This study contributes to filling this gap using appropriate conceptualization and measurement of commercialization and poverty following the smallholder farmer's the production and market behavior, and socio-economic and livelihood wellbeing, respectively. The different conceptualization of poverty identifies different smallholder farmers as being poor (Laderchi et al., 2003). The consumption expenditure or income poverty define poverty as unable to gain income above the poverty line (Bogale et al., 2005; Deressa and Sharma, 2014 and Goshu, 2013). Multidimensional poverty defines poverty as inability to meet minimum international standard indicators related to basic capabilities such as education, health, and living standard dimensions (Alkire and Santos, 2014). Unlike utility welfare economists and its associated income poverty measurement, the present study adopts multidimensional poverty to understand the smallholder farmer's deprivations affect the capability to function and its associated multidimensional poverty index measurement. Previous studies measure output commercialization in two ways. First, output commercialization is calculated as the ratio of gross value of cash crops to cultivated crops' gross value, suggesting smallholder farmers produce food crops for household consumption and cash crops for the market (Alemu et al., 2006). Second, output commercialization is measured as the ratio of the gross value of marketed crops to the gross value of crops produced, considering smallholder farmers cultivate and market mix of crop

species regardless of categorizing as cash and food crops (Bekele and Alemu, 2015; Strasberg et al., 1999). This study measures output commercialization as the ratio of the value of crops marketed to the value of crops produced, understanding the smallholder farmers produce a mix of crop species for household food consumption and market. Eventually, analyzing commercialization impact on poverty through adopting multidimensional poverty and its associated multidimensional poverty index measurement on the one hand, and output commercialization measure through the ratio of the gross value of marketed crops to the gross value of crops produced, on the other hand, uses to conclude the impact of smallholder farmers commercialization on farm household poverty.

5.2 Methodology

5.2.1 Description of the study area

Agriculture is the important livelihood for the rural farm households of the western zone of Gojjam in northwestern Ethiopia. This study aims to examine the factors affecting smallholder farmers' commercialization and its impact on the welfare of rural households. The smallholder farmers' farmland holding size ranges from a minimum of less than 0.1 to a maximum of 10 hectares and an average of 1.23 hectares (CSA, 2012). The smallholder farmers cultivate a diversity of crop species; for instance, cereal crops include maize, teff, wheat, barley, and finger millet; pulse and oil crops such as faba bean, field pea, lentil crops, and a variety of vegetables and root crops (CSA, 2012, 2014).

5.2.2 Data collection method and procedure

Quantitative and qualitative data types were collected to understand the determinants of smallholder farmers commercialization and its impact on smallholder households' welfare through structured questionnaire, focus group discussion, individual in-depth interview, and researchers' observation. Regarding the quantitative data type collection procedure, Dembecha *Zuria* and *Burie Zuria* woredas were randomly selected using the lottery method among the districts administered in west Gojjam zone. District agriculture offices cluster the number of kebeles as lowland, midland, and highland based on agro-ecology and agriculture production capacity. Six *kebeles*[10] *which* are *Zeyushewen, Wadera,* and *Ambaye* from *Burie Zuria* woreda;

[10] *Kebele* is the lowest administrative unit in the government structure.

and *Astevoch-Egziabhierab, Yesheboch,* and *Gelila* from *Dembecha Zuria* woreda, were selected randomly from the list of highlands, midland, and lowland *kebeles*. Regarding sampling frame, list of smallholder farmers was taken from the kebele agriculture offices then, the sampled smallholder farmers were selected using systematic random sampling method. A proportion to size sampling strategy was employed to select 405 sampled smallholder households. The sampled households' size was determined using the Cochran sample size determination formula (Israel, 1992) makes to sample 385 smallholder farmers and 5 percent contingency to select 20 smallholder households. A questionnaire was developed and translated to *Amharic,* the local language, and pre-tested to align with the local context. The survey was conducted through structured interviews administered by five enumerators and one supervisor. The qualitative data collection method was used to understand the process of commercialization, the factors which affect commercialization, and the commercialization impact on the household's welfare. The checklist is prepared to guide the discussion. Two focus group discussions were held in the two districts. Eighteen smallholder farmers have participated in the discussion, ten and eight discussants participated in the first and the second focus group discussions, respectively. The quantitative and qualitative data were collected on household socio-demographic characteristics, household's human, natural, physical, financial, and social assets, agroecology, crop production, input-output markets, transaction costs, access to institutions, health and education status.

5.2.3 Underpinning and measuring commercialization

Agricultural commercialization is a change from subsistence to market-oriented production with the principle of utility maximization. Commercialization is selling outputs, product choice, and purchased input use decisions with the principle of profit maximization (Pingali and Rosegrant, 1995; von Braun, 1995). Commercialization of subsistence agriculture occurs in the selling of outputs with increased marketed surplus; and increased use of purchased inputs (von Braun, 1995).

Commercialization is computed as output market participation (Bekele and Alemu, 2015; Jaleta et al., 2009; Strasberg et al., 1999). Increased use of input purchase translates to increased output market participation (Berhanu and Jaleta, 2010). Thus, smallholder farmers' commercialization is computed as the ratio of the value of crop marketed over the value of crop produced in a production year (Bekele and Alemu, 2015; Jaleta et al., 2009; Strasberg et al., 1999). The value

zero means a household is purely subsistence-oriented and the value one means highly commercialized.

$$Output\ commercialization = \frac{Value\ of\ crop\ sales}{Value\ of\ crops\ produced}$$

$$Outputcomm_i = \frac{\sum_{j=1}^{k} P_j S_{ij}}{\sum_{j}^{k} P_j C_{ij}} \qquad \text{[Equation 1]}$$

Where;

$Outputcomm_i$ is the level of output commercialization of household *'i'*

P_j is the average price of crop *'j'*

S_{ij} is the amount sold by the household *'i'* of crop *'j'*, where *j* ranges from *1* to *k*

C_{ij} is the total volume of crop *'j'* produced by household *'i'*

In Ethiopian smallholder farmers, Gebre-ab (2006) defines that the smallholder farmer sells fifteen percent and above of the crop produced is commercialized; otherwise, the smallholder farmer is non-commercialized. Cognizant of this fact, we categorized smallholder farmers commercialized if the output commercialization index is greater than 15 percent and non-commercialized if the household output commercialization index is less than 15 percent.

5.2.4 Underpinning and measuring multidimensional poverty

Multidimensional poverty encompasses deprivation in multidimensional manifestations of human welfare. Sen's capability approach underpin poverty as people's deprivation in capability and freedom to function (Robeyns, 2005; Sen, 1999). The deprivation capability and lack of freedom to function makes the individuals unable to be well-nourished and sheltered, to lead healthy lives, to be educated, to access public facilities and social care services, and to participate in public events (Robeyns, 2005; Sen, 1985, 1999, 2005; Terjesen, 2004); eventually, people face lack of resources and income, ill health, hunger and malnutrition, limited access to education and other basic services and social exclusion (UNDP, 2016). Thus, measuring poverty incorporates broad-based attributes of poverty manifestations. The multidimensional attributes of poverty are international harmonized standards of basic capabilities (Alkire and Foster, 2011; Alkire and Santos, 2014; United Nations, 2016). Cognizant to this fact, multidimensional poverty index has education, health, and living standard dimensions, and associated weight; which

further classifies into ten indicators with deprivation cut-off points and relative weight for each indicator to measure smallholder farmers multidimensional poverty.

Table1: multidimensional poverty index dimension, indicator, cut off and relative weight

Dimension	Indicator	Deprived if…	Relative weight
Education	Years of schooling	No household member completed five years of schooling	0.167
	Child school attendance	Any child is not attending school or drop out before reach grade eight	0.167
Health	Child mortality	Any child has died in the last five years	0.167
	Nutrition	Any child under five years old who is malnourished[11]	0.167
Standard of living	Electricity	A household has no electricity for lightening the house either from grid or solar source	0.056
	Sanitation	A household sanitation facility is not improved according to MDG[12] or improved but shared with other households	0.056
	Water	A household does not have access to clean drinking water[13] or access clean water but took 30 (round trip) or more minutes to fetch	0.056
	Floor	The household has dirt, dung, or soil floor	0.056
	Cooking energy	The household cooks with firewood, dung, or charcoal	0.056
	Assets	The household does not own more than one of radio, television, cellphone, bike, motorbike or refrigerator and does not own a car or truck	0.056

Source: adapted from (Alkire and Santos, 2014)

[11] MUAC (Mid-Upper Arm Circumference) anthropometric measurement was used to identify the child under five age is malnourished or not. Because, physical growth of children (under 5 years) is an accepted indicator of the nutritional well-being of the farm households.

[12] MDG improved sanitation includes Pit latrine with slab, ventilated improved pit latrine, flush toilet connection to (a piped swer system, septic system), Flush/ pour-flash to a pit latrine. Unimproved sanitation includes toilet types such as using open or bush, and pit latrine without slab

[13] Clean drinking water sources are protected dug well, protected spring, rainwater, tubewell (boreholes), public tap, and piped water. Unimproved water sources are surface water (rivers, lake, dam, pond, stream, cannel), unprotected springs, unprotected dug wells, tanker-turck

The multidimensional Poverty Index (MPI) is the summation of the deprivation score of each indicator. As the value of MPI approaches zero, the household, multidimensional poverty status is getting low while the MPI approaches one, the household poverty status increases.

$$MPI_i = \sum_{j=1}^{d} w_{ji} \quad \text{[Equation 2]}$$

Where: MPI multidimensional poverty status of the household i; w_j the deprivation score of indicators j of the household i and j indicators of poverty dimensions.

5.2.5 Application of endogenous switching regression

Endogenous switching regression is used to deal impact of smallholder farmers commercialization on multidimensional poverty. The two-step switching regression controls both observed and unobserved heterogeneity and, at the same time, estimates two separate treatment outcome equations alongside the selection model (Di Falco et al., 2011; Muricho et al., 2017). This applies to smallholder farmers commercialization is exogenously determined while it is potentially endogenous. To substantiate with evidence, Appendix 1 OLS estimates reveal commercialization doesn't affect smallholder farmers poverty. The smallholder farmers decision to commercialize or not to commercialize is voluntary and may be based on self-selection. That means the characteristics of commercialized and non-commercialized farmers might be different, and they may have decided based on expected utility.

The selection model is used to estimate the variants that affect the farmers' selection to commercialize or not to commercialize. The farmers selection into commercialization is based on the expected utility gain from the market (Alene et al., 2008; Bellemare and Barrett, 2006). In other words, the commercialized household expected utility gain (u_{it1}) is greater than the non-commercialized farmers utility gain (u_{it0}).

$$u_{it*} = u_{it1} - u_{it0} > 0 \quad \text{[Equation 3]}$$

The latent variables capture the utility gain from commercialization. The utilities are unobservable, and they can be explicitly expressed as a function of observable characteristics (z_i) and error term (ε_i). The equation is specified as:

$$A_{i^*} = \alpha_i z_i + \varepsilon_i \text{ With } A_i = \begin{cases} 1 & if\ A_{i^*} > 0 \\ 0 & otherwise \end{cases} \quad \text{[Equation 4]}$$

Where; A_i^* represents the binary variable equals 1 if the household is commercialized; 0 if the household is not commercialized.

α_i presents vector of parameters to be estimated.

z_i represents vector of observable explanatory variables

ε_i represents random errors distributed as normal distribution with zero mean and unitary variance

The first step involves estimation of the binary selection model commercialization decision using [Equation 4]. The second step involves estimation of two OLS regressions explaining the multidimensional poverty of each group in the two treatment regimes corrected for endogenous commercialization through inverse mills ratio are specified as:

$Regime\ 1: Y_{1i} = \beta_1 X_{1i} + \delta_1 \lambda_{1i} + \varepsilon_{1i}$ If A_i=1 (commercialized farmers) [Equation 5a]

$Regime\ 2: Y_{2i} = \beta_2 X_{2i} + \delta_2 \lambda_{2i} + \varepsilon_{2i}$ If A_i=0 (non-commercialized farmers) [Equation 5b]

Where; Y_{1i} and Y_{2i} represent outcome indicator variable for commercialized household *i* and non-commercialized household *i*, respectively; X_{1i} and X_{2i} represent the observed vector of covariates determine multidimensional poverty for commercialized and non-commercialized household i, respectively. λ_{1i} and λ_{2i} are Inverse 'Mill's ratio computed from [Equation 4] to correct selection bias in a two-step estimation procedure, i.e., endogenous switching regression. $\beta_1, \beta_2, \delta_1 and\ \delta_2$ are the vector of parameters to be estimated, ε_{1i}, ε_{2i} are independently and randomly distributed error terms. The standard errors in [Equation 5a] and [Equation 5b] are robust to account for the heteroskedasticity arising from the generated regressors λ_{1i} and λ_{2i}.

Though collinearity between smallholder farmers commercialization and multidimensional poverty was an issue, the significance level of variable interest is not affected due to lack of exclusion restriction (Jaleta et al., 2018). Because we did not use pooled regression rather a separate regression for commercialized and non-commercialized smallholder farmers was estimated in [Equation 5a] and [Equation 5b], respectively; and then, the predicted actual and counterfactual outcomes were compared to explain the impact of commercialization. Despite this, we excluded selection instruments in the multidimensional poverty function the variables related to access to market, such as residence distance to all-weather road and residence distance to market. We check the admissibility of the instruments using the falsification test (Di Falco et

al., 2011). The test shows that the variables jointly affected the decision to commercialization [X^2=10.10 (p = 0.006)] but not the households multidimensional poverty index for commercialized smallholder farmers [F= 1.09 (p= 0.339)] (Appendix Table 2).

Conditional expectations and treatment effects

The expected conditional and average treatment effects in the actual and counterfactual scenarios are given as:

Actual scenarios are expected from the survey: -

$E(Y_{1i}/x, Ai = 1) = \beta_1 x_{1i} + \delta_{1\varepsilon}\lambda_{1i}$ (commercialized) [Equation 6a]

$E(Y_{2i}/x, Ai = 0) = \beta_2 x_{2i} + \delta_{2\varepsilon}\lambda_{2i}$ (non-commercialized) [Equation 6b]

Counterfactual scenarios are hypothetically expected situations where the treated happened to be untreated and the untreated happened to be treated.

Commercialized farmers if they had been non- commercialized

$E(Y_{2i}/x, Ai = 1) = \beta_2 x_{2i} + \delta_{2\varepsilon}\lambda_{2i}$ [Equation 7a]

Non-commercialized farmers if they had been commercialized

$E(Y_{1i}/x, Ai = 0) = \beta_1 x_{1i} + \delta_{1\varepsilon}\lambda_{1i}$ [Equation 7b]

Based on these actual and counterfactual scenarios, we compute treatment effects as:

The expected change in the level of household multidimensional poverty for commercialized farmers i.e. average treatment effect for commercialized farmers' (ATT) equals

[Equation 6a]-[Equation 7a] = $E(Y_{1i}/x, Ai = 1) - E(Y_{2i}/x, Ai = 1) = (\beta_1 - \beta_2)X_{1i} + (\delta_{1\varepsilon} - \delta_{2\varepsilon})\lambda_{1i}$

Similarly, the expected change in the level of household multidimensional poverty for non-commercialized farmers i.e., average treatment effect for non-commercialized farmers' (ATU) equals

[Equation 6b]-[Equation 7b] = $E(Y_{2i}/x, Ai = 0) - E(Y_{1i}/x, Ai = 0) = (\beta_2 - \beta_1)X_{2i} + (\delta_{2\varepsilon} - \delta_{1\varepsilon})\lambda_{2i}$

5.2.6 Hypothesized determinants of commercialization and poverty

The smallholder farmer's resource endowment enhances commercialization and reduces household poverty (Bekele and Alemu, 2015; Bogale et al., 2005; Jaleta et al., 2009). The resources are human, physical, social, financial, and natural. Human capital comprises education, experience, skill, capabilities, etc.(Jaleta et al., 2009). The proxies are household head sex, household head age, and household head education. Household head sex is important to determine the 'households' commercialization. Women-headed households tend to have a lower education and farmland size than men-headed households (MOFED, 2018). In addition, socio-cultural taboo prohibits women from plowing farmland and cultivate crops (Teklu, 2005). Therefore, male-headed households would have a better probability of output market participation; and reduce poverty. Household head age is associated with an increment in farming experience and asset ownership, which reduces poverty (Abdullah et al., 2019; Bogale et al., 2005). Age used to accumulate agricultural knowledge and skill to enhance the adoption of improved agricultural technologies, thereby produce a marketable surplus. Furthermore, it is expected that household head age reduces household poverty. Education increases commercialization (Bekele and Alemu, 2015); and reduces poverty (Bogale et al., 2005). Education enhances farm household's agricultural productivity by affecting farmers' ability to use technologies and access market information (Mihai et al., 2015; Mitku, 2014; Pender and Gebremedhin, 2008). Moreover, education increases earning potential through increasing agricultural productivity, occupational and geographical mobility of labor (Bogale et al., 2005).

Physical assets are landholding size, farm equipment, and farmland rental contracts. Farmland holding size increases commercialization (Bekele and Alemu, 2015) and reduces rural 'households' poverty (Bogale et al., 2005; Ellis and Bahiigwa, 2003). To alleviate the shortage of farmland for crop cultivation, farmland rental contracts in the form of share cropping and renting arrangements is a common phenomenon in the study area. Farmland rental contracts enhance the adoption of improved crop varieties (Zeng et al., 2018); and can increase commercialization and reduce poverty. Household farm equipment includes agricultural production and output processing equipment. The higher the estimated value of household farm equipment implies improving the production, thereby welfare of the households. Financial assets are livestock holding size and non-farm income. Livestock is a source of cash to purchase inputs and engage

in non-farm activities (Barrett et al., 2001); and also, lack of livestock is associated with poverty (Ellis and Bahiigwa, 2003). Therefore, livestock size is expected to increase the household's income and, lastly, reduce poverty.

Market access is important for the welfare improvement of rural households (Ogutu et al., 2020). However, the smallholder farmers' market access is constrained by transaction costs (Pingali et al., 2005). Transaction costs hinder smallholder household's commercialization and may affect household's welfare. Transaction costs measured through proxies such as 'household's residence distance from the market, all-weather roads and input supply. The empirical evidence states that access to roads reduce poverty (Dercon et al., 2009). Therefore, the less the distance from the market and all-weather roads; the smallholder farmers commercialization increases and also, the household welfare is expected to improve.

Access to credit service enhances commercialization and reduces poverty (Abafita et al., 2016; Porter, 2016); because micro-credit providing institutes provide cash to purchase inputs to enhance the production of marketable surplus, thereby reduces poverty. Agricultural extension reduces poverty (Dercon et al., 2009); because, it increases farmers' access to improved technologies and market information. Thereby expected to increase the marketable surplus and reduce households' poverty.

5.3 Result and Discussion

5.3.1 Smallholder farmers descriptive and inferential summary statistics

Table 2 depicts the mean difference between commercialized and non-commercialized farmers multidimensional poverty status, socio-demographic characteristics, physical assets, financial asset, market access, access to institutions, natural capital and social capital using independent sample t-test and chi-square statistical tests for continuous and dummy variables, respectively.

Sampled farm households' average multidimensional poverty index is 0.393. Commercialized and non-commercialized farm households' average multidimensional poverty index is 0.388 and 0.423, suggesting commercialized farm households were less deprived than non-commercialized farm households. The commercialized farmers were younger, better educated, and had large

labor capacity relative to non-commercialized farmers. Farm equipment and landholding size are important to cultivate crops and produce a marketable surplus. Commercialized farmers' average owned farm assets and landholding size were significantly greater than non-commercialized farmers. Farmland rental contracts size of commercialized farmers was greater than non-commercialized farmers. Commercialized farmers' residence distance from the market was lower than non-commercialized farmers. Commercialized farmers accessed agricultural extension services and also cultivate diversified crop species better than non-commercialized farmers.

Table 2: Descriptive and inferential summary statistics

Variables	Total (n=345)	Commercialized (n=236)	Non-commercialized (n=109)	Sig. diff t(chi-square) test
Multidimensional poverty index (number, continuous)	0.393(0.007)	0.3881(0.008)	0.4231(0.017)	-1.811**
Socio-demographic characteristics				
Household head sex (dummy, 1=male,0= otherwise)	0.901(0.015)	0.936(0.014)	0.754(0.052)	21.793
Household head age (years, continuous)	47.5827 (0.617)	46.716 (0.671)	50.884(1.5809)	-2.557***
Household head education status (years, continuous)	1.233(0.108)	1.393(0.128)	0.493(0.153)	3.141***
Real dependency ratio (number, continuous)	0.444 (0.026)	0.467(0.031)	0.359(0.036)	1.549*
Physical asset				
Natural logarithmic value of farm equipment (ETB, continuous)	8.013(0.087)	8.184(0.091)	7.102(0.228)	4.682***
Landholding size in hectare (continuous)	1.256 (0.042)	1.315(0.049)	0.981(0.068)	3.015***
Land fragmentation index (number, continuous)	0.565 (0.012)	0.568(0.013)	0.543(0.029)	0.797
Farmland rental contracts size in hectare (continuous)	0.507 (0.035)	0.589(0.041)	0.159(0.036)	4.695***
Access to irrigation (dummy, 1=accessed, 0=otherwise)	0.248(0.022)	0.260(0.024)	0.217(0.050)	0.546
Financial asset				
Livestock size owned (TLU, continuous)	3.931 (0.133)	4.271(0.143)	2.653(0.317)	4.679***
Natural logarithmic value of crop produced (ETB, continuous)	10.588 (0.056)	10.852 (0.051)	9.337 (0.126)	4.682***
Non-farm income (ETB, continuous)	11797.88 (1669.466)	12675.97(2018.966)	7647.681(1990.487)	1.119
Access to market and institutional services				
Residence distance from main market (minutes, continuous)	93.975 (9.434)	80.835(3.776)	158.942 (51.926)	-3.109***
Residence distance from all-weather road (minutes, continuous)	25.649 (1.941)	23.703(1.427)	27.652(3.666)	-1.118
Farmers' cooperative (dummy, 1 member, 0=otherwise)	0.679(0.024)	0.695(0.026)	0.597(0.060)	2.422
Agricultural extension service (dummy, 1 accessed, 0= otherwise)	0.86(0.018)	0.895(0.017)	0.710(0.055)	16.411***
Access to credit service (dummy, 1 accessed, 0=otherwise)	0.505(0.025)	0.528(0.028)	0.420(0.060)	2.630
Natural capital (highland agro-ecology is base)				
Midland agro-ecology (dummy, 1 midland; 0 otherwise)	0.258(0.022)	0.281(0.025)	0.159(0.044)	0.264**
Lowland agro-ecology (dummy, 1 midland; 0 otherwise)	0.309(0.023)	0.364(0.027)	0.058 (0.028)	0.311**
Herfindahl-Hirschman crop diversity index (continuous)	0.312 (0.009)	0.295(0.008)	0.384(0.031)	3.856***
Social capital				
Household relative lived abroad (dummy, 1=yes, 0=otherwise)	0.069(0.013)	0.070(0.014)	0.073(0.031)	0.004

Note: Standard errors in parentheses; *, ** and *** are significantly higher than the other group mean (proportions) at 10%, 5%, and 1%, respectively—comparisons based on t-test for continuous variables and chi-square tests in the case of dummy variables.

5.3.2 Determinants of smallholder farm households output commercialization: probit regression estimation

Probit regression estimates in Table 3 column (1) depict that the household head education, landholding size, farmland rental contract size, access to cell phone, midland agro-ecology, and lowland agro-ecology relative to highland agroecology enhance the probability of smallholder farmers output commercialization. Moreover, smallholder farmers residence distance from the market and household relative lives abroad constrains the likelihood of farmers output commercialization.

The household head education enhanced the probability of 'farmers' output commercialization. Output commercialization is positively associated with landholding size and farmland rental contract size. Similarly, Bekele and Alemu (2015) state that cultivated farmland increases smallholder farmers output commercialization. Because the quantity of marketed surplus increases as the cultivated farmland size enhances.

As expected, ownership of cell phones enhanced the smallholder farmers probability of output commercialization while residence distance from the market limits the likelihood of output commercialization. Similarly, lack of communication apparatus and access to all-weather road reduces output market participation (Alene et al., 2008; Holloway et al., 2000). Because, as the residence distance from the market increases, it creates disutility greater than the utility gain from the transaction (de Janvry et al., 1991) whereas, ownership of cell phone alleviates the information constraint to market crop outputs. Thus, it affects smallholder farmers' commercialization (Alene et al., 2008; Key et al., 2000).

Compared to highland agroecology, the probability of output commercialization is higher both in midland and lowland agro-ecologies. Because agro-ecology affects crop production, commercialization, and revenue (Bernard et al., 2008; Gebremedhin and Jaleta, 2010; Seyoum et al., 2014). Moreover, the smallholder households had relative in abroad reduced the probability of output commercialization. Perhaps, the remittance might be used to engage in non-farm livelihood activities.

5.3.3 Determinants of multidimensional poverty for commercialized and non-commercialized farm households

Endogenous switching regression estimation in Table 3 column (2) and (3) depicts men-headed households relative to women-headed households of non-commercialized smallholder 'farmers' increase

multidimensional poverty. Perhaps, women may have better awareness about 'household's welfare improvement activities like feeding a balanced diet for their children. Household head age reduces commercialized smallholder farmers multidimensional poverty. Because household head age is associated with an increment in asset ownership and reducing household poverty (Bogale et al., 2005; Kassie et al., 2013). Household head education reduces both commercialized and non-commercialized smallholder farmers multidimensional poverty. Similarly, education reduces poverty (Bogale et al., 2005). Because education increases earning potential through increasing agricultural productivity, occupational and geographical mobility of labor (Bogale et al., 2005); and also increases knowledge and skill about household welfare improvement activities such as feeding diversified food staffs to their children, developing potable water points, educating household members and also investing in living standard improvement activities. The real-dependency ratio increases commercialized smallholder farmers multidimensional poverty. Because, the real-dependency ratio increases household consumption demand, thereby reducing investment in agricultural technologies to enhance agricultural productivity and production and then improve household welfare. Cognizant of this, the empirical evidence witness improving agricultural productivity is key to reduce poverty (Abro et al., 2014).

The estimated value of household farm equipment reduced poverty both within commercialized and non-commercialized smallholder farmers. This is consistent with the poor having fewer assets compared to non-poor (Brück and Kebede, 2013). Farmland fragmentation increases non-commercialized farm 'households' multidimensional poverty. Perhaps, farmland fragmentation increases production costs and decreases yields, revenue, profitability, and efficiency (Latruffe and Piet, 2014); which in turn reduces the household investment in welfare improvement activities such as enrolling children in school, accessing health services and feeding a balanced diet. Herfindahl-Hirschman crop diversity index increases multidimensional poverty both within commercialized and non-commercialized farm households, suggesting that cultivating diversified crop species reduces multidimensional poverty both within commercialized and non-commercialized households. The possible reason is that the cultivation of diversified crop species enabling household access to diversified food consumption, thereby improving household health and labor productivity.

Table 3: Endogenous switching regression estimates of commercialization and multidimensional poverty equations

Model	**Endogenous Switching regression**		
Model	**Probit**	**OLS**	**OLS**
Dependent variable	**Commercialization 1/0**	**MPI (for commercialize)**	**MPI (for non-commercialize)**
Socio-demographic characteristics			
Household head sex (dummy, 1=male,0= otherwise)	0.536(0.476)	-0.0101(0.0542)	0.115*(0.0616)
Household age (years, continuous)	0.000443(0.00978)	-0.00218**(0.000902)	0.00193(0.00203)
Household head education (year, continuous)	0.197***(0.0678)	-0.0134***(0.00404)	-0.0270**(0.0107)
Household real dependency ratio (number, continuous)	0.559(0.421)	0.0308**(0.0130)	0.0331(0.0942)
Physical and financial capital			
Non-farm income (ETB, continuous)	-2.74e-06(1.87e-06)	-1.02e-07(1.44e-07)	3.17e-07(1.36e-06)
Natural logarithmic value of household farm equipment (ETB, continuous)	0.0827(0.0822)	-0.0149**(0.00636)	-0.0355***(0.00894)
Household livestock owned (TLU, continuous)	-0.0703(0.0627)	0.00351(0.00424)	0.0210 (0.00956)
Cellphone ownership (dummy, 1 owned, 0 otherwise)	0.520**(0.252)	-0.0329(0.0247)	0.00987(0.0704)
Land holding size (hectare, continuous)	0.468*(0.268)	-0.000636(0.0152)	-0.0680(0.0662)
Farmland fragmentation index (number, continuous)	-0.350(0.582)	0.0760(0.0484)	0.275*(0.147)
Farmland rental contracts (hectare, continuous)	1.237***(0.345)	-0.0101(0.0158)	0.0783(0.0897)
Access to irrigation (dummy 1 access, 0 otherwise)	0.353(0.258)	0.00806(0.0226)	-0.0248(0.0694)
Access to market and institutional services			
Residence distance from all-weather road (minutes, continuous)	0.00799(0.00508)		
Residence distance from market (minutes, continuous)	-0.00216*(0.00128)		

Access to credit service (dummy, 1=accessed, 0=otherwise)	-0.169(0.220)	0.0238(0.0175)	-0.0300(0.0474)
Access to extension service (dummy, 1=accessed, 0= otherwise)	0.285(0.344)	-0.00393(0.0274)	0.0996(0.0687)
Membership to cooperative (dummy, 1=member, 0=otherwise)	-0.207(0.233)	-0.0110(0.0200)	-0.103*(0.0549)
Natural capital (highland is base agro-ecology)			
Midland agro-ecology (dummy, 1=midland, 0=otherwise)	1.041***(0.318)	-0.0116(0.0317)	0.0482(0.0891)
Lowland agro-ecology (dummy, 1=lowland, 0 otherwise)	1.655***(0.444)	-0.0112(0.0398)	-0.0650(0.0693)
Herfindahl-Hirschman crop diversity index (continuous)	-1.260(0.817)	0.171**(0.0837)	0.292***(0.0987)
Social capital			
Household relative lived abroad (dummy, 1=yes, 0=otherwise)	-0.804**(0.345)	-0.00502(0.0311)	-0.112(0.0901)
Inverse mills ratio (IMR)		-0.0815(0.0575)	0.0263(0.0177)
Constant	-1.385(0.932)	0.568***(0.0918)	0.181(0.173)
Observations	321	234	43
	Wald Chi2 59.69	F (20, 213) 2.79	F (20, 22) = 12.80
	Prob > chi20.0000	Prob > F = 0.0001	Prob > F = 0.0000
	Pseudo R2 / R-squared 0.3879	R-squared = 0.1803	R-squared= 0.6480
	Log pseudolikelihood -83.957307	Root MSE= 0.12983	Root MSE= 0.11446

Note: Robust standard errors in parentheses; significance level *** p<0.01, ** p<0.05, * p<0

5.3.4 Impact of smallholder commercialization on rural 'households' multidimensional poverty

Smallholder output commercialization would reduce 'households' multidimensional poverty status of the rural households. In the actual scenario, cell (a) and (d) represent the sample's expected multidimensional poverty index. Commercialized farm households expected multidimensional poverty index is 0.314 while it is about 0.422 for non-commercialized farm households. The lower the multidimensional poverty index is lower in average poverty of farm households, whereas the higher the multidimensional poverty index is higher in average poverty of farm households. Commercialized 'households' multidimensional poverty was increased by around 7 percent if they had been non-commercialized. This shows that the average treatment effect for the treated (ATT) reduced multidimensional poverty significantly.

On the other hand, non-commercialized 'households' multidimensional poverty was reduced by around five percent if they had been commercialized. This revealed that the average treatment effect for the untreated (ATU) would have been reduced multidimensional poverty significantly. This is therefore, smallholder commercialization reduced multidimensional poverty that enhances the welfare of rural households. Similarly, commercialization reduces poverty (Asfaw et al.,2012; Carletto et al.,2017; Muricho et al., 2017; von Braun,1995). Because commercialization strength the forward and backward linkages of agriculture. The backward linkage enhances efficient allocation of purchased inputs to enhance agricultural productivity whereas the forward linkage expands non-farm livelihood activities, thereby generates income used to invest in household welfare such as education, health, and living standard improvement activities.

Table 6: Commercialized smallholder farmers average treatment effect on 'households' multidimensional poverty

Treatment effect	Decision to commercialize	Decision not to commercialize	Treatment effects
Commercialized (ATT)	0.314(0. 0098) (a)	0.385(0.0035) (c)	-0.071 (0.0104) ***
Non-commercialized (ATU)	0.372(.0126) (b)	0.422(0.0164) (d)	-0.0505 (0.0206839) ***

Note: Standard errors in parentheses; significance level *** p<0.01, ** p<0.05, * p<0; ATT= average treatment effect on treated and ATU= average treatment effect on untreated

5.4 Conclusion and policy implication

The study has needed to understand the determinants and impact of smallholder commercialization on household multidimensional poverty. The result revealed that smallholder farmers household head education, landholding size, farmland rental contracts, midland and lowland relative to highland enhanced the probability of commercialization while residence distance from market and household relative live in abroad affects smallholder farmers commercialization decision negatively. Household head age and education reduce commercialized smallholder farmers multidimensional poverty while the real dependency ratio enhanced commercialized smallholder farmers multidimensional poverty. Farmland fragmentation increases non-commercialized smallholder farmers multidimensional poverty. Herfindahl-Hirschman crop diversity index positively affects non-commercialized and commercialized smallholder farmers' multidimensional poverty, suggesting that smallholder farmers diversify crop production and reduce commercialized and non-commercialized smallholder farmers' multidimensional poverty. Similarly, the estimated value of farm equipment reduces commercialized and non-commercialized smallholder farmers multidimensional poverty. Eventually, the empirical evidence confirms that smallholder farmers commercialization reduced multidimensional poverty unambiguously.

The result contributes to understanding the smallholder farmers commercialization and multidimensional poverty. Household head age and education enhance the knowledge and skill about agricultural production, commercialization, and welfare improvement activities, thereby reduces commercialized smallholder farmers multidimensional poverty. The estimated value of farm equipment reduces commercialized and non-commercialized smallholder farmers poverty. This suggests that poverty is highly associated with human and physical capital. Diversified crop varieties enable to access diversified food staffs for household better food and nutrition security. Therefore, investing in human and physical capital and cultivating diversified crop species reduce smallholder farmers multidimensional poverty. Finally, smallholder farmers commercialization generates cash income used for purchasing diversified food items for household consumption and invest in household education and living standard improvement activities such as electricity, potable water, and other equipment; therefore, smallholder farmers

commercialization reduces multidimensional poverty. This suggests policies that enhance smallholder farmers commercialization, and also, welfare improvement programs have to be endorsed to augment rural households' welfare.

APPENDIX 3

Table 1: OLS estimation of determinants of poverty

Explanatory variables	**OLS(MPI)**
Household head sex (dummy, 1=male,0= otherwise)	0.0442(0.0340)
Household age (years, continuous)	-0.00128(0.000828)
Household head education (year, continuous)	-0.0113***(0.00388)
Household real dependency ratio(continuous)	0.0348**(0.0144)
Non-farm income (continuous)	-1.10e-07(2.06e-07)
Natural logarithmic value of household farm equipment (continuous)	-0.0194***(0.00564)
Household livestock owned (TLU)	0.00442(0.00387)
Cellphone ownership (dummy, 1 owned, 0 otherwise)	-0.0235(0.0206)
Landholding size (hectare, continuous)	-0.00609(0.0158)
Farmland fragmentation index	0.0989**(0.0455)
Farmland rental contracts (hectare, continuous)	-0.00250(0.0151)
Access to irrigation (dummy 1 access, 0 otherwise)	0.00232(0.0203)
Residence distance from all-weather road (minutes, continuous)	-0.000264(0.000344)
Residence distance from market (minutes, continuous)	5.12e-05(3.79e-05)
Membership to cooperative (dummy, 1=member, 0=otherwise)	-0.0197(0.0189)
Household relative lived abroad (dummy, 1=yes, 0=otherwise)	-0.0213(0.0305)
Access to credit service (dummy, 1=accessed, 0=otherwise)	0.0228(0.0161)
Access to extension service (dummy, 1=accessed, 0= otherwise)	0.000897(0.0284)
Midland agro-ecology (dummy, 1=midland, 0=otherwise)	0.0106(0.0235)
Lowland agro-ecology (dummy, 1=lowland, 0 otherwise)	0.0232(0.0276)
Herfindahl-Hirschman crop diversity index (continuous)	0.123**(0.0571)
Output commercialization (1= commercialized, 0 otherwise)	-0.0154(0.0254)
Constant	0.488***(0.0724)
Observation	277
R-squared	0.209

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 2: Parameter estimates: test on validity of selection instruments

	PROBIT	OLS	OLS
Explanatory variables	Commercialization 1/0	MPI	Multidimensional poverty index of households that commercialize
Residence distance to all-weather road	-4.28e-05(0.00290)	-0.000147(0.000193)	-0.000371(0.000314)
Residence distance to main market	-0.00234**(0.000934)	8.11e-05**(3.90e-05)	0.000167(0.000146)
Constant	1.160***(0.123)	0.364***(0.00946)	0.383***(0.0143)
Observations	396	345	276
Lr chi2(2)	10.10		
Prob > chi2	0.0064		
Pseudo r2	0.0276		
Observations			
F(2, 342)		2.24	F (2, 273) 1.09
Prob > f		0.1082	0.3388
R-squared		0.0129	0.0069
Adj r-squared		0.0071	
Root MSE		0.14295	0.13824

Note: standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

CHAPTER SIX

SYNTHESIS

Introduction

Commercialization induces production specialization at farm level and increase agricultural product diversity at aggregate level, along with market and trade development facilitates, thereby diversify consumption eventually brings economic development (Timmer, 1997; von Braun, 1994). However, if support institutions, policies and strategies are not put in place; commercialization might have adverse outcome or may not reduce poverty (Poole et al., 2013; von Braun and Kennedy, 1994). Commercialization is inevitable agrcultural transformation process creates economic linkages (Poole et al., 2013; Yaro et al., 2017). Thus, understanding the smallholder farmers commercialization and its association with livelihood diversification strategies and welfare has paramount importance for the development of the rural economy in particular and the structural transformation of the economy in general. Cognizant with this, this study focused on (i) determinants of smallholder farmers market orientation for smallscale crop commercialization; (ii) determinants of crop output commercialization; (iii) defining and categorizing livelihood diversification strategies and then associate with determining factors especially the role of agro-ecology and commercialization in livelihod diversificaion strategies; (iv) the impact of commercialization on poverty. Along with, defining and conceptualizing the smallholder farmers market orientation, output commercialization, livelihood diversification strategy and poverty were done. Eventually, the study looked in to the relationship between smallholders' commercialization, livelihood diversification strategies and poverty.

In this chapter, we summerize the main definitions, methods, findings along with conclusions and implication for policy and strategy development.

a) Determinants of smallholder farmers market orientation for small-scale crop commercialization in West Gojjam Zone, Amhara Region, Ethiopia

Smallholder farmers' market orientation was estimated using crop marketability index at household level to consider the weight relative to farmland allocation to cultivated crop species and the zero-inflated beta regression model is used to estimate the probability decision and extent of market orientation considering Bernoulli and beta distributions, respectively.

The findings are male-headed relative to women-headed households, owning cell phone; landholding size, farmland rental contracts size and access to irrigation enhanced the smallholder farmers likelihood of market orientation. Agro-ecology and transaction costs are important determinants of smallholder farmers market orientation. Because, agro-ecology affects the crop species production and marketability. While transaction costs affect input and output markets thereby, affects smallholder farmers access to market to purchase inputs and sell outputs; which is vital for commercialization. Therefore, agro-ecology and transaction costs are strategic issues to enhance smallholder farmers market orientation. These findings imply that the need for intensification of development efforts in promoting smallholder farmers' market orientation considering the specificities of gender, landholding size, access to irrigation, agro-ecology, and distance to main markets as key indicator for transaction costs.

b) Determinants of commercializing crop outputs of smallholder farmers in west Gojjam Zone, north-western Ethiopia

Crop output commercialization is measured as the value of crop marketed to the value of crop produced. Because, the study area is characterised as the smallholder farmers produce and sell mix of crop species used for both household food consumption and source of cash income. Zero-inflated beta regression econometric analysis depicts the determinants of output commercialization.

The results of the analysis of the data revealed that the average smallholders' crop output commercialization was estimated at 22.7%. Results from the zero-inflated beta regression model revealed that ownership of cell phones, farmland rental contract, and market orientation increased the probability of output commercialization. However, distance of all-weather roads from residence limited the probability of output commercialization. Household head age, household head educational status, farmland fragmentation, crop diversification and market orientation increased the proportion of output commercialization whereas landholding size reduced the extent of output commercialization. The results imply that increasing the size of landholding reduces intensified crop production; farmland fragmentation allows farmers to access favourable agro-ecological functions for growing marketable crops; crop diversification is

a strategy to reduce market risks and promotes output commercialization. Therefore, policy interventions that improve smallholder farmers access to technologies, lowering input purchase costs, and reducing output market price seasonal volatility would enhance commercializing smallholder farmers crop outputs.

c) Smallholder farmers' livelihood diversification strategies: The role of agro-ecology and commercialization

This part targeted first in identification of important livelihood diversification strategies classification criteria. Then, purpose is identified as criteria for clustering livelihood diversification activities in to categories of livelihood diversification strategies. Then, considering classifciation criterias such as sector, location, function, and purpose; five main livelihood diversification strategies were identified. Which are (i) on-farm wealth accumulation livelihood diversification strategy, (ii) off-farm survival livelihood diversification strategy, (iii) non-farm survival self-employment livelihood diversification strategy, (iv) non-farm surviavl wage-employment livelihood diversification strategegy, and (v) non-farm wealth accumulation livelihood diversification strategy. Once these strategies were identified, the next step was determination of factors affecting smallholder farmers participation in these strategies, which was analysed using multivariate probit model.

Multivariate probit analsysis reveals male-headed households, landholding size, estimated value of farm and non-farm equipment, livestock holding size, estimated value of crop production, commercialization, highland and midland relative to lowland agro-ecology enhance the smallholder farmers engagement in on-farm wealth accumulation and non-farm wealth accumulation livelihood diversification strategies. The higher the estimated value of farm and non-farm equipment, the estimated value of crop produced, livestock holding size, and commercialization are associated with the lower the likelihood of participation in off-farm survival, non-farm survival wage-employment, and non-farm survival self-employment livelihood diversification strategies. This implies that, first, resource endowment increases rural households' participation in wealth accumulation livelihood diversification strategies. Second, agro-ecologies are the interactions between agro-ecosystems and socioeconomic circumstances that affect crop and livestock production consequently, affects choice of livelihood diversification strategies. Third, commercialization increased smallholder farmers' participation

in wealth accumulation livelihood strategies, implying that commercialization creates a backward and forward link between agricultural production and nonfarm livelihood diversification strategies. The important role of resource endowments, agro-ecology and commercialization in the choice of livelihood diversification strategies implies the need to develop policies and development intervenetions in accordance with the different resource endowments, agroecologies and level of comemercialization.

d) The impact of smallholder farmers' commercialization on household poverty

To estimate the impact of commercialization on poverty, it was important to decide how to measure poverty. In this study, poverty is estimated covering its multidimensional aspects, which incoporates eduction, health and living standard dimensions with their respective indicators. The impact was assessed using endogenous switching regression (ESR).

The empirical analysis revelead that household head age and education reduce commercialized smallholder farmers multidimensional poverty while, real dependency ratio enhanced commercialized smallholder farmers multidimensional poverty. Farmland fragmentation increases non-commercialized smallholder farmers multidimensional poverty. Herfindahl-Hirschman crop diversity index positively affect non-commercialized and commercialized smallholder farmers multidimensional poverty suggesting smallholder farmers diversified crop production reduce commercialized and non-commercialized smallholder farmers multidimensional poverty. Moreover, estimated value of farm and non-farm equipment reduce commercialized and non-commercialized smallholder farmers multidimensional poverty. The impact of commercialization on multidimensional poveryt is positive suggests commercialization redueces multidimensional poverty.

Main conclusions

The above presented empirical evidence indicate that there is a need for diversification of development efforts in promoting smallholder farmers' market orientation considering the specificities in terms of gender, farm size, access to irrigation, agro-ecology, and distance to main markets as key indicator for transaction costs. Commercializing smallholder farmers crop outputs is affected by landholding size, farmland fragmentation and crop diversity. Farmland

fragmentation and cultivated crop diversity increses commercializing crop outputs whereas landholding size reduced the extent of output commercialization. The results imply that increasing the size of landholding reduces intensified crop production; farmland fragmentation allows farmers to access favourable agroecological functions for growing marketable crops; crop diversification is a strategy to reduce market risks and promotes output commercialization. Thus, policy interventions consdiering landholding size, farmland fragmentation and crop diversity would enhance commercializing smallholder farmers crop outputs. The important role of agro-ecology and commercialization in the choice of livelihood diversification strategies implies the need to differentiated development and policy intervention for the different agro-ecologies and level of comemercialization depending on the associated resource endowment. Given the postive impact of smallhoder farmers'commercialization in reducing poverty, the policy and development efforts in promoting smallholder crop commercialization need to be considered as part of one of the rural poverty reduction strategies.

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8. Appendix

Addis Ababa University
School of post graduate
College of development studies
Center for rural development
PhD program

Questionnaire prepared to collect data on smallholder commercialization and its implication for poverty
Date of interview: Ethiopian calendar DD/MM/YY/__ /_/__/
Enumerator's name_____
Questionnaire number_____

Woreda _____Kebele_____Village _____

A. General information

1. Name of the respondent_____
2. Sex of the respondent: 1. Male 2. Female
3. Age of the respondent _____years.
4. Marital status: 1. Single 2. Married 3. Divorced 4. Widow 5. Others specify _____
5. Have you been involved in a leadership position? 1. Kebele administration cabinet 2. Religious leader 3. edir 4. If other (please specify)_____
6. Are you member of farmers' cooperative? 1. Yes 2. No
7. In which community organization do you or household member participate or member? 1. Water users association 2. Youth association 3. Women's association 4. Kebele council

8. Demographic characteristics of the household

No	**Name of household member (start with respondent)**	**Age**	**Sex Codes A**	**Education Codes B**	**Health condition (permanently disabled,)**
1					
2					
3					
4					
5					
6					
7					
8					
Codes A	**Code B:** 0. None/Illiterate				

0. Female 1. Male	1. Adult education or 1 year of education or religious education * Give other education in years

9. How long the respondent have been cultivating crop production?_____(years)

B. Asset owned by the household

10. Types and number of livestock owned by the household

No	Livestock type	Owned (#)	Value (Birr)
1	Ox		
2	Bull		
3	Calf		
4	Cow		
5	Heifer		
6	Donkey		
7	Horse		
8	Mule		
9	Sheep		
10	Goat		
11	Poultry		

11. Physical asset owned by the household and its estimated value

Item	**number owned**	**Total current estimated value in Birr**
Animal cart		
House in towns		
Mobile phone		
Television		
Radio		
Milling machine(*wofecho*)		

Farm implements(*maresha, hoe*)		
Improved bed		
Chair (improved wood and sofa)		
Water pump		
Generator		
Bajaj (three-wheeler)		
Bicycle		
Motorcycle		
Tractor		
Pick up		
Lorry/Truck		
Automobile		
Minibus		
Bus (24 and above carrying capacity)		

C. Social capital

12. Social capital in terms of contacts and relationships(between 18-64 years)

No		
1	Number of people who give loan within the Kebele	
2	Number of people who give loan outside the Kebele	
3	Number of traders you know in the market with in the kebele	
4	Number of traders you know in the market outside Kebele	
5	Number of trader relatives within Kebele	
6	Number of trader relatives outside Kebele	
7	Number of government officials you know within the kebele	

8	Number of government officials you know outside the kebele	
9	Number of relatives with regular monthly salary within kebele	
10	Number of relatives with regular monthly salary outside kebele	
11	Number of family members abroad	

D. Land access

13. How many *timad* of land do you have?_____*(timad)*
14. How many irrigated land do you have?_____*(timad)*
15. How many parcel of land do you have (owned land)?_____

Rain fed parcel	*Timad*	Fertility status (fertile(3) medium(2), non-fertile(1))	Irrigated parcel of land	*Timad*	Fertility status (fertile(3), medium(2), non-fertile(1))
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
Total					

16. Land allocation and production of rain fed crops in 2010/9?(*in timad*)

No	Crop type	20010/9			Hired daily labor (adult labor)	Amount produced in *quintal*
		Owned (*timad*)	Rented in(*timad*)	Rented out(*timad*)		
1	Pepper					
2	Maize					
3	Tef					
4	Wheat					
5						
6						
7						
8						
9						
10						

17. Irrigated land allocation for irrigated seasonal and annual crop production in the last year?

No	Crop type	20010/9			Hired daily labor(adult labor)	Amount produced in *quintal*
		Owned (*timad*)	Rented in (*timad*)	Rented out (*timad*)		
1	Pepper					
2	Maize					
3	Tef					
4	Wheat					
5						
6						
7						

8						
9						
10						

18. Average Labor unit price

June	July	August	Sep.	Oct.	Nov.	Dec.	Jan	Feb	March	April	May

E. Land security right

19. Do you fear land you owned will be taken by the government at any time in the future?
    1. Yes 2. No
20. If yes, does it affect your investment decision to commercialize your agriculture? 1. Yes 2. No
21. What is your concern about land security right?_____

F. Technology adoption

22. Types and amount of improved technologies used in 2010/9 production year

No	Crop type	Local seed(kg)	Improved seed (kg)*	Fertilizer(kg)		Herbicide(liter)	Pesticide (liter)	Disease control	Post-harvest handling technologies
				DAP(kg)	Urea(kg)				
1	Pepper								
2	Maize								
3	Tef								
4	Wheat								
5									
6									
7									
8									
9									
10									
	**Improved seed is improved variety introduced within the last five years by the government or NGO*								

G. Marketing

23. Name of the local market? _____Distance from the local market? __(km)
24. Name of the main market?_____Distance from the main market? _____(km)
25. Distance from the all-weather road to transport your product to market?_____(km)
26. Distance from input (fertilizer) source? (km)
27. How do you transport your commodity? 1. Animal cart 2. Vehicle 3. Donkey/horse/mule
28. Where do you get market price information? 1. Cooperative 2. Kebele 3. Neighbor 4. Trader 5. Radio 6. Television 7. If other specify
29. Commodity types left over from last year and before?

No	Commodity type	Amount stored (kg)
1	Pepper	
2	Maize	
3	Wheat	
4	Tef	
5		
6		
7		
8		
9		
10		

30. Commodity types sold (kg) in 2010?

Type of commodity	Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		July		Aug	
	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg
Pepper																								
Maize																								
Tef																								
Wheat																								

31. Commodity types bought (kg) in 2010/9?

Type of commodity	Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		July		Aug	
	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg	kg	birr/kg
Pepper																								
Maize																								
Tef																								
Wheat																								

H. Economic activities

32. What are the activities you or the household members are working on as source of income?(multiple answer is possible)

Activity type	For how long have you engaged in this activity	Activity type	For how long have you engaged in this activity
A. bee keeping		B. construction work (masonry)	
C. poultry production		D. construction work (stone and sand mining)	
E. Transporter (by pack animal and animal cart)		F. forestry activities (timber)	
G. On farm daily laborer		H. forestry activities (firewood collection)	
I. Migrate to work as on farm daily laborer		J. forestry activities (charcoal making and selling)	
K. Migrate to cultivate own crop		L. handicraft(basket or mat making)	
M. Preparing local beverage and food for sale		N. handicraft (pottery)	
O. petty trade (consumer goods)		P. Handicraft(blacksmith)	
Q. livestock trader		R. Handicraft(tailor)	
S. crop trader		T. handicraft(weaver)	
U. casual(construction daily laborer)		V. 25. government employed	
W. construction work carpenter			

I. Income of household

33. What is the income earned by the household from the following different sources?

Source of income	**Does the farm/household earn income from the following activities (1=Yes, 0=no)**	**Monthly income**	**Earning in birr per year**
Income from pepper sales			
Income from maize sales			
Income from wheat sales			
Income from other crop produce sales			
Income from migration crop sales			
Income from livestock sales			
Income from agricultural wage labor			
Income from migration wage labor			
Income earned from pension			
Income from regular employment salary			
Income from construction work(daily laborer)			
Income from construction work (carpenter)			
Income from construction work (masonry)			
Income from construction work (stone and sand mining)			
Income from metal work			
Income from charcoal making and selling			
Income from timber making and selling			
Income from fire wood collection and selling			
Income from basket or mat making			

Income from black smith			
Income from weaving			
Income from tailoring			
Income from pottery			
Income from egg selling			
Income from honey selling			
Income from *Khat*			
Income earned from petty trading (small scale business or consumer goods)			
Income earned from house rents			
Income earned from business (large scale)			
Income earned from domestic remittance			
Income earned from foreign remittance			
Income from transport service provision			
Other (specify)			

J. Poverty (wellbeing)

a. Basic needs

34. Have you experienced food shortage? 1. Yes 2. No
35. How many months you faced food shortage in the last hungry season?
36. How many times do you meal per day during a hungry months/season? (Adult meal)
37. How many times you bought cloth for adult household members for the last three years?
38. How many times you bought cloth for your children for the last three years?
39. How many times you bought shoes for adults for the last three years?
40. How many times you bought shoes for your children for the last three years?
41. What type of toilet do you use? 1. Open or bush 2. Pit latrine without slab 3. Pit latrine with slab 4. Cemented toilet 5. Other (specify)
42. What is the major source of the household drinking water?(select one)

1	Surface water (river, lake, dam, pond, stream, cannel)	4	Protected dug well	7	Tube well/Borehole
2	Unprotected dug well	5	Protected spring	8	Public tap

3	Unprotected spring	6	Rain water	9	Piped water

43. How many minutes it take for round trip (minutes)?
44. Are you or member of your household faced serious illness in the last 12 months? 1. Yes 2. No
45. Have you or household member have got medical treatment? 1. Yes 2. No
46. If yes, where have you got medical treatment 1? Private clinic 2. Public clinic
47. How many distance the health center far from (km)

b. Access to physical capital

48. Do you have your own house? 1. Yes 2. No
49. What type of roofing material used in the construction of main house? 1. Grass 2. Corrugated iron sheet 3. Other(specify)
50. What type of flooring material does the main house constructed from? 1. Dirt 2. Sand 3. Cement 4. Wood 4. Other(specify)
51. What is the source of energy to light your house? 1. Kerosene 2. Solar energy 3. Electricity 4. Battery powered light 6. If other(specify)
52. How many number of a house in the nearby town do you have?
53. What is the source of energy for cooking? 1. Firewood 2. Charcoal 3. Electricity 4. Biogas 5. Cow dung 6. Other(specify)

c. Access to social capital

54. Do you have access to remittance from your relatives in the last year? 1. Yes 2. No
55. Have you got cash credit from informal sources (neighbor, relative) in the past year? 1. Yes 2. No
56. How many number of religious or saint's group (mahiber) do you have?
57. Do you participate in equib in the last year?
58. In how many number of reciprocal/ exchange work group (wonfel) you participate in the past year?

d. Access to financial capital

59. Do you have saving book account in any financial institution? 1. Yes 2. No
60. If yes, could you tell me the amount?
61. Do you have equib? 1. Yes 2. No
62. The total capital of equib per year per household?
63. Have you got cash credit from formal institutions in the last one year? 1. Yes 2. No
64. Have you got credit in the form of cash from informal sources? 1. Yes 2. No
65. Have you got cash in the form of remittance from different sources? 1. Yes 2. No
66. If yes, how many birr do you get in the last year?

K. Access to support services

67. Did you borrow money in the last crop production year? 1). Yes 0). No
68. If yes, what was your source of credit?
    1. Savings and credit institutions 2. Commercial/ developmental banks
    3. Informal creditors 4. Unions/coops 5. If other, please specify_____
69. If your source of credit is formal sector, how much money did you borrow in the last years? _____birr
70. If you didn't borrow from formal credit institute, why?
    1. High interest rate 2. I don't want 3. Collateral requirement
    4. Availability of other alternatives 5. If other, please specify _____

71. If your source of credit is informal sector, how much money did you borrow in the last two years? _____birr
72. What is the interest rate of the money you borrowed from informal source per month?
73. Do you think borrowing helps to expand and intensify cash crop production? 1). Yes 0). No
74. Do you have access to crop production extension service? 1. Yes 0. No
75. If yes, how many times the extension agent contact you per month/year related to crop production? _____
76. What kind of crop related extension service is being provided by the extension agents?
    1. Training food crop production 2. Training on cash crop production
    3. input supply 4. Marketing 5. Storage management practices

L. MDP

77. Is there any school aged child who is not attending or drop out school up to class 8? 1. Yes 2. No
78. Anthropometric measures

No	Less than five years (less than 72 months)	Sex	Age	Weight	Height	Edema(yes, no)	MUAC(middle upper arm circumference of the left arm)
1							
2							
3							
4							

79. Is there any child died in the last five years? 1. Yes 2. No

Thank you very much for your cooperation