DETERMINANTS OF AGRICULTURAL PRODUCTIVITY OF HOUSEHOLDS IN JIMMA ZONE

A Research Thesis Submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science (Economic Policy Analysis)

BY:

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DECLARATION

I hereby declare that the research thesis entitled *"Determinants of Agricultural Productivity of Households in Jimma Zone*" has been carried out by me under the guidance and supervision of Dr. Wondaferahu Mulugeta and Mr. Endeg Tekalegn.

The thesis is original and has not been submitted for the award of any degree or diploma to any university or institution.

Signature: _____ June 27, 2018

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CERTIFICATE

This is to certify that the thesis entitled *"Determinants of Agricultural Productivity of Households in Jimma Zone*" submitted to Jimma University for the award of the Degree of Master of Science in Economics (Economic Policy Analysis) and is a record of bonafide research work carried out by Mr. Boahen Okyere, under the guidance and supervision.

Therefore, I declare that no part of this thesis has been submitted to any university or institution for the award of any degree or diploma.

Main Advisor's Name	Signature	Date
Dr. Wondaferahu Mulugeta	_____	_____
Co-Advisor's Name	Signature	Date
Mr. Endeg Tekalegn	_____	_____

DEDICATION

I dedicate this research work to my family, The Okyere family.

ACKNOWLEDGMENT

First and foremost, I am exceptionally grateful to God for his mercy and for his momentous determination in my life as well.

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Table of Contents

Content **Pages**

LIST OF TABLES AND FIGURES

LIST OF ACRONYMS

ADLI …… Agricultural Development Led Industrialization

AgSS ……. Annual Agricultural Sample Survey

CGE …….. Computable General Equilibrium

CSA …….. Central Statistical Agency

EA ……..….Enumeration Area

EAP …… Economic Active Person

ERSS ……..Ethiopian Rural Socio-economic Survey

FGLS ……..… Feasible General Least Square

IFAD ……..…International Fund for Agricultural Development

Kg/ Km.…… Kilograms / Kilometers

MoARD …….…… Ministry of Agricultural and Rural Development

MoFED ……..…. Ministry of Finance and Economic Development

NBE …… National Bank of Ethiopia

NGOs…….. Non- Governmental Organizations

OECD …… Organization for Economic Co-operation and Development

OLS ……..…… Ordinary Least Square

PFP ……..…….. Partial Factor Productivity

PIF ……..…….. Policy Implementation Framework

PSU ……..…… Primary Sampling Units

SLF ……..……. Sustainable Livelihoods Framework

TFP ……..……. Total Factor Productivity

TLU…….. Tropical Livestock Unit

VIF…….. Variance Inflation Factor

WB ……...……. The World Bank

ABSTRACT

This research thesis aimed at investigating the determinants of agricultural productivity of rural households in Jimma zone. The study applied various methods of analysis including descriptive statistical tools and econometric model to achieve the specific objectives. Multiple linear regression model (ordinary least square estimation technique) was employed to investigate the determinants of agricultural productivity. On the other hand, Ethiopian Rural Household Socio-economic Survey of 2013/14 data collected by Central Statistical Agency (CSA) of Ethiopia in collaboration with the World Bank as the main sources of the secondary data.

The econometric result shows that sex, age, education, family size, land, farm experience and credit access are significantly and positively affect agricultural productivity of sampled households. However, fertilizer application negatively and insignificantly affects agricultural productivity. Sex of the household head was the main socio-economic factor for the variation of income among the rural households. The primary data for the research contains two parts namely agriculture, and households' diverse socioeconomic characteristics. The study was concluded that family size, land size and credit access being the most persuasive factors of production and rural household income enhancement. The policy implications of the study To design and implement appropriate strategy that eases the burden of local farmers' dependence

on limited physical agricultural inputs to encourage agricultural productivity. The government should encourage land renting to continue more preferable than land sharing because the farmer is more beneficial from the long-term perspective.

Key words: Labor productivity, Land productivity, Rural Household income, Econometric Model, Ordinary Least Square Model.

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background of the study

One of the Sub-Saharan African countries, Ethiopia, liberalized its economy to maintain in all sectors for a sustained economic growth and reduce poverty. Over the last decade, the sustainable economic growth brought with it positive trends in reducing poverty in rural and urban areas: while in 2004/05, 38.7% of Ethiopians lived in absolute poverty. However, five years later this declined to 29.6% in 2010/11. Moreover, poverty is more prevalent in rural (30.4 per cent) than urban areas (25.7 per cent) in Ethiopia (MOFED, 2012; CSA, 2010/11). The government statistics shows that 29.6 per cent of the total population of the country lives below the national poverty line. Other studies also confirm that poverty disproportionately affects people in the rural areas (IFAD, 2001; World Bank, 2008). In Ethiopia, about 83.9 % of the total population lives in rural areas and agriculture is the main source of their livelihood. Since 2010, Agriculture became the second most dominant next to service sector of the country's economy, by providing employment for 80% of the total labors force and contributes 42.7 % to Gross Domestic Product and 70 percent of foreign exchange earnings (NBE, 2013; CSA, 2013).

Due to the significant contribution of agriculture, the government of Ethiopia gives high priority to the agriculture sector by setting a strategy of Agricultural Development Led Industrialization (ADLI). The main goal of the agricultural policy is not only achieving the sustainable increase in agricultural production and productivity of small holder farmers but also accelerate agricultural commercialization and agro industrial development in the country (PIF, 2010-2020). Agricultural productivity can be increased by using two ways. The first method is through improvement in

technology given some level of input and the other option of improving productivity is to enhance the output per household labor ratio of rural household farmers, given fixed level of inputs and technology. This study was mainly concerned about the second option of increasing productivity i.e. output per labor input and output per cultivated area of land.

Despite the fact that, the agricultural sector is mostly susceptible in seasonal rain fall, the rural households are generating their family income from different sources to antagonistic the risk associated in agricultural farm sector. Agriculture is the primary source of rural income for households as 80 percent of the rural labor force is engaged in this sector (CSA, 2013). Non-farm income of the rural households referred to an income that the rural households generate from none of the crop or livestock production during a year of agriculture production period. Non-agricultural activities are not getting prevalence in Jimma due to the fact that households are dominated by a subsistence agriculture sector. As a result of this, the income from non-farm activities was very low.

Furthermore, the empirical evidence about the extent and pathways through which gains in agricultural productivity of households in Jimma zone are not very well documented in the country. Other studies (for example, Geda *et al.*, 2009) used econometrics analysis to examine the linkages between agricultural productivity and poverty in Ethiopia. However, these studies use a static framework and did not assess the extent to which the impact of agricultural productivity affects the impact of moving in and out of poverty.

The subsistence agriculture of rural household was socially and economically unsteady to the rural society. Therefore, it was very significant to identify the determinants that affect agricultural productivity and find the methods of the rural household farm improvements.

1.2. STATEMENTS OF THE PROBLEM

Important resources are being utilized by the Ethiopian government to improve the agricultural productivity and rural household income to alter the state of agriculture in the country. Material resources and human capitals are allocated towards this end. Extension workers, packages or programs, and agricultural inputs are some of the resources that are made available to farmers to change their style of farming and augment productivity (CSA**,** 2013)**.** Despite of all these efforts of the government, the agricultural productivity and farm household income is still very low in Jimma zones. The major reason behind is mainly the backwardness of the agricultural sector. Using farm technology is enormous for rural households of Ethiopia as land productivity, traditional tools, draft animals and family labor are still the most important factors of production (Beyene, 2004).

Actually, the important question to raise for agricultural policy makers will be, whether the agricultural sector can be made more productive, by achieving more output with the current input level, or achieving the current output with less input usage than is currently observed in Ethiopia. An important step in answering this question is to identify the determinants of productivity enhancement and its components. Significant share (about 98 percent) of Ethiopia's agricultural output comes from small-scale farm households, but subsistence farmers are still operating under traditional practices. This has limited total production that would have been produced in the country if the productivity of the small scale farmers were enhanced either by improving their production capacity or by using modern technologies or a combination of both.

Even though there have been a positive incremental trends of rural households agricultural production in the last decades in the country, seasonality of farming activity results in unemployment and underemployment for a significant proportion of the rural labor force during

most part of the production year. Actually, the 2013 national labor force survey indicated that the level of unemployment in rural area is only 2% but this figure doesn't include the underemployment rate, CSA, (2013). But practically the rural farm activity in Ethiopia is not worked the full year rather the crop season. This compiled with other economic and natural factors aggravates the problem of the rural household income in the country. Rural households are usually engaged in both agriculture and non-agricultural activities to averse the risk associated with their family income. Some households might depend exclusively on crop farming for their livelihoods and some households might employ wage in the subsistence agricultural sector or other sectors elsewhere.

In Ethiopian rural households until recent years, the income from non-agricultural sector has not been well known in magnitude. Few empirical studies have indicated that the contribution of non-agricultural sector to total households income with sharing range of 18.7% to 59.5% in rural areas (Delil, 2001; Tassew, 2000). Most of these studies focus on identifying determinants of occupational diversification, household participation in off farm wage employment and off farm self-employment or both. Few of them are trying to show the factors that determine the choice of household between off farm self and wage employment e.g. Tassew (2000) and the role of nonfarm activities on poverty alleviation, farm output growth, and the effect of specific source of income on rural income diversification.

In developing countries, like Ethiopia, where income from farm activities varies considerably, farm households usually participate in non-agricultural activities to supplement their agricultural income (Beyene, 2008). Hence, income from non-agricultural activity is also expected to enhance household's production and productivity in farming activity. However, it is not known to what extent households with non-agricultural income are better off than those with agricultural

activity income and whether there exists variability in the level of technical efficiency among the two groups of households in Ethiopia. Rural Farm household income is also often determined by a range of socio-economic and demographic factors. Knowledge of such factors has to be assembled carefully to determine their levels of influence on the change of household income.

However, many rural households' incomes are simultaneously the combination of their livelihood-agriculture with either wage employment, off farm business or both. Consequently, the majorities of the rural households of Ethiopia are combining their livelihood agriculture outputs through their family labor and land productivity enhancing with the non-agriculture income, pare rally at the same time to enhancing their total family income.

Most of the previous studies have failed to consider which agricultural productivity (land or labor) are the most determinants of the agricultural farm productivity and rural household income at regional or district or zonal administrative level. Some of them are focused on national level.

Beside these, all are focused on the total factor productivity which is not appropriate enough to measure the wealth and living standards of the household since it relates to an index of output to a composite index of all inputs. In studies of long-term growth, many analysts focus on TFP as the preeminent measure of productivity. TFP growth is commonly associated with innovation and technological change. Empirically, growth accounting exercise attribute 50 to 70 percent of cross-country per-capita income level differences to differences in TFP (Hseish and Klenow, 2010). However, TFP is subject to many challenges in terms of both theoretical interpretation and empirical measurement; others are focusing on the income diversification. Therefore, this study filled the gap and considers the partial factor productivity measurement to be identified through which agricultural productivity indicators and the rural household agricultural

productivity adversely changes in Jimma zone. The partial factor productivity measures relates output to a single input; for example, labour productivity (output per hour of worked), capital productivity (output per unit of capital), and energy productivity (output per joule of energy used).

1.3 OBJECTIVE OF THE STUDY

1.3.1 General objective

The main objective of the study was to examine the determinants of Agricultural productivity of household in Jimma Zone. Therefore this study focused on Limu and Gomma Woreda.

1.3.2 Specific objectives

This research paper addressed the following specific objectives:

- To determine the agricultural farm productivity for the resource ownership of household heads
- To analysis demographic and socio-economic profile of households in the study area
- To examine socioeconomic factors which can best be the predictor for the variation in agricultural productivity among rural households

1.4. RESEARCH QUESTIONS

This study attempts to answer the following four basic questions derived from its objectives.

- What factors determine the agricultural farm productivity output per unit of labor input and output per unit of cultivated area of land?
- What are the demographic and socio-economic profile of households in the study area
- Are there socioeconomic factors that explain the variation in production among the rural households? If yes, what are they?

- What are the possible policy implications based on the research findings?

1.5 SCOPE AND LIMITATIONS OF THE STUDY

1.5.1 Scope of the study

The major focus of this study was to investigate the factors affecting agricultural productivity of households' in Jimma Zone, South West of Ethiopia. Related issues such the concepts, measurement and factors driving Agricultural Productivity, model for Rural Household Income and its Measurements were part of the study. The research areas selected for the survey study were Limu and Gomma, all in Woreda which are part of the Zones of the region. The agricultural production at the regional level was also critically reviewed from secondary sources. The themes reviewed included crop production and livestock production with respect to Sex household heads at the regional level.

1.5.2 Limitation of the study

Lack of organized and adequate historical data at the regional level was one of the limiting factors in this study. This emanates from the poor record handling and lack of willingness of some of the offices to provide the relevant documents. In addition, the available agricultural production related data was highly exaggerated compared to the sources at national level. This was a challenge for addressing research objectives which depended on the secondary data of the region. The Central Statistics Agency (CSA) of Ethiopia is an institution of relatively high capability which provides reliable statistics for all regions of the country. However, the CSA does not have compiled data on the agricultural production and house hold income at zonal level. As a result, the data from the zonal level was collected through primary data sources.

1.6. SIGNIFICANCE OF THE STUDY

The motive behind the low level of rural households' income and agricultural productivity as well as unable to attract investment opportunity is considered to be inadequate economic development in most developing countries. But several attempts have been made in Ethiopia through, capital inflow like improved farm tools as well as the supply of financial means through group lending methodology by financial institutions to enhance the rural agricultural productivity and their household income. The significant agricultural sector productivity growth of the world mainly comes from the technological enhancements. This has been proved in most Asian countries but countries like Ethiopia, where the agriculture is the main livelihood in rural areas, technology is unusual to enhancing agricultural productivity. As the main income source of the rural household is highly prone on this sector, the overall rural household income is dependent on the success or the failure of agricultural productivity. Therefore identifying the determinants of agricultural productivity and rural household income is very important.

It is also very significant for all stakeholders involve in agricultural productivity development to be aware and understand the factors affecting agricultural productivity to increase the rural household income. It is essential for policy makers to know the critical factors that could accelerate the agricultural productivity and rural household income in the country's rural areas. Also, it makes it easier to facilitate the necessary resource allocation for the rural household income research work, extension service and other rural household income development programs. Therefore, the finding of this paper was significant in identifying the factors affecting the agricultural productivity and equally important in determining the rural household income in Jimma zone.

1.7 STRUCTURE OF THE THESIS

The thesis consists of five chapters as indicated below:

Chapter 1: presents the introductory part which includes sections such as background, problem statement, objectives, research questions, limitations and scope, significance and structure of the study.

Chapter 2: presents the literature review the concepts, measurement and factors driving agricultural productivity, the concepts and theories of rural household income measurements, the role of agriculture productivity in rural Ethiopia.

Chapter 3: deals with the methodology which include source and type of data used, research approach, sampling method, analytical tools and model specification.

Chapter 4: Estimation and analysis of results

Chapter 5: presents concluding remarks, recommendations and policy implications of the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Historically, few issues have attracted the attention of economists as has the role of agriculture in economic development and poverty reduction, generating an enormous literature of both theoretical and empirical studies. Much of this literature focuses on the process of structural transformation of economies, from the least developed in which economic activity is based largely on agriculture, to high-income countries where industry and services sectors dominate.

Agricultural productivity is a key driver for the well-being of the farmers, the agro-based industry and mankind at large. It is linked to food security, prices, and poverty alleviation in the developing countries (Darku & Malla, 2010). Moreover, food supplies have to be geared to meet the challenges of increasing global population, changes in income, and the resultant changes in diet (Bruinsma, 2009). Hence, research on agricultural productivity is of paramount importance.

2.2. THEORETICAL LITERATURE

2.2.1. The concepts, measurement and factors driving Agricultural Productivity

Agricultural productivity is refers as the output produced by a given level of input(s) in the agricultural sector of a given economy (Fulginiti and Perrin 1998). More specifically, it can be defined as “the ratio of the value of total farm outputs to the value of total inputs used in farm production” (Olayide and Heady 1982). However, agricultural productivity can be measured by partial productivity or total factor productivity measures depending on the number of inputs under consideration.

Productivity is a measure of how efficiently inputs are combined to produce outputs. Productivity growth reflects increases in the efficiency of production processes over time and is an important mechanism by which material living standards in an economy are improved. This is because productivity growth is the only way to grow aggregate income without also using up additional physical inputs (Productivity Commission 2008). Productivity growth in the agriculture sector is also important for maintaining the international competitiveness of domestic agricultural industries (Productivity Commission 2005). Productivity and the 'terms of trade' (which is a measure of the relativity between the prices for farm outputs and inputs) are the twin determinants of farm profitability. Farm operators generally cannot control changes in their terms of trade. Hence, productivity growth becomes the main mechanism through which producers can influence farm profits and their living standards.

Productivity is broadly measured as the ratio of a volume (or quantity) measure of output to a volume measure of inputs, and productivity growth measures the growth rate of outputs that is above and beyond the growth rate of inputs. Measures of productivity growth can be differentiated according to whether they are partial factor productivity (PFP) measures or total factor productivity (TFP) measures. PFP measures relate output growth to a single input such as capital or labour. For example, yield per hectare is a commonly used PFP measure in agriculture. TFP measures relate output to a bundle of inputs such as capital, labour, land and intermediate inputs (OECD 2001).

Total factor productivity is also defined as the ratio of an index of agricultural outputs to an index of agricultural inputs. The agricultural output index is a value-weighted sum of the whole components of agricultural production, whereas, the agricultural input index is the value-weighted sum of the whole conventional agricultural inputs such as fertilizer, land, labor,

machineries and livestock. However, it is difficult to aggregate variety of outputs and inputs into a single index to measure productivity (Ruttan 2002). This approach also overstates or understates productivity of inputs when input ratios change without a change in technology (Gebreeyesus 2006). Markets are also not well-functioning in the case of aggregating output and input. For example, if the market of land and labor are not well functioning, rental values and wage rates for hired labor cannot be measured with accuracy and hence TFP measure becomes intractable. This idea is supported by Kelly et al, (1995) and finds that TFP calculations in many areas of Africa is constrained by missing input prices (from missing markets), especially for land and manure and to a lesser extent for labor.

Regarding the methods of estimation the literature shows that: adjustments to the measures of variables affect the estimated productivity and different indexes used in the measurement of TFP could lead to different results. Also, the rate of technical change differs based on the estimation method used (e.g., indexing method vs. conventional TFP measures).

As a result of these limitations, this study is considering the partial measure of agricultural productivity to address its objectives. Partial measures of agricultural productivity are the amount of output per unit of a particular input (Diewert and Nakamura, 2005). It is commonly used partial measures yield (output per unit of land), labor productivity (output per economically active person (EAP) or per agricultural person-hour). Yield is commonly used to evaluate the progress of new production practice or technology (Wiebe et al, 2003; Zepeda, 2001). And Labor productivity is mainly used for measuring as comparing the productivity of agricultural sectors within or across the rural households. It also used to measure the rural living standard or welfare indicator as it reflects the capacity to making income through sale of agricultural production. Partial measurement of productivity is a key element towards assessing standards of living. A

simple example is per capita income, probably the most the whole components of agricultural production, whereas, the agricultural input index is the value-weighted sum of the whole conventional agricultural inputs such as fertilizer, land, labor, machineries and livestock.

2.2.2 The Role of Agriculture Productivity in Rural Ethiopia

The Government of Ethiopia has made significant efforts in terms of public investments to speed up the growth of agriculture as a means of accelerating the economic transformation (MOFED, 2012). However, public investments did not achieve the intended objectives and rapid population growth may be dampening any investments made in the rural sector. Furthermore, the empirical evidence about the extent to which and pathways through which gains in agricultural productivity help reduce poverty at the household level are not very well documented in the country. For instance, Dorosh and Thurlow (2009) and Diao and Pratt (2005) studied the economy- wide effects of agricultural growth using Computable General Equilibrium (CGE) models. The main concern with the CGE models is that total factor productivity (TFP) growth is assumed to be exogenous. Thus, the models lack the scope to analyze the endogenous drivers of productivity growth. Moreover, the aggregate nature of the models does not allow examining the dynamics of poverty and productivity at household level.

2.2.3 The concepts and Theories of Rural Household Income Measurements

According to Chambers and Conway (1991) the conceptual framework for the rural household income measurement is drawn from the Sustainable livelihoods framework (SLF). In the SLF framework, assets, all activities, and their access, are altogether required for a means of living by an individual or a household to construct a livelihood. The framework shows how, in different contexts, sustainable livelihoods are achieved through access to a range of livelihood assets which are combined in the pursuit of different livelihood strategies to achieve certain livelihood outcomes such as increased incomes (Alinovi *et al.*, 2010). Households can access a range of assets or resources (physical, natural, economic, human and social capital) which they can use to engage in farm or non-farm activities or both (Scoones, 1998). The decision of rural households to participate in nonfarm activities is influenced by individual or household specific factors, as well as other social, economic and environmental factors (Barrett, Reardon and Webb 2001; Escobal 2001; Lay et al. 2008; Idowu et al. 2011; etc).

Various social relations, institutions, organizations, policies, as well as trends, shocks and seasonality modify access to and ability to convert livelihood assets into livelihood outcomes (Vedeld *et al.*, 2012). As regards seasonality; in the dry season, especially in semi-arid regions some rural households obtain remittances from seasonal migrants, incomes from local nonfarm activities and, cash from the sale of crop and livestock products (Reardon 1997; Ellis 1993). While some farm households can also allocate part of their labor during the rainy season where nonfarm labor pays better than farming and where farm households can count on food markets to buy food (Reardon 1997). However, the rural household income could be measured using Ordinary least square (OLS), feasible generalized least square (FGLS) and two stage least square (2SLS) measurement technique.

2.2.4. Measuring the theoretical model for analyzing Agricultural Productivity and Rural household income

Agricultural productivity is a crucial factor in production performance of agricultural output in one nation. Increasing national agricultural productivity could raise the living

standards and wealth of rural households, because more real income improves people's ability to purchase goods and services, enjoy leisure, improve housing and education and contribute to social and environmental programs. By considering of its importance, measuring agriculture productivity will clearly shows the level of incomes of the rural household those who are engaged in agricultural activity. Agricultural productivity most commonly estimated using parametric and the non-parametric approach. In the parametric approach, the coefficients of the production function are estimated statistically using econometric approach whereas, in the non-parametric approach by using the mathematical programming approach. It is the parametric approach commonly used in the estimation of production functions while the non-parametric approach used in efficiency analysis (Coelli et al., 1998). This study is considering the parametric approach to estimate the agricultural productivity function. Because the econometric approach has the advantage of being statistical, hence permitting hypothesis testing and calculation of confidence intervals to test the reliability of the model estimated. This approach explicitly measures the marginal contribution of each category of inputs to aggregate agricultural output. If a flexible functional form is chosen, a further advantage is that fewer restrictive assumptions about technology are imposed; the flexible functional form provides a second order approximation to a general function (Antle and Capalbo, 1988). The major limitation of the econometric approach is that it requires more data than the other approaches.

As Singh and Dhillion, (2000) stated that agricultural productivity is frequently associated with the attitude towards work, thrift, industriousness and aspirations for a high standard of living, etc. Hussain, (1976), also developed a technique of how to measure agricultural productivity of farm households. He converted all the agricultural production into its monetary values of a regional unit in production. For the analysis of agricultural productivity, the Cobb-Douglas production function found to be theoretically and empirically more apparently reasonable, since it is easy to estimate and mathematically manipulate and possible to test the significance of the estimated elasticity using standard test statistics such as t–ratios and f-ratios. However, according to Coelli et al. (1998) it has also many restrictive properties imposed on the production structure like fixed returns to scale and elasticity of substitution always equal to unity.

Therefore, by following Nigussie and Mulat (2003), the Cobb-Douglas production function can be specified as:

$$\boldsymbol{Y = F(X, E)}$$

Where: **Y**= Yield response

X= a vector of technological inputs like fertilizer, pesticide and others

E= vectors of physical inputs such as sex, age, level of household head education, farm size, household size, and others.

Therefore, the Cobb-Douglas production function can be expressed as:

$$\boldsymbol{Y_{i=}\pi(X_{ij}^{\beta j}E_{ij}^{\delta j})e^{\alpha+\varepsilon i}}$$

Where: $\mathbf{Y_i}$ = yield response of the ith Area of land

$\mathbf{X_{ij}}$ = the use of the ith Area of the jth technological input

$\mathbf{E_{ij}}$ = the use of the ith Area of the jth physical input

For all the above production functions, Y is the output produced and X's are the inputs used in the production process.

2.2.5. Analyzing the Theoretical Model for Rural Household Income and its Measurements

Theoretical analysis of household income revealed that rural income is mainly derived from farm and non-farm sources. Farm and non-farm variables played a vital role in rural household economy. All variables had their own effects, either increasing or decreasing effect. In this part the study tries to investigate the determinants of income to explore the basic sources of welfare of rural households. It also examined what characteristics of rural households were associated with their real income. It used econometric models and the ordinary least square (OLS) regression estimation technique to establish relationships between income and various household characteristics. It considered both economic and non-economic characteristics of rural households to identify determinants of household income.

The economic characteristics include land size owned by individual households, and income shares from agriculture, wage-salary, business-commerce, gift-remittance assistance and income from other sources. The non-economic characteristics include household size, household type, household head's age, Sex and educational status. One important dummy variable will be used to capture the effects of credit constraint on the specific household income. These variables included whether the household has credit constraints or not. This implies that a borrower household who needs a desire for more credit and non-borrowers who responded that they couldn't obtain credit will assumed as credit constraint.

The study constructed regression models as defined and used by Dercon (2006), and Isik-Dikmelik (2006). The model for estimation is as follows:

$$\boldsymbol{log}\left(\boldsymbol{y_{h,t}}\right) = \mu_{\boldsymbol{h}} + \boldsymbol{\Psi X_{h,t}} + \boldsymbol{\varepsilon_{ht}}$$

Where, $\boldsymbol{log}\left(\boldsymbol{y_{h,t}}\right)$ = the dependent variable, is the income (logarithm) of the rural households;

$\mu_{\boldsymbol{h}}$ = the intercept of the regression line;

$\boldsymbol{\Psi X_{h,t}}$ = the explanatory variables which influence Household income, Productivity & non-farm income etc.

$\boldsymbol{\varepsilon_{ht}}$ = the error terms.

$\boldsymbol{\mu}$ and $\boldsymbol{\Psi}$ = are called the parameters, also known as regression coefficients

This model could be extended by separating household economic and non-economic characteristics (endowments).

2.3. EMPIRICAL LITERATURE

2.3.1. Measurement of Labor in Agriculture

Potential measurement of labor in agriculture is another key concern. This is due to the fact that agriculture in poor countries falls largely into the informal sector; there are not detailed data on employment of the kind that might be found in the formal manufacturing sector. There are unlikely to be payroll records or human resources documentation. Most workers in the agricultural sector are unpaid family members and own-account workers, rather than employees. For example, in Ethiopia 2005, 97.7 percent of the economically active population in agriculture consisted of "own-account workers" and "contributing family workers," according to national labor force survey made available through the International Labour Organization. A similar data set for Madagascar in 2003 put the same figure at 94.6 percent. Many workers in services and even in manufacturing are effectively self-employed, and labor economists often argue that informal non-agricultural activities represent a form of disguised unemployment in poor countries, with low hours worked. To return to the Ethiopian data, in 2005, 88.4 percent of the

non-agricultural labor force consisted of own-account workers and family labor. Thus, the predominance of self-employment and family business holds across sectors. If there are important differences in hours worked across sectors, we cannot simply assume that this results from differences in the structure of employment (Vollrath 2010; FAO, 1996)

2.3.2. Agricultural productivity and rural household income in Ethiopia

The determinants of agricultural productivity in particular country are different and distinctive from others. This section would refer to some studies indicating the determinants of agricultural productivity and rural household income in Ethiopia. By using a cross-sectional data, a study conducted in Walaita and Gemugofa zones of South nation, nationalities and people of Ethiopia for assessing productivity and technical efficiency of smallholder farmers, shows that, there was significant level of productivity improvement among maize producing farmers (Geta *et al.*, 2013). Two stage estimation technique, trans log production function were used to determine the levels of productivity and Tobit regression model to identify factors influencing technical efficiency. The model result depicted that productivity of maize was significantly influenced by the use of labor, fertilizer, and oxen power.

Another literature studies by Berg and Kumbi (2006) suggested that agriculture was the main source of rural income inequality in Oromia national states of Ethiopia. Their results showed that 90 percent of total inequality was due to farm source of income. On the other hand, nonfarm income was found to be inequality decreasing source of rural income.

As Adugna (2002) identifying the determinants of household income in rural households of Ethiopia indicates that, the household demographic characteristics like family size, educational status of the household head and sex of the household head is determining the income of the household to enhancing or to lowering.

Another study made by Endale, (2011) by using the panel data of cereal crops and translog estimation technique followed by FGLS for the fixed effect estimation, founds that the land size and family labors are significant for agricultural productivity in the study area of four regional state of Ethiopia.

Studies conducted by Gebru and Holden (2013) stated that, for the aim of investigating productivity difference among land certificate owner and non-owner in Tigray Regional state of Ethiopia by using DEA based on malmquist productivity index, founds that on aggregate farmers those who are not owned the land certificate are less productive than those who are already owned the land certificate. The study also found no evidence to suggest that, the agricultural productivity difference between the two groups is due to difference in technical efficiency.

2.3.3. Factors affecting agricultural production and farm income

The comprehensive agricultural support policies by government or donors such as fertilizer subsidies, credit subsidies, fixed prices, floor prices and public irrigation schemes, were the main features of the Asian Green Revolution of the 1970s (Bahiigwa, Mdoe,& Ellis, 2005, p. 119). Bahiigwa et al. (2005) further indicated that it was challenging to replicate the Asian Green Revolution in Africa because the Structural Adjustment Program (SAP) of the 1980s and 1990s eliminated the agricultural support policies enjoyed by Asian countries. The Structural Adjustment Program, with the emergence of neo-liberal conservative ideologies, reduced the government sponsored agricultural support (Markelova, Meinzen-Dick, Hellin, & Dohrn, 2008, p. 1).One of the aims of the program is for governments to reduce external and internal deficits by restricting money and credit growth (Weissman, 1990, p. 1622). As a result, it became difficult for many farmers to get access to services (Markelova, Meinzen-Dick, Hellin, & Dohrn, 2008, p. 1; Benson, & Jafry, 2013, p. 382).

2.3.3.1 Household characteristics of farm operators

The household characteristics consist of many variables that affect the agricultural production of farm operators. Some of these variables are: age, gender, education level, family size, landholding size and possession of oxen, as reviewed below.

- ***Education and agricultural production***

Research findings have indicated the importance of education in agricultural production and income. For example, Asfaw & Admassie (2004) reported that the conventional factor of production such as growth of stock of capital and labour were unable to explain fully the growth in national income. The contribution of education to the growth of national income was recognized in the 1960s. To achieve agricultural development, the investment in production techniques and technology should be supported by a comparable investment in human capital (Bingen et al., 2003). This is because information and knowledge are prerequisites for farmers to adopt technology, access input, change ways of doing things and market their produce (Chowa, Garforth, & Cardey, 2013).

- ***Gender and Agricultural Production***

Gender refers to socially constructed roles and relationships of women and men in a given culture or location (Adeoti, Cofie, & Oladele, 2012). In enhancing agricultural production and income, the full participation of men and women is very important. Women tend to be the major players in the farm labour force engaged in production, harvesting and processing activities (Jafry, & Sulaiman, 2013). It is also known that the majority of food is produced by women farmers and they are responsible for fulfilling the basic needs of the family (Camara, Diakite, Gerson, & Wang, 2011). Studies have also indicated that women farmers are more environmentally conscious compared to men farmers (Burton, 2013). Nevertheless, there are

research findings that indicate the existence of gender inequalities in the agricultural sector. For instance, there is categorization of some crops to be "men's crops" and others as "women's crops" (Mohammed, & Abdulquadri, 2011). A study conducted in Ghana by Adeoti et al. (2012) indicated that vegetable production demanded more physical strength and was dominated by men. On the other hand, de Brauw, Li, Liu, Rozelle and Zhang (2008) revealed that, in China, the contribution of women to livestock production was 64 per cent while 59 per cent of the marketing work was dominated by men. They noted that this is labour feminization and that the earnings are controlled by their male counterparts. In Ethiopia, gender differences in economic production remain a challenge with the majority of women still facing discrimination. However, the revised Family Law of Ethiopia has improved the rights of women to manage common marital property along with their husbands (Hallward-Driemeier, & Gajigo, 2013).

- ***Age, family size, landholding size and agricultural production***

Agricultural production is influenced by other household characteristics such as the farm operator's age, family size and landholding size. The age of the household head is a proxy variable for the farming experience of farm operators. Farmers are highly dependent on their previous knowledge of farm practices in cultivating different crops (Adomi, Ogbomo, & Inoni, 2003). Hence, experienced farmers are expected to enhance the productivity of their holdings. However, it is not without limit as older farmers lack the required physical strength on the farm and lowers the probability of technology adoption (Moussa, Otoo, Fulton, & Lowenberg-DeBoer, 2011, p. 363; Burton, 2013, p. 23). Land is the most critical natural resource for countries like Ethiopia where the agricultural sector is the engine of the national economy (Amsalu, Stroosnijder, & de Graaff, 2006, p. 448). Farm operators with larger landholding sizes would have a better farm income if sufficient family labour was available. This leads to an

increased demand for children who can work on the land (Hedican, 2006, p. 324; Kim, &Park, 2009, p. 278). It is not possible to expand the landholding size without matching it with an increase in the size of the household. Hence, households with larger families face a challenge to feed each of the family members and this will have its own negative effect on the nutritional status of the family (Olayemi, 2012, p. 137).

- ***Possession of oxen and agricultural production/ income***

Historically, for thousands of years, oxen have been recognized as the first draft animals to serve human beings, to cultivate land and pull heavy loads (Bryant, 2010, p. 360).The possession of oxen determines the farming ability of farm operators because if farmers do not have oxen they would be obliged to rent out their land to other farmers (Holden et al., 2004, p. 375). In this case, farmers would enter into sharecropping. This further diminishes the production and income of the household as the yield is shared with oxen owners. There are advantages associated with owning oxen. Oxen owners can cultivate and sow their land at the right time. This has a positive impact on the productivity of land. In addition, oxen could also be rented out on a daily payment basis to till the land for other households. Therefore, they may serve as a source of additional income for the owners.

2.3.4 Agricultural production technologies

Agricultural production technologies include biological and chemical technologies. Specifically, these technologies include chemical fertilizers, selected seeds or High Yielding Varieties, irrigation and soil quality enhancing technologies. Farmers use these technologies in order to enhance the production and productivity of the land. It is also indicated that, for poor farmers, adoption of technology places new demands on their limited resource base (Kamruzzaman, & Takeya, 2008).

- ***Chemical fertilizer***

African governments have promoted the increasing use of agricultural inputs in their own countries inspired by the Asian Green Revolution which was brought about by using high-yielding seed and fertilizer technologies (Crawford, Kelley, Jayne, & Howard, 2003). In a similar vein, Aune & Bationo (2008) argued that the entry point for intensification is the use of organic and inorganic fertilizer in the Sahel because, if soil fertility is not improved, the use of other technologies such as high-yielding varieties will not have a significant impact.

Crawford et al. (2003) further indicated that the objectives of input promotion strategies have many features such as financial, economic, social and political objectives. The financial aspect of the input promotion strategy is to increase the net income of farmers, traders or other participants in the agricultural economy. The economic feature of input promotion strategy is also to increase the real income of the society as a whole. The social aspect of the input program is the improvement of welfare indicators that are difficult to measure in terms of monetary values. Some of the social objectives are to improve nutrition intake and national food self-sufficiency. The political objective of the input program arises because of the government intervention for the sake of equalization of benefits. Some programs may be designed intentionally to build political support; as a consequence, they may benefit one or more groups at the expense of others.

In the year 2012/13, the Bureau of Agriculture and Rural Development of the region revealed that the sales of chemical fertilizer, improved seeds and chemicals were intended to be fully paid for in cash (BoARD, 2012b). For instance, in the Sidama Zone of Ethiopia, 53 per cent of the farmers did not use chemical fertilizers because they did not have the money for them (Moges, & Holden, 2007). In the study conducted in Amhara region, Bewket (2011) farmers in Ethiopia

were unable to use chemical fertilizers to restore the fertility of land because of the high cost of chemical fertilizers and the lack of government subsidies to make them affordable.

- ***Irrigation facilities***

The poorest people who mainly depended on rain-fed agriculture for their livelihoods reside in Sub-Saharan Africa (Burney, & Naylor, 2011, p. 110). Burney and Naylor stated that crop yields in Sub-Saharan Africa were low and influenced by the variability of weather conditions in the area. The cropland which is irrigated accounted for only 3 per cent compared to 39 per cent in South Asia and China (de Janvry, 2010, p. 22). One of the lessons of the Asian Green Revolution was that repeated cultivation during a year and improved yield could be possible with the application of irrigation combined with fertilizer and improved crop varieties (Burney, &Naylor, 2011, p. 111). Water, as one of the major instruments of poverty alleviation, plays a significant role in food production, food security, hygiene, sanitation and environment (Hussain, & Hanjra, 2004, p. 3).The proper utilization and the reduction of wastage of water resources is critical. This is because the level of water consumption in agriculture is influenced by the efficiency of irrigation systems and cultivation methods used by farmers (Castro, & Heerink, 2010, p. 168). For instance, introducing a system of trading water can be a powerful incentive to reduce the amount of water used in agriculture once it has a value and can be sold by the rightful owners (de Janvry, 2010, p. 30).

- ***Crop rotation***

As declining soil fertility is a major challenge for Sub-Saharan Africa, farmers in Nigeria use shifting cultivations as a means of sustainable agriculture (Kintomo, Akintoye, & Alasiri, 2008, p. 1262). Crop rotation is a regularly recurrent succession of different crops on a given plot of land (Tulu, 2011, p. 57). It helps to ensure the required fertility and controls weeds, insects and

plant diseases through the appropriate application of crop orders (Knox, Leake, Walker, Edwards, & Watson, 2011, p. 176).Shifting cultivations are in contrast to continuous monoculture in which a single crop species repeatedly grows on the same plot for years (Nel, 2005, p. 274). Shifting cultivation or fallowing methods of improving soil quality are not indicated in situations where there is rapid population growth (de Rouw, & Rajot, 2004, p. 264; Kintomo et al., 2008, p. 1262).

- ***Intercropping***

Intercropping is another practice of cultivation used by farmers to improve soil quality and productivity. The aim of intercropping is to enhance the yield of farm land by using resources that cannot be used by a single crop (Kamruzzaman, & Takeya, 2008, p. 220). Intercropping is practiced by a large proportion of farmers in developing countries (Guvenc, & Yildirim, 2006, p. 30). While in western Kenya, intercropping with leguminous plants and fallow rotation has been applied to increase the fertility of the soil (Waithaka et al., 2007, p. 213), in developed countries monoculture has increased crop yield with a huge energy cost of production and operation of machinery, fertilizers and pesticides (Karlidag, &Yildirim, 2009, p. 107). This is because in developed countries intercropping was not suitable for mechanized farming and was abandoned (Guvenc, & Yildirim, 2006, p. 30).

Intercropping is becoming crucial for increasing crop productivity and fulfilling the food requirements of the world's growing population (Karlidag, & Yildirim, 2009, p. 108). The intercropping method has also contributed to the sustainability of agriculture (Guvenc, & Yildirim, 2006, p. 30; Karlidag, & Yildirim, 2009, p. 108). In addition, to ensure yield and quality in intercropping, the varieties that are considered to be complementary in the utilization of resources should be identified (Guvenc, & Yildirim, 2006, p. 31).

- ***Livestock ownership***

The zero-grazing approach is applied in all districts of the national regional state of Tigray. Previously, the special feeding treatment was given to plough oxen, milking cows and young stock but the other domestic animals were expected to find their feed roaming in the harvested crop fields (Edwards et al., 2010, p. 41).The free movement of animals in the field has resulted in environmental degradation, destroying plant seedlings and destroying physical structures constructed for soil and water conservation (Edwards et al., 2010, p. 41; Bewket, 2011, p. 56). The availability of feed resources and their nutritional qualities are the most critical factors that make a difference in the productivity of livestock (Tesfay, 2010, p. 4). In the study conducted in the Ethiopian highlands, Holden et al. (2004, p. 386) found that, in the past ten years, the reduction in fodder production as a result of land degradation led to the reduction of livestock assets.

- ***Farm experience***

Adomi, Ogbomo, and Inoni, (2003) in their works stated that farmers are highly dependent on their previous knowledge of farm practices in cultivating different crops. However, Moussa, Otoo, Fulton, & Lowenberg-DeBoer (2011) pointed out that experienced farmers are expected to enhance the productivity of their holdings.

- ***Market distance linkages***

Surplus producing areas co-exist with areas of deficit but farmers are unable to take advantage of the deficit markets because the markets are poorly coordinated (Alene et al., 2007, p. 318).When the market for agricultural inputs and outputs is poorly developed, this creates unfavourable relationships between input and output prices (Aune, & Bationo, 2008, p. 120).

- ***Credit markets/agricultural loans***

Agricultural credit is described as banking finance for primary production, processing and trade of agricultural products, and the production and distribution of inputs (Aggelopoulos, Mamalis, & Soutsas, 2011, p. 234). Poor farmers have very little chance to borrow from the formal sector because they rarely have collateral acceptable to banks. They may not have clear title deeds for the land they cultivate but even if they do, rural land markets may not function well enough for land to be considered a "bankable" asset (Kindness, & Gordon, 2001, p. 29). Smallholder farmers may have access to credit from Micro-credit institutes which do not have the collateral requirements. Micro-credit schemes are often associated with group lending where peer pressure is an effective substitute for collateral and group members may take action to prevent one member from defaulting (Kindness, &Gordon, 2001, p. 29). In line with this, Ellis (1992, p. 128) stated that input delivery should be combined with credit provision in order to reduce the working capital constraints to adopting new inputs for farm households.

2.4 REGIONAL PROFILE

The central statistical agency report at the region level indicated in Table 2.1 shows the total number of households involved in only crop production. On average a mean of 1.316 was recorded. With respect to only livestock production of the households who were involved in that sector was 1.436 on average. Also, on average a mean of 1.216 was recorded which indicates the households who were involved in both crop production and livestock farming. From the table below (Table 2.1), livestock farming are much involved in the agriculture production as compared to the crop production.

Table 2.1: Sex and Farm Type at Regional Level

	Summary of Sex	
Farm Type	**Mean**	**Std. Dev.**
Crop	1.3163265	.46623289
Livestock	1.4361949	.49648851
Both	1.2169214	.41222544
None	1.5671088	.49549892
Total	1.4929388	.49996788

Source: CSA, 2013/14

Table 2.2 below shows the regional level agricultural post planting of sex household heads and the farm type. For both crop and livestock production at the regional level the study found that the male household heads contribute more (3,870) as compared to the female counterparts (435). Moreover, non-contribution to crop and livestock production, the study reveals that the female household heads non participants are more (6,288). The study again shows that about 95% of agricultural household heads are coming from the rural part of the region. This is due to that fact that most agricultural activities are done in the rural sectors since the soil is fertile and there is no kind of hazardous pollution. One average the age of regional sampled respondents is 21 years. With the post planting process, on average 9.42kg of improved seeds were purchased on credit for the agricultural production by farmers and the total value of seed that was purchased on credit cost about 159 Birr. Transportation for carrying out the seed from the market to the farm site cost about 13 Birr. In all an average of 11.6kg of the improved seeds were used.

Table 2.2 Regional Level Agricultural Post Planting

Farm Type					
Sex	**Crop**	**Livestock**	**Both**	**None**	**Total**
Male	2477	1393	3,870	5,264	9,134
Female	291	144	435	6,288	6,723
Total	2768	1537	4,305	11552	15857

EA rural urban indicator	**Freq.**	**Percent**	
Small town	759	4.79	
Rural	15,098	95.21	
Variable	**Obs**	**Mean**	**Std. Dev.**
Age	15857	21.5397	18.33631
Improved seeds	**Obs**	**Mean**	**Std. Dev.**
Amount purchased on credit (kilo)	3690	9.421095	15.53742
Transportation cost	3308	12.62908	175.6579
Total value of seed purchased on credit (Birr)	4030	159.1979	721.5713
Total amount of seed used (kilo)	14300	11.64573	53.49486

Source: CSA, 2013/14

Regional level agricultural post-harvest of household farmers are indicated in Table 2.3 below. The study shows that on average 1.27 days of labour is hired for the agricultural production of farmers and an amount of 63.57 Birr is paid as total wage for hired labour per day. Each household member work almost 2 weeks for helps increase productivity. Moreover, on average 112 kg of the crops were harvested and sold in total with respect to about 50% of the respondents. The total value of all crops according to the study shows that about 886 Birr was made from the total sales and the total cost for conveying the crops from the farm site to the nearest market for sale was about 13 Birr.

Table 2.3 Regional Level Agricultural Post Harvesting

Variable	**Obs**	**Mean**	**Std. Dev.**
Days hired labour	3978	1.279035	10.17234
Total wage paid for hired labour (Birr/day)	3960	63.57588	320.3004
Household member work per week	19774	1.777233	1.949337
Variable	**Obs**	**Mean**	**Std. Dev.**
Total sale of crop (kilo)	1752	112.0245	294.6309
Total value of all crops (Birr)	1750	886.4989	2074.212
Total cost of transportation for all crops	1618	13.82108	67.86651

Source: CSA, 2013/14

From Table 2.4 with regard to agricultural livestock, the study indicated that on average 1.81 livestock was used in the last 12 months for farming practices to plough the land like the cattle for each agricultural farmer. About 61 of the various livestock were consumed by the owners. Moreover, the production level of livestock in the last 12 months was on average 5.06. Also 18.7 livestock on average was sold at about 352 Birr.

Table 2.4 Regional Level Agricultural Livestock

Variable	**Obs**	**Mean**	**Std. Dev.**
Livestock usage (last 12 months)	39136	1.818709	.3852639
Own consumption	7095	61.00183	40.55759
For sale	7095	18.79422	32.93574
Household production (last 12 months)	6549	5.060018	3.177762
Livestock sales (Birr)	2847	352.1963	1087.433

Source: CSA, 2013/14

CHAPTER THREE

METHODOLOGY

3.1. SOURCE OF DATA AND THE TYPE OF DATA USED

The data for this research paper came from the panel survey of Ethiopian Rural Household Socioeconomic Survey (ERHSS), conducted by Central Statistical Agency (CSA) with the alliance of the World Bank Living Standard Measurement Study (ISLM) team. The survey was conducted for the year 2013/14 in Ethiopia as full sample coverage at regional. The primary data for the research contained two part namely agriculture, and households' diverse socioeconomic characteristics. The agriculture part includes cultivated land area, the types of input used, crop production and Livestock production of the farm households. The Household socio-economic characteristic comprises of household borrowing, lending, from where they borrow and to whom they lend, food consumption items, the income from different source including remittance and source of their income, educational status of the household members and household demographic characteristics etc. This socioeconomic survey focused on the number of household assets, the loan amount of money in cash or in kind that the household received, time of repayment, if the household repay on time or not and the amount to be paid back and the reasons for those who do not get loan.

3.2. RESEARCH APPROACH

In the study, both quantitative and qualitative approaches were employed, because it is important to identify and analyze, in detail, the status and determinants of agricultural productivity, and household income level.

In order to get all the necessary information on the area under which the research was conducted, primary sources of information were mainly used. The main sources of data were mainly households, who engaged in agricultural activities. In addition to this, community leaders, government officials, and key informants were also used as sources of information. The informants that were considered as key informants include influential persons in the area, local officials and well-informed people. These people were more aware of the situation and were expected to give extra and complementary information regarding Agriculture Household income level. These sources helped the researcher to get first hand and relevant information about the real situation of agriculture. Both quantitative and qualitative data was collected using questionnaires, and interviews. Quantitative data was collected through the use of structured questionnaires from sample households (farmers).

3.3. SAMPLING METHOD

Central Statistical Agency (CSA) uses the sample frame as the standard procedure for data collection for which the slope containing Enumerations Area (EA) of Jimma and its respective agricultural households was obtained from the 2007 (1999 E.C) Population and Housing Census Frame which was used as the sampling frame for the selection of EAs Primary Sampling Units (PSU).

As regard to sampling, its objective is to select a set of elements from a population using Random sampling which enhances the probability of accomplishing this objective and also allows for the objective assessment of the reliability of the sample. Therefore one hundred and fifty (150) households were selected as sampling size from the study area for which each element of the population stands an equally opportunity of being selected; whereas the sample frame was 360. Taking 150 samples from the study area was reasonably achievable and desirable in line

with research fund and that for Woredas Jimma Zone which comprises of Gomma and Limu. Therefore, this project was undertaken for a total of two Woredas as the study site. Based on the 2007 Census conducted by the CSA, Jimma Zone has a population of approximately 2.5 Million, of whom 50.3% are men and 49.7% are women and with area of 15,568.58 square.

Consequently, all sample EAs was selected from this frame based on the design proposed for the survey.

3.4. ANALYTICAL TOOL AND MODEL SPECIFICATION

The study used both descriptive statistical tools and econometric models. Descriptive statistics like percentages, ratios, mean values, Standard Deviation, and frequencies were used to examine demographic and socio-economic features of respondents. In addition, the micro-econometric technique, multiple regressions model, was applied to identify the main socio-economic determinants of agricultural productivity. The data which was collected through household survey were entered, manipulated and analyzed using STATA software. In addition MS-Excel was used to supplement the software.

3.4.1. Model Specification: The previous studies that were conducted in different part of the world used various approaches to examine determinants of agricultural productivity. For instance, Camelia Burja (2012) used Data Envelopment Analysis (DEA) method; Meseret Urgecha Kussa (2012) Cobb Douglas stochastic frontier analysis. Moreover, agricultural productivity can be measured in aggregate or partial. Though a conventional agricultural productivity index (Total factor productivity), which is a measure of output divided by a measure of inputs used in the production and the best indicator of agricultural productivity. It is very difficult to construct TFP measures since it is often difficult to key value inputs where markets are not well-functioning. Hence, many studies used partial factor productivity (PFP) to derive

agricultural productivity. Partial factor productivity measure divides physical output by a given physical factor input, like land, labor, etc.

This study used multiple linear regression models to examine factors affecting agricultural productivity in the study area. To measure agricultural productivity, partial factor productivity was used. As partial factor productivity cultivated total land was taken as physical input. Variations in land productivity arose from differences in socio-economic variables, demographic variables, technology or variations in others (unmeasured inputs). After seriously reviewing previous literature including potential variables that affect productivity, the used regression model is specified as follows:

$$In\,Agr = \beta 0 + \beta 1 Sex + \beta 2 Age + \beta 3 Famsize + \beta 4 land + \beta 5 Famexp + \beta 6 Dist + \beta 7 Educ + \beta 8 Livestock + \beta 9 Fert + \beta 10 Credit + \varepsilon$$

Where:

- Dependent variable: Agricultural productivity expressed as Crop value per hectare of total cultivated land. It expressed as logarithm functional form.
- Independent variable: Age, Sex of household head, Family size, Distance coverage, Educational level, Farm experience, Land size, Livestock ownership, Fertilizer application, and Credit access
- $\beta' s$ are coefficient of each variables that measure by how much crop value per hectare of land changes when the given variable changes by a unit.

Table 3.1: Description of the explanatory variables

Variables	Description	Category	Expected sign
Sex	Sex of household head	A dummy variable having a value of 1if male , 0 otherwise	+
Age	Age of household head	Continuous variable	+/-
Educ	Educational status of household head	A Discrete variables having a value of 1 if households are literate , 0 otherwise	+
Famsize	Family size of households, measured as Adult equivalent unit	Continuous variable	+
Dist	Distance from nearest local market (measured in KM)	Continuous variable	+/-
Land	Total amount of cultivated land owned by household head (measured in hectare)	Continuous variable	+
Livestock	Livestock ownership, measured in tropical livestock unit	Continuous variable	+
Fert	Amount of fertilizer (measured in Kuntal)	Continuous variable	+/-
Dist	Distance coverage from the farm to the nearest market (measured in Kilo meters)	Continuous variable	+
Credit	Access to credit	A dummy variable having a value of 1 if households have access to credit, 0 otherwise	+

The ordinary least square estimation techniques were based on some basic assumptions like homoscedasticity of error term variance, error term should be normally distributed, there should be no serious correlation among explanatory variables (no serious problems of multicollinearity), and no problem of autocorrelation. Therefore, it was mandatory to conduct various diagnostic tests to apply ordinary least square estimation techniques. Based on this, the study used Breusch-Pagan Godfrey test for heteroscedasticity, which were used on the residuals to determine the OLS assumption on the error term. The Ramsey RESET test for functional form was conducted

to check for the correct specification of the error-term. The variance inflation factor (VIF) test was conducted to check for existence of multicollinearity problem.

The collected data through household survey was entered, manipulated and analyzed using STATA 13 software. In addition MS-Excel was used to supplement the software. Tables were used to describe the data result. The expected relationship between dependent and independent variables used for this study were summarized in the Table below.

Table 3.2: Summary of the relationship between Dependent and Explanatory Variables

Dependent Variable: Agricultural productivity				
S. No	Independent variables	Nature of Variable	Expected Sign	Remark
1	Sex	Categorical	+	Sex and adoptions are negatively related.
2	Family size	Numeric	+	
3	Education	Categorical	+	
4	Farm Experience(Years)	Numeric	+	
5	Land size	Numeric	+	
6	Livestock ownership	Numeric	+	
7	Distance from local market	Numeric	+	
8	Access to Credit	Categorical	+	Access to credit and adoptions are positively related.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter presents the results and discussion of the factors that affect agricultural production in Jimma zone specifically Limu and Gomma Woreda. In addition, the socio-economic characteristics of respondents, the major factors affecting the production and income of farmers are analyzed. Agricultural production and income influencing factors such as age, sex, educational level, family size, land size, farm experience and distance from the farm to the nearest market, fertilizer application, credit access and livestock ownership are presented and discussed. Furthermore, agricultural production and income were found to be influenced by access to markets and participation of the farmers. Finally, the secondary sources that dealt with the conditions of agricultural production and household levels were critically reviewed. Based on the nature of the data, a qualitative and quantitative presentation and analysis of the secondary data were presented as regional profile in Chapter two.

4.1 SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

The biographic data as well as the socio-economic characteristics sub-section included Woreda, age, sex, marital status, family size and educational levels of respondents in the survey study.

As indicated in Table 4.1, 52.67 percent of the sampled respondents are from Limu and the remaining 47.33 percent are from Gomma. This means that more of the questionnaires were administered and retrieved in Limu Woreda. Moreover, the majority of respondents (71.33%) were male household heads. With respect to marital status, about 64% of respondents were married. The educational level of household heads indicated that 54% of the respondents have educational background of below primary school, implying that they can neither read nor write. Moreover, the proportions of household heads with educational level equal and above Primary

school are very low (46%). The average age of sampled respondents is about 33 years, which lies in the productive age group. The study also revealed that the average family size of sampled household is 3.76.

Table 4.1: Demographic Characteristics of Household Head

Woreda Name	**Freq.**	**Percent**
Limu	79	52.67
Gomma	71	47.33
Sex of household head	**Freq.**	**Percent**
Male	107	71.33
Female	43	28.67
Marital Status	**Freq.**	**Percent**
Single	24	16.00
Married	96	64.00
Divorced	18	12.00
Widow	12	8.00
Education level	**Freq.**	**Percent**
Primary	59	39.33
Secondary	6	4.00
Tertiary	4	2.67
Illiterate	81	54.00

Source: Own Survey (2018)

Variable	**Obs**	**Mean**
Age	150	33.06
Variable	**Obs**	**Mean**
Family size	150	3.766667

Source: Own Survey (2018)

The farm experience and distance coverage from the farm site to nearest market of household heads are indicated in Table 4.2 below. The sampled households' in the study area have on

average 9.18 years of farming experience. This better experience of households is mainly associated with their participation in agricultural activities at early age of their lives. The surveyed households' average distance to the nearest market is about 10 Kilometers (Km).

Table 4.2: Farm Experience and Distance coverage from the nearest market of household head

Variable	Obs	Mean
Farm Experience	150	9.18
Distance Coverage	150	9.966667

Source: Own Survey (2018)

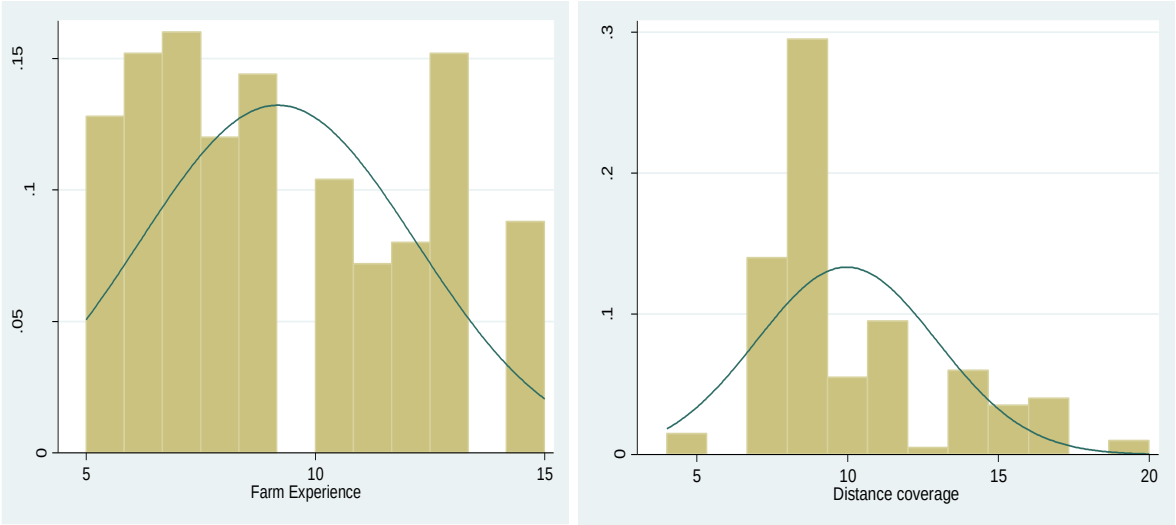

Figure 4.1: Farm experience and distance coverage of the household heads

In rural part of Ethiopia, land and livestock are the basic resources of households whose livelihood highly depends on income generation, and job creation. As indicated in Table 4.3 the sampled households' have 2.44 hectare of land on average, it includes land holding, rented, owned or both. Regarding livestock ownership, the study revealed that the households have 2.79 livestock as measured by Tropical Livestock Unit (TLU). On average a total crop value of 5082.667 birr was recorded annually.

Table 4.3: Resource Ownership and Value of Cereal Crop Production of Household Head

Variable	Obs	Mean
Land size (Measured in hectare)	150	2.438333
Livestock Ownership (Measured in Tropical Livestock Unit)	150	2.786667
Total Crop Value of land	150	5082.667

Source: Author's Computation (2018)

Table 4.4 to 4.6 compared cereal crop value by sex, educational level, marital status and credit access of surveyed households. When we look at the cereal crop value of households by sex, the study found that on average male households are more productive (5182.243) compared to female households' production (4834.8837). The result is expected as agriculture, predominantly crop production, required more physical control as compared to other sectors. Also, the result in Table 4.4 shows that only household heads with secondary school background are more productive than illiterate household heads.

Table 4.4: Cereal Crop Value in Birr, by Sex and Educational Status

Sex	**Mean**
Male	5182.243
Female	4834.8837
Educational level	**Mean**
Primary	4989.8305
Secondary	6000
Tertiary	4125
Illiterate	5129.6296

Source: Authors' Computation (2018)

The result in Table 4.5 indicates that on average married households are relatively more productive (5458.9474) as compared to households in other marital status category. This may be associated with the fact that agricultural activities in rural areas highly require cooperation and

support of all family members including housewife, children and adulthood, for they contribute to increase agricultural production either directly or indirectly.

Table 4.5: Cereal Crop Value in Birr, by Marital Status

Marital Status	**Mean**
Single	4183.3333
Married	5458.9474
Divorced	5000
Widow	4033.3333

Source: Authors' Computation (2018)

Table 4.6 also shows that about 86 (57.3%) of the sampled household heads have got credit from group lending methodology by financial institutions. This may be due to the fact that having access to credit service give households more power to purchase agricultural inputs like chemical fertilizer, improved seeds, more ox, and farming equipment. Moreover, households that have taken credit service have benefited more than the households without access to credit service. From Table 4.6, 64 (43.7%) of the sampled household heads have no access to credit and have produced cereals worth of 4960.94 birr compared to 5173.26 birr for households with access to credit. On average 4960.9375 of the households have not taken credit and due to that have not enjoyed better benefits from their farm produce.

Table 4.6: Cereal Crop Value in Birr, by Credit Access

Cereal Crop Value			
Credit Access	Mean	Std. Dev.	Freq.
Yes	5173.2558	1373.482	86
No	4960.9375	1194.2477	64
Total	5082.6667	1300.116	150

Source: Authors' Computation (2018)

Regard to Table 4.7, the study shows that Crop rotation and intercropping were practiced by farmers in the two districts. With respect to inter-cropping 96 (64%) of the total respondents

practice it but 54 (36%) of the respondents do not practice. In the works of Kamruzzaman, and Takeya (2008), the aim of intercropping is to enhance the yield of farm land by using resources that cannot be used by a single crop. Moreover, Karlidag, and Yildirim (2009) studies showed that Intercropping has become crucial for increasing crop productivity and fulfilling the food requirements of the world's growing population.

However, the majority 123 (82%) of the respondents were practicing crop rotation. The practice of crop rotation and inter-cropping is environmental friendly and such fertility enhancing methods can reduce the amount of chemical fertilizers farmers need to apply. According to Tulu (2011), Crop rotation is a regularly recurrent succession of different crops on a given plot of land. Similarly, Knox, Leake, Walker, Edwards, and Watson (2011) stated that crop rotation helps to ensure the required fertility and controls weeds, insects and plant diseases through the appropriate application of crop orders.

Table 4.7: Inter-Cropping and Crop Rotation practices of households

Woreda Name	**Inter-cropping**		
	Yes	**No**	**Total**
Limu	63	16	79
Gomma	33	38	71
Total	**96**	**54**	**150**
	Crop Rotation		
Limu	67	12	79
Gomma	56	15	71
Total	**123**	**27**	**150**

Source: Authors' Computation (2018)

Table 4.8: Pearson Correlation Test of crop value per hectare of land with some variables

		Sex	Distance coverage	Age	Educational level	Farm Experience	Credit Access	Land size	Livestock
Crop value per hectare of land	Pearson Correlation	(0.1212)	(0.539)	0.1467	0.0331	0.3824*	0.8894*	0.7662*	0.3202*
	Sig.(2-tailed)	0.1395	0.5123	0.0733	0.6877	.0000	.0000	.0000	.0001
	Number of Observation	150	150	150	150	150	150	150	150

Source: Authors Computation (2018)

In table 4.8 above, there is a positive correlation between crop value per hectare and age of household heads. This may be because of households with higher age have relatively better experience of agricultural production. Livestock ownership is also positively and significantly associated with crop value per hectare.

With respect to Farm experience, the Pearson correlation shows that it has a significant correlation with crop per hectare of land at one percent significant level. This implies that farm experience of households enhanced agricultural production in the study area. The same applies to land size, which is statistically significant at one percent and correlated positively with crop value per hectare of land. This may imply that as households with bigger land size tend to produce more output.

Moreover, access to credit has positive correlation and statistically significant with crop value per hectare of land at one percent significant level. This is because households which have credit access could purchase more chemical fertilizer, farm implements, and improved seeds for better production and good harvesting.

Regarding the educational level, it has a positive correlation but insignificant with agricultural productivity. This may infer that household heads with secondary school background are more productive. Also illiterate household heads may lack the knowledge and information which are fundamentals for farmers to adopt technology and modify the way of doing things.

Sex household heads and distance coverage shows a negative and insignificant correlation with crop value per hectare of land. This may be due to the fact that women do not take full participation in enhancing agricultural production in the study area. Also farmers with the study area travel a long distance of about 10km from the farm site to the nearest market center to sell their farm produce.

4.2 Heteroscedasticity Test and Multicollinearity Test

Various diagnostic tests were conducted. The diagnostic tests include heteroscedasticity, multicollinearity, and functional form associated with the model. In order to ensure that the residuals are randomly dispersed throughout the range of the dependent variables, heteroscedasticity test was used. The variance of the error should therefore be constant for all values of the dependent variable. The result showed that the model satisfied basic assumptions of ordinary least square estimation. The result of Breusch-Pagan test showed that we fail to reject the null hypothesis of homoscedasticity of error term variance since the *p*-value is greater than 0.05. The decision rule is to reject the null hypothesis if the probability is less than 0.05, meaning heteroscedasticity is present. On the other hand, if the probability is greater than 0.05, we do not reject the null hypothesis, implying that there is no heteroscedasticity. As such, errors are homoscedastic. If the null hypothesis is rejected at 5% level measured by Ramsey RESET test, it implies that agricultural productivity does not have significant impact on household income specifically in Limu and Gomma. Agricultural production technologies which include biological

and chemical technologies like chemical fertilizers, selected seeds or high yielding varieties, irrigation and soil quality enhancing technologies help farmers to use these technologies in order to enhance the production and productivity of the land. Agricultural production is influenced by other household characteristics such as the farm operator's experience, family size and landholding size.

Table 4.9: Result of Diagnostic Tests

Test	Statistic with P-value	P-value
Heteroscedasticity: Breusch-Pagan / Cook-Weisberg test	chi2(1) = 1.82	0.1772
Multicollinearity: Variance inflation factor	Mean VIF = 1.96	
Specification (Functional Form): Ramsey RESET test	F(3, 138) = 1.19	0.3173

Source: Own Survey and Computation (2018)

Table 4.10: Results of Variance Inflation Factors and Tolerance

Variable	**VIF**	**1/VIF**
Credit access	4.09	0.244759
Land size	3.44	0.290416
Distance coverage	2.01	0.498490
Educational level	1.84	0.542928
Sex	1.55	0.645181
Farm Experience	1.48	0.675586
Age	1.45	0.688962
Livestock ownership	1.37	0.732118
Fertilizer application	1.26	0.795602
Family size	1.12	0.894579
Mean VIF	**1.96**	

Source: Own Survey and Computation (2018)

The primary concern is that as the degree of multicollinearity increases, the regression model estimates of the coefficients become unstable and the standard errors for the coefficients get wildly inflated. As a rule of thumb, a variable whose Variance Inflation Factor (VIF) values are greater than 10 may merit further investigation. Tolerance, defined as 1/VIF, is used by many researchers to check on the degree of collinearity and a tolerance inflation value lower than 0.1 is comparable to a VIF of 10.

With respect to Table 4.10, the result of variance inflation factor equal to 1.96 indicates that there is no serious problem of multicollinearity as the value is less than 10. Moreover, the Ramsey RESET test statistic showed that the model has no specification problem.

4.3 MULTIPLE LINEAR REGRESSION MODEL

In investigating the determinants of agricultural productivity, the application of multiple linear regression model was used. The dependent variable, crop value per hectare of land in birr was regressed against ten major independent variables.

Table 4.11: Econometric Result of Determinants of Agricultural Productivity

Variable	Coefficient	T	P-Value	Number of obs = 150 F(8, 141) = 85.92 Prob > F = 0.0000 R-squared = 0.8607 Adj R-squared = 0.8507
Sex	0.368	3.26	0.001	
Age	0.148	2.48	0.014	
Educational level	0.091	2.36	0.020	
Family size	0.217	4.19	0.000	
Distance Coverage	0.027	1.39	0.166	
Land size	0.099	1.76	0.080	
Livestock Ownership	0.081	1.54	0.127	
Farm Experience	0.041	2.49	0.014	
Credit Access	0.001	12.99	0.000	
Fertilizer Application	-0.003	-0.74	0.462	
_cons	0.180	3.55	0.001	

Source: Own Survey and Computation (2018)

The econometric results above shows that the demographic characteristics are statistically significant with agricultural productivity, thus crop value per hectare of land. Moreover, variables such as land size, farm experience, and credit access are significantly and positively correlated with crop value per hectare of land.

4.3. Interpretation of the regression result for determinant of Agricultural Productivity.

The study found that sex of household head is more productive than female counterpart. The land productivity of male households is 36.8 percent greater than female counterpart, holding other things remain constant. The better productivity of male households may be due to the fact that agricultural activities require high physical energy. Moreover, the significant effect was

consistent to the study conducted in Ghana by Adeoti et al. (2012) indicating that vegetable production demanded more physical strength and was dominated by men.

The study indicated that the input of age of households on agricultural productivity is positive and statistically significant in the study areas. As age of household increases by one year, the agricultural productivity increases by 14.8 percent, holding other things remain constant. This can be associated with the fact that households with higher age can have better experience regarding agricultural production. The significant outcome was consistent with the findings of Adomi et al. (2003) where their finding shows that experienced farmers are expected to enhance the productivity of their holdings.

The study found that agricultural productivity was statistically significant at 5% but positively correlated with education. Holding other factors constant as educational level of household increases by one level, agricultural productivity increases 9.1 percent. Research findings have indicated the importance of education in agricultural production of farm households. The significant effect of education on agricultural productivity was consistent with the findings of Chowa, Garforth, and Cardey, (2013) which found out that information and knowledge are prerequisites for farmers to adopt technology, access input, change ways of doing things and market their produce.

The number of family size per household was statistically significant and positively correlated with agricultural productivity at one percent level. Ass family size increases by one member, agricultural productivity increases by 21.7 percent, holding other thing constant. This implies that members of the household engage themselves with the farming activity by means of increased labour, therefore the larger the family size, the better agricultural production. The above result was similar to Hedican, (2006), Kim and Park, (2009) where farm operators with

larger landholding sizes would have a better farm income if sufficient family labour was available. This leads to an increased demand for children who can work on the land.

Regard to distance from the farm site to the nearest market, the study showed that there is a positive relationship but insignificant with agricultural productivity. Assuming other things remain constant as distance to the nearest market increases by one kilometer, agricultural productivity increases by 2.7 percent. As the households are far from nearest market the prices for agricultural products becomes disadvantageous. The insignificant effect was similar to the finding of Aune and Bationo (2008) which revealed that when the market for agricultural inputs and outputs is poorly developed, it creates unfavorable relationships between input and output prices.

As expected, the size of agricultural land has strong effect on agricultural productivity. Its coefficient is positively correlated and statistically significant with agricultural productivity. As the size of land increases by one hectare, agricultural productivity increases by 9.9 percent, holding other variables constant. Land with better soil fertility is one of the basic assets that are required by households in agricultural production in rural part of Ethiopia. This means possession of farm land determines the farming ability of farm operators because if farmers do not have quality land they would be obliged to rent out their land to other non-farmers activities. The positive and significant effect was consistent with the finding of by Endale, (2011) by using the panel data of cereal crops and translog estimation technique followed by FGLS for the fixed effect estimation, founds that the land size is significant for agricultural productivity in the study area of four regional states in Ethiopia. Also, the above results were similar to that of Amsalu, Stroosnijder, and de Graaff, (2006) where land is the most critical natural resource for countries like Ethiopia where the agricultural sector is the engine of the national economy.

As expected livestock ownership, measured in tropical livestock unit, is also strongly affects agricultural productivity. Its coefficient is positively correlated with agricultural productivity. Livestock, mainly ox, is one of the basic resources used by households in agricultural production in rural part of Ethiopia. This means possession of oxen determines the farming ability of farm operators because if farmers do not have oxen they would be obliged to rent out their land to other farmers. As shown in the regression result if households' livestock ownership increases by one unit, crop value per unit of land increases by 8.1 percent.

With respect to farm experience, it is positively correlated and statistically significant with agricultural productivity. As farm experience increases by one year, agricultural productivity increases by 4.1 percent, holding other variables remain constant. This implies that experience of household farmers contribute to high productivity. However, the above finding was similar to that of Ogbomo et al. (2003) whose result revealed that experienced farmers are expected to enhance the productivity of their holdings. This shows the significant contribution of farm experience with regard to agricultural productivity.

Fertilizer Application: the study shows a negative correlation and insignificant level with agricultural productivity. All other things being equal, as fertilizer application decreases by one kilogram, agricultural productivity decreases by 0.3 percent. The quantity of chemical fertilizer applied on the farm was below the standard required which resulted in less productivity and less market value for the crop due to finance. The insignificant and negative impact of chemical fertilizer was similar to the finding of BoARD (2012) where in the year 2012/13, the Bureau of Agriculture and Rural Development of the regional level revealed that the sales of chemical fertilizer, improved seeds and chemicals were intended to be fully paid for in cash. In addition, it was similar to the finding of Bewket (2011) in the Amhara region, where farmers in Ethiopia

were unable to use chemical fertilizers to restore the fertility of land because of the high cost of chemical fertilizers and the lack of government subsidies to make them affordable.

Credit Access is one of key determinants of agricultural productivity and hence production in rural areas of Ethiopia. The regression result shows a significant and positive correlation between credit access and agricultural productivity. As access to credit increases by one Ethiopian Birr, agricultural productivity increases by 0.1 percent, holding other variables constant. Households who have access to credit are more productive than households with no credit access. Households who have access to credit are more productive than households with no credit access. This implies that households that have access to credit purchase more fertilizer and improved seed for which they are more productive in their production. Ellis (1992) in his findings revealed that input delivery should be combined with credit provision in order to reduce the working capital constraints to adopting new inputs for farm households.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

Agriculture plays a vital role and has deep implications in ensuring quality of life and sustainable development in developing countries economy, mainly in the rural areas. Agricultural activities provide the basic source of livelihood upon which rural life depends, providing food and income for survival. Indeed, the sector's performance directly reflects that of the overall economy. The study embraced sampling method from two districts within Jimma zone which were selected randomly. Then, random sampling was used to select households from each of the two districts. A field survey covered 150 household heads. With respect to the method of data used for the analysis, the study employed descriptive statistics, and econometric model analysis to achieve the specific objectives of the study. The descriptive statistics used to show the households profile, farming experience, distance to the nearest market, credit accessibility, fertilizer application and crop value per hectare of land by using chi-square, independent t test. With econometrics model, multiple linear-regressions were applied to investigate determinants of agricultural productivity of households in the study area.

Crop rotation and intercropping were practiced by most of the farmers in the two districts. The problem was that these practices were not on the agenda of the extension agents and therefore the farmers did not get the required support from them. They applied crop rotation and intercropping without following any scientific methods and without identifying complementary crops. The methods of crop rotation and intercropping are environmentally friendly and such fertility enhancing methods that reduce the amount of chemical fertilizers farmers required should be applied. As expected, educational level, age, sex of household heads, family size, farm

experience, land size, livestock ownership, distance from the farm to the nearest market, and credit access show a positive correlation with agricultural productivity. On the other hand, fertilizer application was found to be negatively correlated with agricultural productivity.

The multiple linear regressions shows that sex, age, education level, family size, farm experience, land size and access to credit are statistically significantly with agricultural productivity of sampled households. Households benefited from the credit they took by analyzing the total crop value of land. Members of households which make the family size engaged themselves with farming activities by means of labour. This helped the farming production to yield profitably.

5.2. Recommendations

The agricultural sector is the basis of livelihood for a large proportion of society in Ethiopia which has been regarded as a critical sector. As Lefort (2012, p. 686) stated, the current government of Ethiopia is highly involved in the agricultural sector and, through its developmental state theory, has put the highest level of investment into the sector. The Agricultural Development Led Industrialization (ADLI) is the national policy of the country. Regardless of the government's policy attention and investment, there is a long way to go for smallholders to ensure food self-sufficiency.

In general, the study recommends that the various stakeholders with the likes of the community, NGOs, Government officials and policy makers should collaborate to design policy directions and intervention plans and strategies to increase agricultural production. In this regard much attention should be given to improve household living conditions and wealth mainly, livestock ownership; expanding educational and training facilities for farmers since education is important

to the improvement in agricultural productivity such that formal education opens the mind of farmers to knowledge, non-formal education gives the farmer hands-on training and better methods of farming. As the education level increases, output increases having the highest return on agricultural productivity; and provision of credit facilities for all.

Specific Policy Recommendations:

- The results of the findings reveal a positive correlation of sex household heads and agricultural productivity. This is mainly due to the fact that better productivity of male households in agricultural activities requires high physical energy.
- To design and implement appropriate strategy that eases the burden of local farmers' dependence on limited physical agricultural inputs to encourage agricultural productivity.
- The government should encourage land renting to continue more preferable than land sharing because the farmer is more beneficial from the long-term perspective.

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APPENDIX 1: HOUSEHOLD SURVEY ON FACTORS AFFECTING AGRICULTURAL PRODUCTION

Dear Respondents

This research is in partial fulfillment for the award of Master of Science in Economic Policy Analysis. The purpose of the study is to investigate factors affecting agricultural productivity and the income level of household in Jimma Zone from two selected Woredas. Investigating these factors that affect the agricultural production is helpful for policy makers in their attempt in improving the agriculture sector and the livelihood of farm operators.

This interview is completely confidential, strictly for academic purpose. Therefore, everyone participating in the survey will be anonymous and the information you provide can never be traced back to you. Your valuable input is highly appreciated.

DEMOGRAPHIC CHARACTERISTICS

Q1. Woreda name ……

Q2. Gender (A) Male (B) Female

Q3. Marital Status A Single B Married C Divorced E Other

Q4. Age (A) 1-18 (B) 19-25 (C) 26-40 (D) 41-60 (E) Other

Q5. Education (A) Primary (B) Secondary (C) Tertiary (E) Illiterate

Q7. Family size ……

AGRICULTURAL PRODUCTIVITY

Q8. Do you possess your own cultivated land for the agricultural work?

(A) Yes (B) No

Q9. Did you use fertilizer inputs in your own or rented land in the recent harvest year (2009 E.C.)? (A) Yes (B) No

Q10. Did you use improved seeds in your own or rented land in the recent harvest year?

(A) Yes (B) No

Q11. Are you motivated you to apply chemical fertilizer and/or selected seeds in your own and rented land?

(A) Yes (B) No

Q12. If you did not use fertilizer inputs, will it results to high selling price due to low harvest?

(A) Yes (B) No

Q13. Do you practice crop rotation? (A) Yes (B) No

Q14. Do you practice inter-cropping? (A) Yes (B) No

Q15. Did your zone apply the practice of zero-grazing?

(A) Yes (B) No

Q16. If your zone has applied the practice of zero-grazing, is there any merit you get from it?

(A) Yes (B) No

Q17. Is there any negative impact of zero-grazing on the livestock population?

(A) Yes (B) No

HOUSEHOLD SOCIO-ECONOMIC CHARACTERISTICS

Q18. Have you ever taken credit in the recent harvest time?

(A) Yes (B) No

Q19. If your answer for question number 18 is yes, did the loan obtain benefited you?

(A) Yes (B) No

Q20. Is there are institution or association that provide the sources of credit?

(A)Yes (B) No

Q21. How do you repay the loan with an interest?

(A)Yes (B) No

Q22. Do you think the most frequent period of loan repayment is convenient to you?

(A) Yes (B) No

Q23. Did you get an advice or any support from the extension agents in the last production season? (A) Yes (B) No

Q24. Do you think the number of contacts with the extension agents were enough?

(A) Yes (B) No

Q25. Do you have a smooth relationship with the extension agent?

(A) Yes (B) No

THANKYOU!!!

APPENDIX 2: INTERVIEW QUESTIONS FOR LOCAL FARMERS

1. How many years have you been in the farming business?
2. What is the distance coverage from the farm site to the nearest market center?
3. How many hectares of land do you owned or rented or both for the farming?
4. What is the major cereal crops value in terms of price when sold?
5. What is the crop value per hectare of land or how much does it cost to sow crops on an hectare of land?
6. What do you think are the major challenges or problems in using inorganic fertilizer and selected seeds?
7. How many kilo grams of inputs did you use in or your own or rented land?
8. If most of you have applied inorganic fertilizer, what initiated you to do so?
9. Did you purchase the inorganic fertilizer on credit bases or in cash?
10. What is the cost of fertilizer inputs used? Unit cost (Birr) and Total cost (Birr)
11. If you practice crop rotation and/ or inter-cropping? Why or why not?
12. Are there agricultural cooperatives at the zonal level?
13. Q8. What are the major supports provided by these agricultural cooperatives?
14. Q9. In your view, what are the major weaknesses of agricultural cooperatives?
15. Do you have Farmer Training Centre (FTC)?

APPENDIX 3: INTERVIEW QUESTIONS FOR KEY INFORMANTS

1. What were the plans you designed or given to you by the zone in 2009 E.C?

   (a) crop expert (b) livestock expert

2. How did you evaluate the achievement of the planned activities (crop and livestock?)
3. Did you have any mechanism to provide a direct advice for farming wives in addition to male and female household heads? How?
4. What are the major constraining factors for agricultural productivity and production? (Farmers, experts and others)
5. Do you have a Farmer Training Centre (FTC)?
6. On the average, how many households are under your supervision and guidelines?
7. Is there any quota given to the extension agents for farmers to join to different packages?
8. What should be done by all agents at the *Limu* and *Gomma* to enhance agricultural production and income?
9. What are the major reasons for the farmers to apply below the standard?
10. What are the possible consequences for fertilizer utilization below the standard on the productivity of land?
11. What are the scientific justifications for the benchmark of 200 kg/ha?
12. What about the differences in location and crops to be grown?
13. What are some of the improved varieties of seeds requested by the farmers?

APPENDIX 4:

1. Number farmers in Woredas

Woreda	Freq.	Percent	Cum.
1	79	52.67	52.67
2	71	47.33	100.00
Total	150	100.00	

Note: 1 = Limu; 2 = Gomma;

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. sum Age Familysize FarmExperience Distancecoverage
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Variable	Obs	Mean	Std. Dev.	Min	Max
Age	150	3.306667	.826951	1	5
Familysize	150	3.766667	.8387964	3	5
FarmExperi~e	150	9.18	3.016888	5	15
Distanceco~e	150	9.966667	2.995336	4	20

2. Frequency distribution of Size of land and number of livestock by sample farmers

	Livestock owned				
Landsize	2	3	4	5	Total
.5	12	0	0	0	12
1	17	3	0	0	20
1.5	13	6	4	2	25
2	8	9	0	0	17
2.5	8	4	10	1	23
3.25	5	16	6	0	27
3.75	1	1	0	1	3
4.25	2	1	1	3	7
5	3	3	6	0	12
5.5	4	0	0	0	4
Total	73	43	27	7	150

3. Econometric Result of Determinants of Agricultural Productivity

Source	SS	df	MS
Model	216783499	10	21678349.9
Residual	35071434.7	139	252312.48
Total	251854933	149	1690301.57

Number of obs = 150
F(10, 139) = 85.92
Prob > F = 0.0000
R-squared = 0.8607
Adj R-squared = 0.8507
Root MSE = 502.31

CropvalueTotal	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Sex	-368.5279	112.9141	-3.26	0.001	-591.7791	-145.2767
Age	-148.8765	59.95135	-2.48	0.014	-267.411	-30.34204
Educhead	-91.23278	38.67643	-2.36	0.020	-167.703	-14.7626
Familysize	217.562	51.86928	4.19	0.000	115.0072	320.1168
FarmExperience	41.32486	16.59498	2.49	0.014	8.513644	74.13608
Distancecoverage	27.07353	19.4582	1.39	0.166	-11.39878	65.54584
Landsize	99.30187	56.31064	1.76	0.080	-12.03427	210.638
Livestockowned	81.88533	53.33046	1.54	0.127	-23.55846	187.3291
FertilizerApplication	-3.140129	4.258021	-0.74	0.462	-11.55899	5.278735
TotalCreditaccess	1.032557	.0794904	12.99	0.000	.8753902	1.189723
_cons	1801.742	507.112	3.55	0.001	799.0916	2804.393

4. Results of Variance Inflation Factors and Tolerance

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. vif
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Variable	VIF	1/VIF
TotalCredi~s	4.09	0.244759
Landsize	3.44	0.290416
Distanceco~e	2.01	0.498490
Educhead	1.84	0.542928
Sex	1.55	0.645181
FarmExperi~e	1.48	0.675586
Age	1.45	0.688962
Livestocko~d	1.37	0.732118
Fertilizer~n	1.26	0.795602
Familysize	1.12	0.894579
Mean VIF	1.96	