Determinants of Teff farm production level in South Achefer District, West- Gojjam zone, Ethiopia.

A 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 (Msc.) in developmental economics.

By

Abrham Ayalneh Mengistie

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

June, 2021

Jimma, Ethiopia.

Determinants of teff farm production/output level in South Achefer District, West-Gojjam zone, Ethiopia.

By

Abrham Ayalneh Mengistie

Under the Guidance of

Major Advisor: Mrs. Minyahil A. (Assistant Professor)

And

Co- Advisor: Ms. Nejat K.

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN DEVELOPMENT ECONOMICS.

JIMMA UNIVERSITY

June, 2021

Jimma, Ethiopia

CERTIFICATE

This is to certify that the thesis entitles "Determinants of teff farm production level/output in South Achefer District, West-Gojjam zone, Ethiopia", submitted to Jimma University for the award of the Degree of Master of Science (Msc.) and is a record of bonafide research work carried out by Mr.Abrham Ayalneh Mengistie, under our guidance andsupervision.

Therefore, we hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree or diploma.

Main Adviser's Name	*Date*	*Signature*
Mr. Minyahl A. (assistant professor)	_____	_____

Co-Advisor's Name	*Date*	*Signature*
Ms. Nejat K.	_____	

DECLARATION

I hereby declare that this thesis entitled "*Determinants of teff farm production level in South Achefer District, West-Gojjam zone, Ethiopia,'*'has been carried out by me under the guidance and supervision of Mrs. Minyahil A. (Assistant Professor) andMs.NejatK.

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

Abrham Ayalneh Mengistie Date: _____Signature: _____

ACKNOWLEDGEMENTS

First of all I would like to praise GOD almighty for giving me strength to finalize my thesis. Furthermore, my foremost appreciation and thanks go to Mr. Minyahl A.(assistant professor) my advisor for his invaluable comments, professional advices and encouragements that contributed to the successful realization of my study.

I owe my deepest gratitude to Ms. Nejat K, co-adviser for her invaluable comments, and professional advices.

My sincere appreciation also goes to HailuTamiru for his invaluable support and inspiration played a significant role by laying a solid foundation through my course work.

I am also delighted to send my heartfelt thanks for G/tsadik Getaneh, my best friend for his brotherhood advice, encouragement, and being one source of my strength to effectively carry out my study.

I would like also deeply gratitude my brother Mengistu Ayalneh for his unreserved support and encouragement throughout my study. I am indebted of him. Without his coverage and support all things are uphill road that couldn't rise.

My deep appreciation also extended to my best friends Setegn Ferede, Wassihun Zewdu, Kidane Geremew, Ermias Tadesse, and Belainesh Andarge for their unreserved support and encouragement throughout my study.

It is great pleasure to extend my appreciation to south Achefer woreda agricultural Office for their permission and cooperation to use available data from respective offices.

I want to thank the enumerators for finishing the tedious data collection work in time. It is also my pleasure to thank Mr. Dagninet Adane who is the manager of south Achefer woreda agricultural Office to give all necessary information I needed.

I am deeply grateful to all people who have assisted me through all stages of the study.

Table of Contents

List of figures

List of tables

Abbreviations

ADLI: Agricultural Development Led Industrialization

CSA: Central Statistical Agency

DEA: Data Envelopment Analysis

EAP: Economically Active Person

FEM: Fixed Effect Model

FGLS: Feasible Generalized Least Square

ISLM: International Standard Living Measurements

LSDV: Least Square Dummy Variable

MLE: Maximum Likelihood Estimation

NBE: National Bank of Ethiopia

NGO: Non-Governmental Organization

OECD: Organization for Economic Co-operation and Development

OLS: Ordinary Least Square

PFP: Partial Factor productivity

PIF: Policy Implementation Framework

PP: Producer price

SSA: Sub-Saharan Africa

2SLS: Two Stage Least Square

TFP: Total Factor Productivity

ABSTRACT

Agricultural productivity growth is a prerequisite for economic growth and poverty reduction as well as food and Nutrition security in agro-based economies such as Ethiopia.Among agricultural product,Teff is one of the dominant crops and its productivity is low in south Achefer district. This meansthat it is possible to obtained additional output from existing inputs used, if resource are properly used and efficiently allocated. The aim of this study is to analyze the determinants of the level of teff production in smallholder farmers. A multi-stage sampling technique was employed to select 151 sample farmers. Quantitative data were collected through individual survey based structured questionnaires. The questionnaires were designed and formulated to collect information about socio-economic and demographic determinants of teff production level from sampled farm house holds to obtain data pertaining to teff production during 2012/2013 E.C production year. A Cobb-Douglas translog production model was used to estimate productivity and identify the determinants of productivity of teff producing farmers. The parameter estimation showed that teff output was positively and significantly influenced by farm size, fertilizer, labour, credit access, age, education, manure, pesticide and number of oxen. This would mean that there is a room to increase teffoutput from the existing levelof teff output if farmers are able to use these input variables in an efficient manner.

Key words: *Cobb-Douglass production function, Determinants and production level, South Achefer district, teff*

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Agriculture is the main engine of the economic growth for Sub-Saharan African countries. However, feeding the increasing population of Sub-Saharan Africa is becoming a critical challenge for most of the countries in this area. In line with this, underscore the existence of two schools of thought or debates in African agriculture. These debates focus on the potential roles of agriculture and industry in improving African development and the ability of the agricultural sector to ensure pro-poor growth. Hence, the argument that agriculture is a large sector and that upgrading it leads to a better aggregate growth, justifies the public investment in the sector (Birhan, 2015).

Agriculture is the most important sector in Ethiopia; it accounts for 46 per cent of GDP, 80 per cent of export value, and about 73 per cent of employment. The sector still remains largely dominated by rain-fed subsistence farming by smallholders who cultivate an average land holding of less than a hectare (Aklilu, 2015).

The decomposition of sources of growth in global agricultural output indicated that contributions came from the following factors. These are: - Growth in land and water (irrigation), intensification of other inputs per unit of land, and total factor productivity (TFP). In Ethiopia, about 83.9 per cent of total populations live in rural area and agriculture is main source of their livelihood. Since 2010, Agriculture become the second most dominant next to service sector of the country's economy, by providing employment for 80 per cent of the total labors force and contributes 42.7 per cent to Gross domestic product and 70 per cent of foreign exchange earnings (NBE, 2013).

Agricultural productivity can be increased by using two ways. The first is through improvement in technology given some level of input and the otheroption of improving productivity is to enhance the output per household labor ratio of rural household farmers, given fixed level of inputs and technology (Tessema, 2015).This study considered thelatter because all inputs are limited.

A large majority of Ethiopians and the poor living in rural areas are deriving their livehood from agriculture. The proportion of the population of Ethiopia residing in rural areas in 2040 is

predicted to be nearly 70per cent, when there will be 30 per cent more rural residents (UN, 2014).

Agriculture in Ethiopia is dominated by smallholder farming households, which cultivated 94 per cent of the national cropped area in 2013/14 (CSA, 2014).

Growth in agriculture was one of the major drivers of the remarkable economic growth recorded in Ethiopia in the last decade (NBE, 2016).

The major grain crops grown in Ethiopia are teff, wheat, maize, barley, sorghum and small millet. Out of the total grain production, cereals account for roughly 60 per cent of rural employment and 80% of total cultivated land (Quintin, 2017).

In the crop production sub-sector, cereals are the dominant food grains. The major crops occupy over 8 million hectares of land with an estimated annual production of about 12 million tons. (CSA, 2018),

The potential to increase productivity of these crops is very high as it has been demonstrated and realized by recent extension activities in different parts of the country. However, population expansion, low productivity due to lack of technology transfer and decreasing availability of arable land are the major contributors to the current food shortage in Ethiopia (Hailemaraim, 2015).

According to(CSA, 2018), Ethiopian population will exceed 126 million by the year 2030. This increase in population will impose additional stress on the already depleted resources of land, water, food and energy.

Teff is an important crop in terms of cultivated area, share of food expenditure, and contribution to gross domestic product. Despite the remarkable growth in teff production in the last decade, the drivers of this growth are not well understood. In particular, there is a lack of evidence on the contribution of improvements in productivity to this growth and the link between farm size and productivity. Moreover, doubts exist on whether it is possible to sustain such growth on land holdings that are declining in size.

Teff accounted for about a fifth of the nation-wide agricultural area and was cultivated by nearly half of smallholder farmers during the 2004/05-2013/14 period (CSA, 2015). During the same period teff output grew at average annual rate of 9.3% and yields grew at 5.2%.

Evidences indicated that part of the growth in teffoutput has been driven by increases in cultivated area (Dorosh, 2018).

However, it is not well understood whether there were improvements in productivity and the contribution of such improvements for growth in output various staple crops dominate different parts of Ethiopia. But, teff is either the principal staple or among the most consumed crops in almost all parts of the country. Moreover, the demand for teff is elastic with respect to income. The share of spending on teff in food expenditure is highest in urban areas and increased by 3.4 % nation-wide between 2005 and 2013, during which time real income increased considerably and the share of all other cereals declined (Worku Ibrahim, 2016).

As it is one of the most common consumed cereals in Ethiopia, it has been historically neglected compared with other staple crops. In terms of production, teff is the dominant cereal by area planted and second only to maize in production and consumption. However, yields are relatively low (around 1.4 ton/ha.) and high loss rates (25-30% both before and after harvest) reduce the quantity of grain available to consumers by up to 50% (CSA, 2016).

Teff is the most widely adapted crop compared to any other cereal or pulse crop in South Achefer district and it is grown under wider agro-ecologies (variable rainfall, temperature and soil conditions) (WOA, 2015).

In spite of the fact that the study area (South achefer district) is one of those the districts in west Gojjam zone that show lowest achievement in teff productivity. Accordingly, lack of credit, high cost value of inputs, repeated use of land and lack of technology were factors responsible for this low productivity (WOA, 2019).

1.2. Statements of the Problem

The Ethiopian agricultural production and productivity is very low and the growth in agricultural output has barely kept pace with the growth in population. The high potential areas of Ethiopia can produce enough grains to meet the needs of the people in the deficit areas. However, the inefficient agricultural systems and differences in factors of production discourage farmers to produce more(Kinfe Aseyehegn, 2016).

Gains in agricultural output through improvement of efficiency levels are becoming particularly important now a day. The opportunities to increase farm production by bringing additional forest land into cultivation or by increasing the utilization of the physical resources have been diminishing. In addition, eliminating existing inefficiency among farmers can prove to be more cost effective than introducing new technologies as a means of increasing agricultural output and farm household income (Wondimu Tesfaye, 2015).

According to previous researches in Ethiopia for example, (Alamirew., 2016) and (Mesay Yami, 2013) there also exists a wide cereal yield gap among the farmers that might be attributed to many factors such as lack of knowledge and information on how to use new crop technologies, poor management, biotic, climatic factors and more others.

Because of the scanty resources that are on ground, recently it is getting importance to use these resources at the optimum level which can be determined by efficiency searches (Gebregziabher Gebrehaweria, 2017).

Thus, increasing crop production and productivity among smallholder producers require a good knowledge of the current efficiency/inefficiency level inherent in the sector as well as factors responsible for this level of efficiency/inefficiency (Essa channe, 2014).

Though there have been various empirical studies conducted to measure efficiency of agricultural production in Ethiopia, (for example, (for example, (Wondimu Tesfaye, 2015)), (Hassen, 2016), (Fantu, 2015)), to the best of the author's knowledge, there were no similar studies undertaken on productivity of teff producing household in the study area.

However, the production level of agricultural system in the study area is very low. The poor production and productivity of crop and livestock resulted in food insecurity.

Despite its potential, South Achefer District's teff productivity is declining from time to time (CSA, 2016). Therefore, the need for the efficient allocation of productive resources cannot be over emphasized. However, in areas where there is reduction in productivity, trying to introduce new3 technology may not bring the expected impact, unless factors associated with inefficiency among farmers are identified and acted upon.

The south Achefer (WOA, 2019), report showed that, about 38,064 hectares land was covered by cereal crops. Out of that, teff is the leading one next to maize. However, there is no empirical study that revealed whether the existing scare resources and technologies are utilized efficiently or not in the production of teff. The extent, causes and possible remedies of productivity of smallholders are not yet given attention.

The determinants of agricultural productivity in particular country are different and distinctive from others. Moreover, since social development is dynamic, it is imperative to update the information based on the current productivity of farmers.

Therefore, this study attempted to fill this gap with analysis of productivity in teff production and provides valuable information so as to make an intervention in order to increase production and productivity of teff in South Achefer district.

As it is shown from the above literatures, a significant determinant variable for one researcher is found to be insignificant variable for the other researcher even in the same region. The methodologies that the researchers followed were also questionable. This implies that there is obvious research gap on the issue of the determinants of teff productivity. Besides, the rate of productivity is showing a dramatic decrease in the recent years. Moreover, south Achefer district is one of the least productive districts in arm productivity though no empirical study is made on this issue. Therefore, the intention of the researcher is to fill the research gap existed in the issue of the determinants of teff productivity and provides valuable information so as to make an intervention in order to increase production and productivity of teff in South Achefer district. Fundamentally, two basic issues motivated the researcher to carry out this study. The first is inconclusive results of former studies on the determinants of teff productivity. The second is the decrease in teff productivity despite farmer's effort. Hence, the foremost intension of the study is to identify the factors that determineteff productivity.

1.3. Objective of the study

The main objective of this study was to examine the determinant factors of teff farmproduction level in the study area.

Specifically the study is aimed to:

- To estimateteffproduction levelof smallholder farmers in the study area,
- To identify factors affecting the level of teffproduction among farmers in the study area.

1.4. Hypothesis

Technology package, demographic and socioeconomic factors do not affect production level of teff in south Achefer District.

1.5. Significance of the Study

The study focused on the issue of factors affecting production level of teff and identified factors associated with technical efficiency among farmers. It could play a significant role in providing useful information concerning productivities in production and by identifying those factors, which would associate with inefficiencies that may exist. It couldalso indicate an entry point for further policy interventions to productivity of smallholder farmers. Therefore, this study is expected to generate adequate understanding of the issues that might lead towards taking appropriate actions for improvement of productivities. Hence, the outcome of this piece of work can have important implications for the professionals and for the policy formulation purposes.

Therefore, in the view of the above narrated importance of knowing the factors affecting production level of teff, the study would have significant importance as follows; first, the result provided useful information for the government and policy makers regarding the key factors affecting production. Thus, it would contribute to design appropriate policies and strategies to increase teff productivity. Secondly, the study would also contribute to useful information for other grain crops that usually have similar production processes for farm households and helps in designing teff extension package in the context of the zone and region as well as the national level. Finally, it would serve as source for future empirical literature for scholars and students interested in the area of efficiency and in the field of agricultural economics and related fields.

1.6. Scope and Limitations of the study

This study is focused on production level of teff during meher season in one district; using a cross sectional data of the 2012/13 E.C production year collectfrom151 teff producing smallholder farmersin the district. Covid 19was one of the examinant challenges to collect data from the farm house holds and to accomplish the study.

The other limitation was related with the methodology used. The study does not show inter temporal differences in production level of teff producing farmers. In addition, the study is limited to the analysis of productivity of teff production without regard to other crops. In addition to the budget and time constraints, the study is limited to only south Achefer district of west-Gojjam Zone, Amhara National Regional State, Ethiopia

1.7. Organization of the paper

This paper is organized into five chapters. Chapter one constituted the introduction, which focuses mainly on the background, statement of the problem, objectives, significance of the study, the scope and its limitation. Chapter two is dealt with the review of the theoretical and empirical literature pertinent to the concern of the study and conceptual framework. Chapter three is described the research methodology that includes a brief description of data collection method, procedures, analytical model and techniques of estimation method. Chapter four is dealtreports on results of the study along with discussion. Finally, conclusion and recommendation are presented in Chapter five.

CHAPTER TWO

REVIEW OF LITERATURE

2.1. The concepts and Theories of Agricultural Productivity Measurements

Agricultural productivity refers as the output produced by a given level of input(s) in the agricultural sector of a given economy (Fulginiti, 2015). 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"(E O Heady, 2018). However, agricultural productivity can be measured by partial productivity or total factor productivity measures depending on the number of inputs under consideration.

Total factor productivity is also explained 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 isthevalue-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 (Tessema, 2015).This approach is also overstates or understates productivity of inputs when input ratios change without a change in technology (Gebreeyesus, 2012). 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, 2014) 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. 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, 2013). It is commonly used partial measuresyield (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, 2011). 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 common measure of living standards: income per person in an economy varies directly with one measure of labor productivity, value added per hour worked. In this sense, measuring labor productivity helps to better understand the development of living standards (OECD Manual,, 2017). Partial measures of productivity index also have a limitation that, it may not account forall the inputs used in production process. However, carefully constructed partial measures are applied to measure output that attributable for variations in measured factors (Alston, 2016). This study considers both land and labor productivity measurements to evaluate the progress of farm production practice. The stochastic frontier production function can be specified through the use of the Cobb-Douglass or Translog production functions (Biggs, 2014) used for the measurements. The Cobb-Douglass-production function is a simple tool which canhandle multiple inputs in its generalized form. However, use of Cobb-Douglass production function also has its own limitations due to its restriction on the elasticity of substitution (Kim H. , 2016).Therefore alternatively, Trans log functions are more sufficiently flexible to use. Since, it allows us for estimation of partial elasticity's of substitution for any number of inputs (Zhang, 2018). Because it doesn't impose a restrictions on elasticity's of substitution and returns to scale and also the Cobb-Douglass production function has both linear and quadratic terms which enable for using more than two factor inputs (Kim, 2016). But, the variables in such a specification are highly correlated and hence the choice among Cobb-Douglass and translog has to be based on the overall goodness of fit and other diagnostic results such as multicollinearity and Heteroskedasticity.

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, education and contribute to social and environmental programs. By considering of its importance, measuring agriculture productivity will clearly show 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, 2015). This study is considered 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, 2012). The major limitation ofthe econometric approach is that it requires more data than the other approaches.

As (Dhillion, 2011), stated that agricultural productivity is frequently associated with the attitude towards work, thrift, industriousness and aspirations for ahigh standard of living, etc.

(Hossain, 2013), also developed a technique of how tomeasure 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 estimateand mathematically manipulate and possible to test the significance of the estimate delasticity's using standard test statistics such as t–ratios and f-ratios. However, according to (Coelli T. D., 2010) 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 (Demeke, 2015), the Cobb-Douglas production function can be specified as:

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

Y= production level of teff/output

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:

$Y=\prod(X^{\beta i}_{ij}E^{\delta i}_{ij})e^{\alpha+\varepsilon i}$

Where: **Yi** = production levelofteff/output of the ith Area of land

Xij= the use of the ith Area of the jth technological input

Eij= 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 inputsused in the production process.

2.4. Empirical literatures

There exists quite vast literature on the trends of teff productivity, factors affecting agricultural productivity and ways to improve agricultural productivity in both developed and developing countries. Agricultural productivity of a given farm household is determined on many factors in the literature.

(Ellis, 2009), argued that small farms interms of land size are more productive than large farms and his recommendation thatagricultural development strategy based on the promotion of small rather than large farms can serve both growth and income distribution objectives.

Empirical studies have also arrived on the same conclusion (Berry, 2011). But still there are also counter arguments which says large farms perform better than the small one.

Literature reviewed showed that agricultural productivity increases more in developed countries compared to less developing countries. This is due to high investment in research and development, labor, land and capital and improvement in the use of inputs such as fertilizer, machinery increases and others. It must be notice that agricultural productivity depends primarily on technological change, improved input use efficiency and conservation of natural resources. These in turn, depend crucially upon investments in agricultural research, extension and human capital.

Agricultural growth may reduce poverty through direct effects on farm productivity, incomes, and employment. It may also generate indirect impacts on the welfare of rural households through the growth linkage with the non-farm sector as well as through its impacts on food prices (Adeoti, 20013). There have been arguments that the poor typically spend a highshare of their income on staple food; therefore, they benefit from a decline in the price of staple food induced by agricultural productivity improvement.

In Asia, (Chang, 2014) determined how to promote agricultural productivity growth to achieve sustainable food security. The study looked at the role of investment, both in physical and human capital, in maintaining and increasing agricultural productivity. By using TFP and partial factor productivity functions they found that, the only way topromote agricultural productivity was through improving labor productivity. Due to the improvement in labor productivity, the agricultural output growth for these countries has remains positive from the period of 1961 to 1994.

According to (Haji, 2008), increased productivity in agriculture has a number of advantages. Firstly, it increases the flow of resources from one sector to the other, thereby enhancing

economic growth. Secondly, a higher level of agricultural productivity results in lower food prices that increase consumers' welfare. Thirdly, productivity growth improves the competitive position of a country's agricultural sector.

(Zepeda, 2015), by using number of models of production growth (index numbers or growth accounting techniques, econometric estimation of production relationships and non parametric approaches) to measure the change in output, to identity the relative contribution of different inputs to output growth and to identify the Solow residual or output growth not due to increases in inputs. He found that a relatively weak relationship between physical capital and growth, as compared to investment in technology and human capital.

(Fulginiti, 2014), using the data of eighteen developing countries over the period 1961–1985 to examined the changes in agricultural productivity. The study used a non-parametric, output based malmquist index and a parametric variable coefficient Cobb-Douglas production function to examine, whether declining agricultural productivity in less developed countries was due to use of low inputs. Econometric analysis indicated that most output growth was imputed to commercial inputs like machinery and fertilizers.

Another study made by (Byerlee, 2017)argued that interaction of productivity growth, farm income, employment, and food prices could lead to a pro-poor outcomedepending on two key conditions. Firstly, agricultural productivity per unit of labor must increase to raise farm income, but agricultural productivity per unit of land must increase at a faster rate than that of labor in order to raise employment and rural wages. Secondly, increased total factor productivity (TFP) in agriculture must result in a decrease in real food prices, but the TFP must increase faster than food prices decrease for farm profitability to rise and for poor consumers to benefit from lower food prices.

(Thomson, 2017), indicated four transmission mechanisms when there is an increase in agricultural productivity to progress the poverty reduction in rural households. These four transmission mechanisms are the direct impact of improved agricultural performance on rural incomes; an impact of cheaper food for both urban and rural poor; an agriculture's contribution to growth and the economic opportunity in the non-farm sector; and agriculture's fundamental role in stimulating and sustaining economic transition as shift from being primarily agricultural towards a broader base of manufacturing sector and services.

The (Triparti, 2015), studied Indian agricultural productivity growth by using Cobb-Douglas-production function, argued that an improvement is not only labor but also capital and land

productivity can improve agricultural productivity. Their results indicated that output elasticity of land was 1.98, labor 1.06 and capital 0.15 and when added up they gave a sum greater than one. This meant that labor and land inputs had positive and significant influence on agricultural productivity growth.

(Rao, 2018), studied the relationship between size of land holdings and agricultural productivity. He used the GLS regression technique to estimate a translog function to formalize the relation between output and inputs. His study was conducted using farm level data from several states in South India over the period 1962 to 1970. Thestudy finds that there was no systematic relationship between the measures of productivity and land size. He also indicated that capital had a positive effect, land and labor, a negative effect on the elasticity of gross value of output per unit of land. However, large capital infusion canceled out the negative effects of land, and led to a positive relation between land-size and productivity.

Another study made by (Kampen, 2014), stated that, the growth in agricultural production in Sub Saharan Africa in the past was achieved by expanding the amount of land cultivated, but today there is litter scope for increasing the area under cultivation. Further increase in agricultural production in the area could be achieved only by increasing the productivity of land and labor.

(Wiebe, 2013) in their study on "Agricultural policy, Investment and Productivity in sub-Sahara Africa (SSA),'' argued that an expected increase in output from improved infrastructure and price policies were difficult to quantify, but such improvements were probably prerequisites to make possible the increases in productivity from the use of conventional inputs and research. The study concluded that education of rural labor force and agricultural research is needed to improve the future prospects for productivity growth in SSA.

(Owuor, 2013), study partial factor productivity measurement by using cob-Douglas production function method; found that the determinants of family labor productivity are consistent with those of land productivity in Kenya. Agricultural land and family labor productivities are positively correlated and significant (0.64, 0.01) respectively. Most of the literature suggests that rural household income increases through agricultural farm land and agricultural labor productivity. This could be due to the fact that, agricultural productivity has a positive impact on real rural household incomes. This idea is consistent with (Blunck, 2016) argued that a high standard of living can be sustained by improvements in agricultural productivity, either through achieving higher productivity in existing farms or through successful entry into higher productivity farms.

(Palmer-Jones, 2017), during their evaluation of the link between poverty and geographical location of rural Indian households by using ordinary least square (OLS) and maximum likelihood (ML) estimation technique, found that the rural households are being poor or rich was strongly associated to where they lived and the low level of income as well as poverty were highly correlated with agricultural productivity performance.

(Aikaeli, 2015) studied the determinants of rural income in Tanzania by using feasible generalized least square (FGLS) estimation technique, finds that as the size of family labor force, cultivated land size for farm income and educational level of the household head increases, the per capital income of the rural household is significantly increased.

(Akram, 2013), in Pakistan by using cross-sectional data to analyze an empirical analysis of rural household income finds that, the increase of land holding size, the level of household head education, the households rental income and non-farm occupation are significantly increases the rural household incomes. The study used semi log multiple regression model to analysis the cross-sectional data.

Another literature shows that the standard of living or household wealth in most nations is determined by productivity with which a nation's human capital and natural resources are deployed and the output of the economy per unit of labor and/or capital employed (Porter, 2009). It is important to identify factors that influence on agricultural productivity in Ethiopian agriculture because these factors would automatically have indirect impacts on the poverty incidence if the force of agricultural productivity to the household income is significant. The determinants of agricultural productivity in particular country are different and distinctive from others.This section would refer to some studies in indicating of determinants of agricultural productivity 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 technicalefficiency of smallholder farmers, shows that, there was significant level of productivityimprovement among maize producing farmers (Geta, 2013). They were used a two stage estimation technique, translog production function to determine the levels ofproductivity 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, 2016), was 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.

The study conducted by (Bogale, 2005), in the assassination of the determinants of poverty in rural Ethiopia shows that cultivated land per adult in the household, the living geographical locations of the rural household, educational status of the household head and owning of oxen are significantly important determinants for holding the household resource endowments or households are deprived from basic livelihood assets.

Another study made by (Foltz, 2009), by using the panel data of cereal crops and translog estimation technique followed by FGLS for the fixed effect estimation, finds that the land size and family labors are significant for agricultural productivity in thestudy area of four regional state of Ethiopia.

The study made by (Holden, 2013)for the aim of investigating productivity difference among land certificate owner and non-owner in Tigray Regional state of Ethiopia by using Data Envelopment Analysis (DEA) based on malmquist productivity index, found 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.

(Ogada, 2014), used a two-stage nonparametric approach on household panel data to estimate the efficiency levels of the smallholders and establish the sources of its variation across Kenya's smallholder food crop farmers. His result indicated that age, gender, education, size of household, credit, social capital, family labour, intensity of manure use, distance to the nearest road and distance to the nearest market are negatively and significantly affect technical inefficiency and plot size under crops, land under other activities, annual rainfall amount and wage rate to farm worker positively affect technical inefficiency in the study area.

From this literature, the factors that influence the productionfunction include: fertilizer, labor inputs, cultivated land area or farm size, credit, education, pesticide,manure, animal power etc.

Chemical Fertilizer

A soil which has a high production potential and which at the same time is fertile cannaturally produce high yields. (Binam, 2009), found that farmers who are located inmore fertile regions perform significantly better than those located in less fertile regions. Therefore, reinforce the argument that improvement in soil fertility is a crucial element inincreasing productivity.

(Tchale, 2017), results also show that high levels of technical efficiency are obtained when farmers use integrated soil fertility options compared to the use of inorganic fertilizer only. Therefore, fertilizer appears to be themost important factor of production.

Labor

Most of African agriculture is traditional and characterized by labor intensive production and excess demand for labor often occurs during periods of land preparation, weeding and harvesting. Agricultural labor consists of two categories, namely hired labor and family labor. According to Mensah (1986), as stated by (Antwi, 2016), the causes of labor shortages in less developed countries is largely due to the migration of labor from rural to urban areas. According to (Antwi, 2016), labor is normally measured in man-days, man hours or in value terms. Labor availability is another often-mentioned variable affecting farmers' decisions concerning the adoption of new agricultural products or inputs. Most empirical studies are found that the estimated coefficient for labor was positive and statistically significant, which implies that labor increases the level of production and productivity. This means that the larger the family size with effective members, the morelabor is available for farming operations, thus increasing the production of farmers. On contrast, over utilization of labor input is negatively affects farm production, (Tijani, 2011) and (Tchale, 2017)

Land area or farm size

Land in agricultural production is quite heterogeneous in terms of soil size, soil type, associated soil characteristics and other productivity-related factors within developing countries. Failing to account for these differences would lead to a biased measure of theland input as well as productivity levels (Nehring, 2005). The majority of studies of agricultural productivity in developing countries support the view that there is an inverse relation-ship between productivity and farm size. This may be a result of market imperfections, such as missing rural labor markets. The recent literature suggests that land has a major influence on production since its estimated coefficient is positive in most studies; for instance, (Mushunje, 2009) study on relative technical efficiency of cotton farmers in Manicaland Province of Zimbabwe, find positive coefficients in land significant at all levels.

(Fufa, 2003), also found that the estimated coefficient of land is positive and significant. This shows that the positive influence of land on agricultural production. Most literatures are shows a positive relationship with output. However, producing farm outputs in uneconomic region or zone found to negative correlation with output, (Chirwa's, 2013). In the above literature we reviewed both the theoretical and empirical literature onagricultural productivity and rural household income. The theoretical literature suggeststhat, the agricultural labor productivity is crucial for household income enhancement andthe rural farm-household income is revealed mainly derived from farm and non-farmsources.

(Biam, 2016), employed the Cobb-Douglas stochastic frontier cost function to measure the level of economic efficiency and its determinants in small scale soybean production inCentral Agricultural Zone of Nigeria. Their result of the analysis showed that average economic efficiency was 52%. The study found age, farm size and household size to be negatively and significantly related to economic efficiency. Education, farming experience, access to credit and fertilizer use were significantly and positively related to economic efficiency. No significant relationship was found between economic efficiency and extension contact and membership of farmers' association.

In the empirical literature, agricultural productivity determinants are generally estimated using the Cobb-Douglas production function models and argued that, both labor and land productivity can improve agricultural productivity. Regarding household incomeanalysis, literature shows that, rural household income increases through agricultural labor and land productivity due to its positive effect on household income.

Credit: This is dummy variable that represents whether the farmer get credit access or not for teff production related purposes in the production year. Since farmers in developing countries have not sufficient working capital to run agricultural activities unlike developed countries, farmers need to have that potential to engage in such business. Hence, credit is an important source of financing the agricultural activities of smallholder farmers and this is supported by empirical studies conducted by (Biam, 2016) and (Gebregziabher, 2012) amount of credit is positively and significantly related to level of technical efficiency of crop production.

Hence, in this study credit was expected to have positively related with *teff* production efficiency.

Pesticide: it is a dummy variable that represents whether the farmers use or not for teff production related purposes in the production year.

The role of pesticides has become critically important with modernization ofagriculture. Modernization of agriculture implies increased use of modem inputs such as chemical fertilizer, irrigation and modern seeds, which provide a favourable climate for rapid growth of pests. Moreover, modern seeds are more susceptible to insect pests and diseases.The use of pesticides, however, carries several dangers.

Non-optimal and non-judicioususe of pesticides may result in a series of problems related to both loss of their effectiveness in the long run and certain externalities like pollution and health hazards (Sabur, 2001).

Heavy treatment of soil with pesticides can cause pollutions of beneficial soil micro-organisms to decline. According to the soil scientist Dr. Elaine Ingham cited by (Wasim, 2009), "If we lose both bacteria and fungi, then the soil degrades. Overuse of chemical fertilizers and pesticides have effects on the soil organisms that are similar to human overuse of antibiotics. Indiscriminate use of chemicals might work for a few years, but after a while, there aren't enough beneficial soil organisms to hold onto the nutrients". For example, plants depend on a variety of soil micro-organismsto transform atmospheric nitrogen into nitrates, which plants can use.

A review of studies in Ethiopia also addressing issues related to improved agricultural productivity and household income suggest that, the size of farm land and labor productivity are significant for agricultural productivity and positively affects the household income.

In summary, different studies used different models to analyse the productivity of farmers and the influence of different agro-climatic and socio-economic conditions on farmers'productivity. Therefore, undertaking studies on farm households' productivities in different localities help the policy makers and other development workers to design and implement an appropriate policy intervention. It was also indicated that a number of factors can affect the productivity level of farmers, but these factors are not equally important and similar in all places at all time. A decisive factor in one place at certain time may not necessarily be a significant factor in other places or even in the same places after some time. Therefore, policy implications drawn from some of the above empirical works may not allow in designing area specific policies to be compatible with its socio-economic as well as agro ecologic conditions.

In case of south Achefer district such type of research work has not been conducted and there is a need to know the level of productivity to small scale farmers particularly with respect to teff production since teff is one of the important crops to the study areas as well as the nation. In a nutshell, what can be suggested from the literature is that at the current level of technology and

factor endowment, there is a potential to increase agricultural production by improving the demographic, institutional, and environmental factors. Therefore, this study intends to fill this information and knowledge gaps.

2.5. Conceptual Framework

Conceptual framework is defined as a network or a plane of interlinked concepts that together provide a comprehensive understanding of a phenomenon. In other words, it is avisual or written product that explains either graphically or in a narrative form, the mainthings to be studied (key factors, concepts, variables and the presumed relationships among them (Miles and Huberman, 2014).

The conceptual framework for this study is based onthe institutional analysis and development approach of the new institutional economics. In the institutional analysis and development approach by (Ostrom, 2011) it is assumed that an exogenous set of variables that influences situations of actors and the behaviour of the actors in those situations leading to outcomes, which then feedback to modify both the exogenous variables and the actors and their situations.

The conceptual framework is shown in the following Figure below, which represents how various factors inter-relate to influence teff productivity and hence the welfare of teff producers.

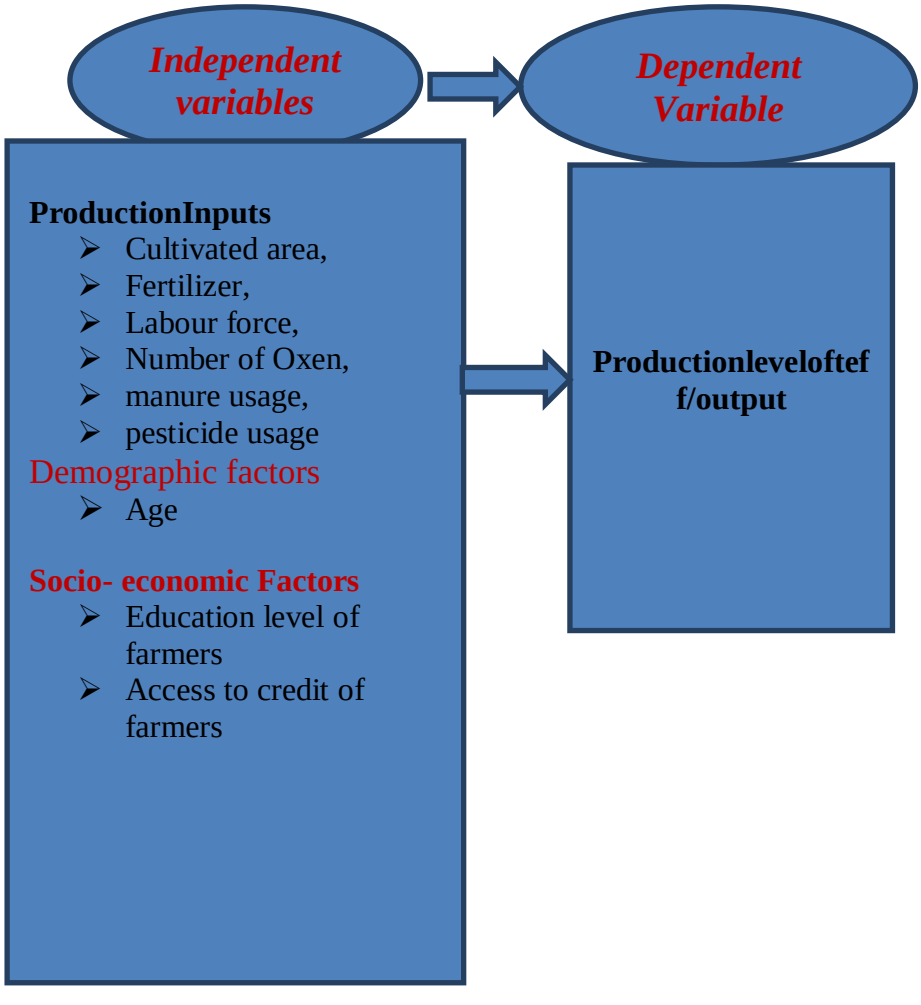
The policy environment is characterized by agricultural policies, governance and existing political and economic trends in the country which have an influence on the farming system and indirectly determine teff productivity. However, within the farming system various sets of factors interrelate to determine teff productivity.

Production inputs such as fertilizers, area, oxen power (number) and labour are used as input into teff production. The availability and distribution of these inputs may be influenced by policy framework in place which in turn determines teff productivity. It is expected that more inputs used by the farmers up to recommended level leads to higher teff productivity. In addition, teff productivity is also affected by technical efficiency because for a production to be effective, the way in which available inputs are utilized is crucial.

However, productivity of farmers is also influenced by farmer's characteristics, cultivated land characteristics, crop specific factors, institutional and socio-economic characteristics of farmers. A farmer that is technically efficient is therefore expected to realize higher teffproductivity compared to that of less efficient in teff production. Therefore, this has a positive spill over effect on the welfare of teff producer farmers. Improved welfare of farmers then provides a feedback effect in form of increased access toproduction inputs and relevant lessons to policy makers.To

conduct this study, both demographic and socioeconomic Variables are taken as independent variables while the teff productivity of the farm house hold is the dependent variable.

Figure 1. Conceptual framework



Source; Literature Reviews (2021)

CAPTER THREE

RESEARCH METHDOLOGY

3.1. Description of the Study Area

Location

South Achefer woredais one of the 15 (fifteen) woredas found in West Gojjam Administrative Zone, is located 60 km south-west of Bahir Dar town, the capital of Amhara Region. It borders North Achefer to the north, Awi zone to the south and west and Mecha woreda to the east. The lesser Abay river defines the woreda's eastern boundary. It is sub-divided into 22 rural and 4 urban kebele administrations, the lowest level in the hierarchy of government administrative system.

Topography and climate

The altitude of South Acheferworeda ranges from 1,500 to 2,500 m above sea level. The woreda is known for its flat topography, but there are also mountains, valleys and undulating areas. 87 per cent of the woreda has a temperate climate and the remaining 13 per cent has roast climatic conditions. The mean annual rainfall ranges from 1,450 to 1,594 mm.

Population

According to the Amhara Regional State Bureau of Finance and Economic Development 2019 population prediction, the total population of the woreda is about 148,974. The rural population is 134,447 or 90.2 per cent, which is high when compared with the national level, 83per cent. The number of people living in urban areas is 14,528, accounting for 9.8per cent of the total population of the woreda. This clearly indicates that any effort to improve the productivity of agriculture in this woreda will make a considerable contribution to improving the wellbeing of the community at large.

According to the woreda agriculture office sources, the total geographical area of South Achefer is about 118,228 ha. The arable and grazing lands are known to be 39,195 and 18,018 ha respectively. The forest land covers about 4,850 ha or 4% of the total geographical area. Out of the total, the female population is 73,456 or 49.3 per cent, and the male population is 75,519 or 50.7 per cent. Dividing the total population by the total geographical area, we can estimate that

the population density is about 1.24 people per hectare, which can be considered as densely populated.

Agriculture and livelihood practice

Mixed farming is practiced in all parts of the woreda and by each of the households in the community. It is at subsistence level and practiced in fragmented holdings which mostly lack of modern technology. The average land holding at woreda level is 1.5 ha per household which ranges from 0 to 3 ha among the farmers in the woreda. In the crop sub-sector, the main crops grown include maize, teff, small millet, wheat, chickpea, beans, Niger seed, and cabbage. In the livestock sub-sector, cattle are dominant, and large numbers of poultry, sheep and goats are also kept. Oxen, cows, heifers, bulls, calves, chicken, goats and sheep are found in numbers in most households. Livelihood therefore depends to a large extent on agricultural production and trading. South Achefer is considered as one of the most food secure and surplus producing woreda in the region.

3.2. Data Sources

The study used both quantitative and qualitative data. Quantitative data were collected through individual survey based structured questionnaires. The questionnaires were designed and formulated to collect information about socio-economic and demographic determinants of teff production level from sampled farm house holds. Qualitative data were also collected through focus group discussions (FGDs). The FGDs were administered with those farmers who were produced teff at the time of the survey. It was carried out to together information in order to substantiate the findings obtained through structured questionnaires.

Besides, secondary data obtained from records of administrative offices, publications, journals, books and other sources relevant to this study were also used to enrich the investigation.

3.3. Sampling Technique and Sample sizeDetermination

In order to select sample households, multi-stage sampling technique where combinations of purposivesampling, simple random sampling and convenience sampling techniques were used to select the district and sample household heads. In the first stage, out of the 15 districts in west Gojjam Zone, South Achefer district is purposively selected due to long year experience in teff production in west Gojjam Zone. According to the information obtained from west Gojjam zone Agricultural Office, South Achefer district is known by producing large amount of teff. In the

second stage, out of the two agro-ecologies (temperate and roast) of the district, weyina dega (temperate) weather condition was selected purposively due to the major teff production part of the districtbut qolla or roast weather condition is not convenient to produce teff and most of the residents do not produce teff. In the third stage, out of the total weyina dega (16) kebele's, five kebeles selected by simple random sampling technique by using lottery method. However, due to fragmented settlement of farmers, the study applied convenience sampling technique from each selected kebeles based on probability proportion to size sampling technique in the fourth stage.

In order to determine a representative sample size from the selected kebeles, the study used a sample size determination formula given by Yamane (1967) as cited by (Abugamea, 2018). The relation is given as below.

The sample size for the study is determined based on Yamane (1967) since the population is homogenous in agro-ecology and production system. The simplified formula provided by Yamane is used to determine the required sample size at 91.89% confidence level and 8.11% level of precision. The simplified formula used to determine the sample size of the study is specified as follows.

$$n = \frac{\mathrm{N}}{1 + \mathrm{N(e)2}}$$

Where: n = sample size; N = total number of teff producing farmers in weyina dega kebeles (15,528); e = level of precision (0.0811).

$$n = \frac{15528}{1 + 15528(0.0811)2} = 150.56 \approx 151$$

Based on the formula the total sample size of the study was 151 farmers.

In order to determine the number of sample respondents from each five kebeles, the researcher applied the proportional sample determination technique as follow;

$ni=\frac{Ni}{N}n$ Where n_i is the proportional sample taken from each sample kebele

N_i the total farmer population of each respective sampled kebele

N is the sum of the total teff producer population of the five kebeles and

n is the total sample size taken.

Therefore, the distribution of samples in to fivekebeles is shown in the table below;

Table 1.Distribution of Samples Across Five Kebeles

kebele	Number of teff producer population	Proportional sample size (ni=$\frac{Ni}{N}n$)
Amba	250	ni=$\frac{250}{1622} * 151$=23
Kati	302	ni=$\frac{302}{1622} * 151 = 28$
Atit	392	ni=$\frac{392}{1622} * 151 = 37$
Nunu	298	ni=$\frac{298}{1622} * 151 = 28$
Limtan	380	ni=$\frac{380}{1622} * 151 = 35$
Total sample		**151**

3.4. Methods of Data Analysis

Descriptive statistics and inferential statistics along with econometric models were used to analyze the data. Descriptive statistics such as mean, standard deviation, frequency and percentage were employed to analyze the data collected on socio-economic, institutional and agro ecological characteristics of the sample households while inferential statistics such as t-test and chi-square ($\chi 2$) tests used to undertake statistical tests. The econometric analyses followed the following processes. In the first step, the data were checked for regression model assumption including multicollinearity, Heteroskedasticity and model specification test. Finally, the data were analysed using Cobb-Douglass production approach by using translog estimation technique.

Econometric Models

Among the possible algebraic forms, Cobb-Douglas and the translog functions have beenthe most widely used functional forms in most empirical production analysis studies. Each functional form has its own advantage and limitations. Some researchers argue that Cobb-Douglas functional form has advantages over the other functional forms in that it provides a comparison between adequate fit of the data and computational feasibility. It is also convenient in interpreting elasticity of production and it is very parsimonious with respect to degrees of freedom. So, it is widely used in the frontier production function studies as stated in (Hazarika, 2016).

Most of the studies using the Cobb-Douglas production function approach stated that, the functional form of the Cobb-Douglas production model is assume homogeneity, unitary elasticity of substitution between input and output. And also it is among the best well known production function utilized in applied production and productivity analysis (Enaami, 2011).

But According to (PHIRI, 2018), the Cobb-Douglas production function is degree one if $\alpha + \beta = 1$, Then Productions function of degree one has constant returns to scale. If $\alpha + \beta < 1$ then the production function exhibits decreasing returns to scale. If $\alpha + \beta > 1$ the production function exhibits increasing returns to scale. The value of α and β will determine what degree of returns to scale a Cobb-Douglas production function can exhibit. Since the values of α and β are not limited, Cobb-Douglas production function can exhibit any degree of returns to scale.

The logical basis for choosing Cobb-Douglas production function is based on the fact that it is relatively simple and convenient to specify and interpret.

By considering all these, the model employed was specified started with output supply equation which is taken out from the theoretical farm household model described under the theoretical model measurements in chapter two. The output supply equation includes inputs, socio-economic and demographic characteristics of households.

Agricultural labor productivity levels are determined by many causes, including in any production function of the agricultural sector except the labor force since it is already the labor productivity denominator. These agricultural productive factors have been included in all estimations of agricultural productivity (Hayami, 2008). However, the current analysis consider all the factors of production such as cultivated area of land, chemical fertilizer, number of oxen as proxy for capital input, are considered.

The econometric model applied for analyzing factors influencing the agricultural productivity is the Cobb-Douglas production model shown below in equation.

$$\mathbf{Y_i=\alpha(L^{\beta 1}{}_i K^{\beta 2}{}_i)e^{\mu i}} \text{----------(1)}$$

Where: **Yi**= is the value of the **ith** hh all teff output in quintal (Qt) during Period 2012/13year

Li= is the ithnumber of labor inputs used during period 2012/13year

Ki= is the ith capital inputs at a time 2012/13year

μi= is the disturbance or an error term

α =is the total factor productivity,

ß$_1$and **ß$_2$**=are elasticity of labor and capital respectively

If we transform equation (1) in its log-transformation form, it will give us:

LnYi =α+ß1lnLi+ß2lnKi+µi …… (2)

Therefore, in the case of our several independent variables the ln-linear model would be:

$LnYi=\alpha+ß_1lnlabi+ß_2lnldi+ß_3lnFEri+ß_4lnoxi+ß_5agi+ß_6edui+\gamma_1PESi+\gamma_2cri+\gamma_3manr_i+ui$----- (3)

Where,

LnYi= the log of total teff farm output produced by ith hh during the survey period of 2012/13 E.C year

Lnlabi= the log of ith hh agricultural labor inputs during the survey period of 2012/13 E.C year

Lnldi= the log of cultivated land area of the ith hh during the survey period of 2012/13 E.C year

LnFEri= the amount of chemical fertilizer in quintal used by the ith hh during the survey period of 2012/13 E.C year

lnoxi= the number of oxen used to plough by ith hh during the survey period of 2012/13E.C year

agi=Age of the rural farm household head the ith hh during the survey period of 2012/13E.C year

edui= Educational level of the ithhh head during the survey period of 2012/13 E.C year

pesi= if the ith hh were used pesticide or not during the survey period of 2012/13 E.C year

cri= if the ithhh was got credit during the survey period of 2012/13 E.C year

manri= if the hh used animal manure during the survey period of 2012/13 E.C year

3.5. Definition of Variables

In the course of identifying factors influencing the production level of teff through the rural household, the main task is to analyze system which factors influence the productivity performance of agricultural through the rural household farming. Therefore, potential variables, which are supposed to influence farmer's production level of teff, will be explained next.

Dependant variable (amount of teff produced during the production year 2012/13)

The dependent variable of $Y_i$is the total amount of teff produced expressed in terms of physical output of teff in quintal (Qt) of sample households. It is the logarithm form of the value of the i-th rural household total teff output (in quintal).

ExplanatoryVariables

Variables of the study Review of literatures on the determinants production level of teff in the rural household conventional inputs that are all used for farm production are also used as inputs for productivity measurements. Beside the conventional inputs, the demographic and socio-

economic factors will use to establish working hypotheses for this study. In other words, among a number of factors, which have been related to productivity, in this study, the following conventional inputs and demographic, socio-economic factors will hypothesize to explain the dependent variable.

1. Agricultural labor input (Lab): The labour force is proxies by percentage of agricultural labour force.

According to (PHIRI, 2018), the relationship between labour force and agricultural productivity is expected to be negative. This is due to the pressure on the agricultural land with an increase in population.

Labour represents the total labour (family, exchange and hired) utilized in various farm activities (plough, sowing and fertilizer application, weeding, harvesting and threshing). It is a critical input and perhaps a major constraint in the agricultural sector where mechanization remains a dream in color far from its realization. Human labor is the most important input to mobilize other inputs in the production process (Sharma, 2016). This refers to the total number of family members of the household who have directly involved on the farm activity measured in man equivalent and the total hired labor during the production process. The number of all family members those who were involved in farm activity were included as family labor. The more the labor force utilized for the farm production process the more farm land preparation will be made. Therefore, agricultural labor was hypothesized to have a positive impact on agricultural productivity.

2. Cultivated area of land (ld): It is a continuous variable which is the total cultivated area of land (it is the sum of owned cultivated land, rented-in land and land secured through share cropping arrangements during the survey period) by the household. Larger firms might benefit from economies of scale, but larger farms can also practice less intensive forms of agriculture, which will result in a lower productivity per hectare, but not necessarily per worker. The larger the cultivated land size the more households may produce farm output which required additional labor and capital demands. The main hypothesis was that the households who cultivate larger size of land can utilize more labor and will be more productive than household those who cultivate small size of land.

3. **Chemical fertilizer (FER):**

It is a continuous variable that the total amount of chemical fertilizer used by sample households to produce farm output. The agricultural productivity of the household those who are the user of chemical fertilizer and do not user varies due to may be chemical fertilizer input. Therefore, chemical fertilizer was expected to hypothesize that it is positively related with farm productivity.

4. **Age of the rural farm household head (AG):**

The farmer become less efficient as he/she gets older and his ability to manage farming activities are expected to decrease. Younger farmers are tending to be more open and likely exposed to methods and techniques (Biam, 2016).

It is a continuous variable, defined as the farm household heads age is the number of years from the date of birth to the day of the survey interview date in full year. Those household heads having a higher age due to a good farm experience will have much better association with more productive, and it was hypothesized that household heads with certain age rage may have more productive.

5. **Educational level of the household head (EDU):** The number of years or the highest grade completed by the household head during the survey period. Household heads who attend more level of education are expected to have more exposure to the external environment and accumulate knowledge of farm practicing. They have a better ability to identify the problem of their farm income as well as analyze its costs and benefits (Lelisa, 1998).

A lot of empirical studies showed that education is one of the most recognizedfactors in determining the efficiency level of the farmers in the world and resulted that education determined productivity positively and significantly (Hailemaraim, 2015), (Ali S. a., 2014) and (Ouedraogom, 2015).

Therefore, it will be expected that those farmers who are advanced in school level have better opportunity for agricultural productivity.

6. **Pesticide (PES):** It take is a dummy variable weather the households were used pesticide or not to produce teff during the survey period. The labor productivity of the household those who are the user of pesticide and do not user varies due to may be the use of pesticide input. Therefore, pesticide will expect to hypothesize that it is positively related with farm productivity.

7. **Credit access (CR):** It is measured in terms of whether at least one member of the household has received a credit or not during the last 12 month prior to the survey period.

Farmers who have access to credit may overcome their financial constraints and therefore buy inputs. Farmers without cash and no access to credit will find it very difficult to attain and adopt new technologies (Wolday A. , 1999). It is expected that receiving credit will increase the probability of farm productivity.

8. **Manure used (MANR**): It is also a dummy variable which measured whether the household were used the animal dung or manure or not duringthe survey period. Households those who useanimal dung or manure for crop production process during the survey period will expect to increase the probability of farm productivity.

9. Number of oxen (OX):

It is the number of oxen that the household was used to produce the teff output during the survey period.

There may be a productivity differences between households those who has an ox and not have. As a result, there will be a positive relationship between production level of teff and number of oxen (Beyene, 2008).

10. $\mathbf{U_{it}}$ is the random error term.

Table 2. Variable Description and the Variables Used for Regression of Determinants of Teff ProductionLevel

Variables	Descriptions	Measurement units
lnYit	The natural log of the value of totalteff output produced by the household	Quintal
lnLab	The number of family members and hired labour those who are participated on teff production process	number
lnLd	The natural log of the total teffplanted area of land by each households	Hectare
lnFER	The natural log of chemical fertilizer applied for eachcropped area to produce teff	Kilogram
lnOX	The natural log of ploughed oxen owned by the households	Number
AG	Age of the household head	Number
EDU	The highest level of grade completed of the household head in year	Grade completed
PES	Whether the households were used pesticide or not to produce farm output	Dummy "1" if used"0" otherwise
CR	At least if one member of the household was received credit	Dummy "1" if yes"0" otherwise
MANR	If the household were used Manure or not	Dummy "1" if yes"0" otherwise

CHAPTER FOUR

RESULTS AND DISCUSSION

The chapter has been divided into two main sections. The first section deals with the results of descriptive analysis pertaining to socioeconomics, demographic characteristics and various activities related to teff production undertaken by sample household heads. In the second section, the econometric results related to level of technical productivities realized and factors affecting production level of teff have been presented and discussed.

4.1. Descriptive Results

The descriptive statistics presented in this section is comprised of demographic characteristics and institutional support.

4.1.1. Demographic and Socio-Economic Characteristics of Sample Households

Age of the household head: The survey result showed that, the mean value of age in the sample household heads was 39.58 years. Their age ranged from 24 to 58 years with standard deviations of 8.19. It is one of the important factors which are used as the farming experience of the farmer. Diminution in the size of cultivated area and subdivision of holding are phenomena of long period. Age of household is important to study such a long period phenomenon, related with the change in farm size and extent of subdivision. All these contribute in determination of individual farm efficiency.

Education status of the household head:

An attempt was made to assess the educational status of the sample households who had informal and formal education. Educated farmers were expected to adopt new agricultural technologies and had better managerial skill (Lockheed, 1980).

In the study area, the average years of formal schooling of sample farmers were found to be 2.74 years with standard deviation of 2.20. The maximum educational achievement for the sample farmers was grade 8. From the total sample household heads, 80.13% of the total sample household heads have attended formal level of schooling.Education enhances the acquisition and utilization of information on improved technologies by farmers. This implies that, education together with increased experience could guide farmers to better manage their farm activities.

4.1.2. Labour Availability

Family labour was the main source of labour for performing various farming activities for smallholder farmers. In the study area, it has been observed that there was a sort of labour division in various farm works between family members. Ploughing and planting were types of activities belonging to male whereas food preparation and childcare were left to female. In most of other cases than these both female and male worked together.

4.1.3. Resource Basis

4.1.3.1. Average size of cultivated land holding by sample household heads

To mitigate the challenge of land shortage, young farmers usually shared land with their parents and relatives during marriage or obtained land use access through sharecropping and renting in land.The survey result indicates that 8.72 per cent of the sample household had less than 0.5 hectare, 63.77 per cent of the sample household had between 0.5 and 27.51 per cent of household had more than 2 hectare of cultivated area. The analysis and pattern of cultivated land among sample households indicated that the average size of farm owned by the sample household heads were 1.48 ha. There were large variations in the distribution of the land holding among sample households. Above 40% of the households owned more than 1.48 ha ofcultivated land.

The farming system of the district is mixed crop-livestock where crop plays the major role in the farmers' income. Teff, maize and barley were the most frequently sown annual crops and cover 57.5%, 34.8% and 7.7% of the total plots respectively in 2012/13 E.C production year. The average area covered by cereal crops were 1.31ha of which teff constituted 0.75 ha (divided 197.5 hectares of farm area under teff production by the total sampled household heads). The other areas were allocated for pulse crops, home garden, grazing land and other farm activities.

4.1.3.2. Ownership of livestock by sample household heads

Livestock have diverse functions for the livelihood of farmers in mixed farming system. They provide food in the form of meat, milk, and non-food items such as manure as inputs into crop production. In addition, they were source of cash income and act as a store of wealth and play a determinant role in social status within the community and buffering risk. Cows were the largest class of livestock owned by sample farmers.

4.1.3.3. Level of oxen power utilization by sample household heads

Oxen were the only sources of traction power in the area. Shortage of oxen and there power leads to poor land preparation and delayed completion of the operation. Poor land preparation leads to poor plant establishment, heavy weed infestation and low yields.

Larger number holding of oxen permit a greater area of land to be cultivated (Ogada, 2016). Oxen power was found as an important factor of production in the study area. Almost in all sample kebeles, farmers on average ploughed their land three to five times for production of teff. Usually the land preparation started from the first commencement of rain and they continued ploughing each month until sowing of the crop. Weed infestation was found to be a serious problem in the area due to the high rain fall from the month of June to August. It was also observed that the sample farmers in the study area gave more emphasis to ploughing as compared to weeding which is the major challenge for improving productivity.

4.1.4. Description of Production Function and Variables

This part present summary statistics results of production variables (both the physical inputs used in the production of teff output) used for analysis in the translog model. The result of analysis for output variable indicates that on average a household produced 9.98 Qt of teff output that ranges from 7 Qt to 13 Qt with standard deviation of 1.88among the sample farmers in 2012/2013 production year (Table 3). This indicates there is no large variability of output among the farmers.

The average land area allocated to teffproduction (both owned and rented land) was approximately 1.31 hectare and ranged from 0.5 ha to 1.75 hectare with a standard deviation of 0.25 (Table3). The mean land allocated to teff conforms to the fact that the farmers are small scale and held family-managed and operated farm plots in the study area, which also confirms that, one of the characteristics of subsistence agriculture.

The mean level of labour (both family and hired) used by teff growers in the study area wasfound to be 2.45 labour, which was obtained by aggregating labour used for all teff production activities that include ploughing, sowing, fertilizer application, weeding, harvesting and threshing. This implies that, per house hold there are about 2.45 of farm labours are participated in one hectares of land for crop production process to enhance land productivity.

The minimum and maximum level of labour used was1and 3 labours respectively (Table 3).

Regarding fertilizer type, farmers in the study area commonly using DAP and Urea fertilizer. The summary result indicates the mean rate of fertilizer application of 64.9 Kg and which ranges from 50 Kg to 175 Kg minimum and maximum application rate, respectively. The use of oxen power in teff production activities like ploughing and threshing in the study area is usual. The result indicated that the number of owned oxen was 2.02, with the maximum and minimum of 1.5 and 0.5 pair of oxen per season respectively (Table 3). The mean of the household that uses the pesticides input and get Credit accesses are 54.9% and 55.6 % of the total sampled household with their standard deviation of 0.499 and 0.498 respectively.This implies that, only half of rural households have got credit accesses during the survey period.

4.1.5. Institutional Support

Credit: There exist both formal and informal lending institutions to provide credit. Theformal sources of credit in the study area are Amhara Credit and Saving Institution (ACSI) and local cooperatives, whereas friends, relatives, traders, and the like are informal sources from which farmers could get credit. Nevertheless, the requirements and procedure to use credit from the formal institutions were not as easy as the local co-operatives and informal institutions. For instance, in the case of ACSI farmers were asked to form a group of 25-100 farmers in one main group and 3-10 farmers in one sub group to get credit. If any one of the sub groups was unable to pay back the amount they acquired, the remaining main group members would be obliged to repay the total amount.

If any one of the sub group members was unable to pay back the amount he/she acquired, the remaining subgroup members would be obliged to repay the total amount. In addition to this, to be a member in a group the farmers must have live animals or land as collateral. Most of the time farmers face food shortage before the next new harvesting season. As a result, most of the credit user farmers reported that they used the money to purchase food grains and medicines. On the other hand, the remaining credit users also reported that they used the credit to finance school expenses and to purchase farm inputs. Even if the constitution and other land laws prohibit to sale as well as use land as collateral, it is reported that land was asked as collateral by credit institutions (formal as well as informal). Livestock and other physical properties and crops were also used as collateral by most of the informal lenders.

Table 3 Descriptive statistics of variables used in production function estimation

Variable	Observations	Mean	Std. Dev.	Min	Max
Output of teff in quintal	151	9.986755	1.879669	7	13
Labour used in number	151	2.450331	.5852491	1	3
Farm size in hectare	151	1.307947	.2523947	.5	1.75
Fertilizer used in quintal	151	64.90066	28.3106	25	150
Oxen used in number	151	2.019868	.6373926	1	3
Age of the household head in year	151	39.58278	8.185644	24	58
Educational level of the household head	151	2.741722	2.198374	0	8
Use of Pesticides (yes =1)	151	.5496689	.4991826	0	1
Credit access (yes =1)	151	.5562914	.4984745	0	1
Manure used (yes =1)	151	.5827815	.4947406	0	1
Log of teff output (teff in quintal)	151	2.283024	.1936488	1.94591	2.564949
Log of labour used in number	151	.9273601	.3201578	0	1.386294
Log of farm size	151	.2459704	.2251946	.6931472	.5596158
Log of fertilizer used in quintal	151	4.067279	.4808875	3.218876	5.010635
Log of oxen used in number	151	.6459526	.3545671	0	1.098612

Source: STATA summery results based on the survey of, 2013 E.C

4.2. Econometric Results

The econometric analysis of the study is mainly dealt with the analysis of major factors that determine teff outputof the rural farm households of south Achefer district.

4.2.1 Diagnostic tests

There were different demographic and socio-economic factors that were contributing in the determinants of production level of teff in the rural farm household's of south Achefer district. In

order to identify the significant factors, we employ the cobb-Douglass production function and translog model.

Prior to predicting the production level of teff production and making any empirical analysis using translog regression model, basic econometric tests such as Correlations, the overall significance, significance of individual variables, goodness of fit of the model, Heteroskedasticity and multicollinearity diagnoses were made.

Figure 2.General Regression Results of Variables

```
. reg lnY lnlab lnld lnfer lnox ag edu pes cr manr

      Source |       SS       df       MS      Number of obs   =       151
-------------+------------------------------   F(9, 141)       =    187.17
       Model |  5.1905106         9  .576723399   Prob > F        =    0.0000
    Residual |  .434469667      141  .003081345   R-squared       =    0.9228
-------------+------------------------------   Adj R-squared   =    0.9178
       Total |  5.62498026      150  .037499868   Root MSE        =    .05551

------------------------------------------------------------------------------
         lnY |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnlab |    .121408   .0206478     5.88   0.000     .0805887    .1622272
        lnld |   .1749394   .0256434     6.82   0.000     .1242442    .2256347
       lnfer |   .0573809   .0106162     5.41   0.000     .0363934    .0783683
        lnox |   .0408015   .0174654     2.34   0.021     .0062737    .0753294
          ag |   .0055855   .0009765     5.72   0.000      .003655    .0075161
         edu |   .0128607   .0027356     4.70   0.000     .0074526    .0182688
         pes |   .0390534   .0143332     2.72   0.007     .0107176    .0673892
          cr |   .0343319   .0156525     2.19   0.030     .0033879    .0652758
        manr |   .0331424   .0159046     2.08   0.039       .0017    .0645847
       _cons |   1.551433   .0467667    33.17   0.000     1.458979    1.643888
------------------------------------------------------------------------------
```

Source: STATA regression results based on the survey of, 2013 E.C

Statistical significance of coefficients: In order to evaluate the statistical significance of coefficients of the model, the researcher used chi2 and the 't'statistic. Accordingly all explanatory variables were found to be significant at 5% level of confidence.

The parameters of the translog model of the partial factor productivity of the south Achefer district farm household indicate that, most of the variable was statistically significant. This implies that the variables used in the model of estimation (Equation 3) are significant determinants of teff production level in the rural farm households of the district during the period of analysis (2012/13 E.C).

The estimation model shows that, agricultural labour, cultivated area of land (farm size), amount of fertilizer, the use of pesticides, the number of oxen used for ploughed and the age of the household head were found to be the determinant factors of output teff production of rural households. It shows that, as the agricultural labour increases by 1 percent, teff production level/output increases by 12.14 percent. As a result having more labour with in a household would be able to a high possibility of farm management work like timely land preparation to increase farm output.

The result implies that, the increase of labour force usage, increases output of teff to rural households.

There is a significant land productivity difference between chemical fertilize user household and non-user. As the household are increases the use of chemical fertilizer inputs by one percent the land productivity increases by about 5.7 percent.

The use of pesticide input in teff production processes was also statistically significant at 5 percent level. This means, if the household use of pesticide, the teff production/output increases by 3.9per cent relative to non-user households. Therefore, accessing and advising the rural household to the use of pesticide inputs during their farm production processes would enhance of productivity of rural households.

The number of ploughed oxen variable is also statistically significant at 1 percent level and it shows a positive change in productivity as the household use the one extra more ploughed ox, teff productivity increases by 4.1per cent. This implies that productivity is associated with more oxen use of farm practicing for productivity enhancement in rural farm households.

Use of manure is also statistically significant, indicates that if the household uses manure, the teff productivity increases by 3.3 per cent relative to non-user households. Therefore, use of manure is important for land productivity enhancement especially as chemical Fertilizer input may not be affordable for some poor rural households.

There is also age of the household head is statistically significant at 5 percent level. This implies that as the age of the household heads increases by one more year, the output of the rural household shows a slightly increases by 0.56 per cent. One reason would be more a possibility of young household head to be matured and increases his/her farm practicing experience would be high which able to increase household's teff farm output.

Goodness of fit:

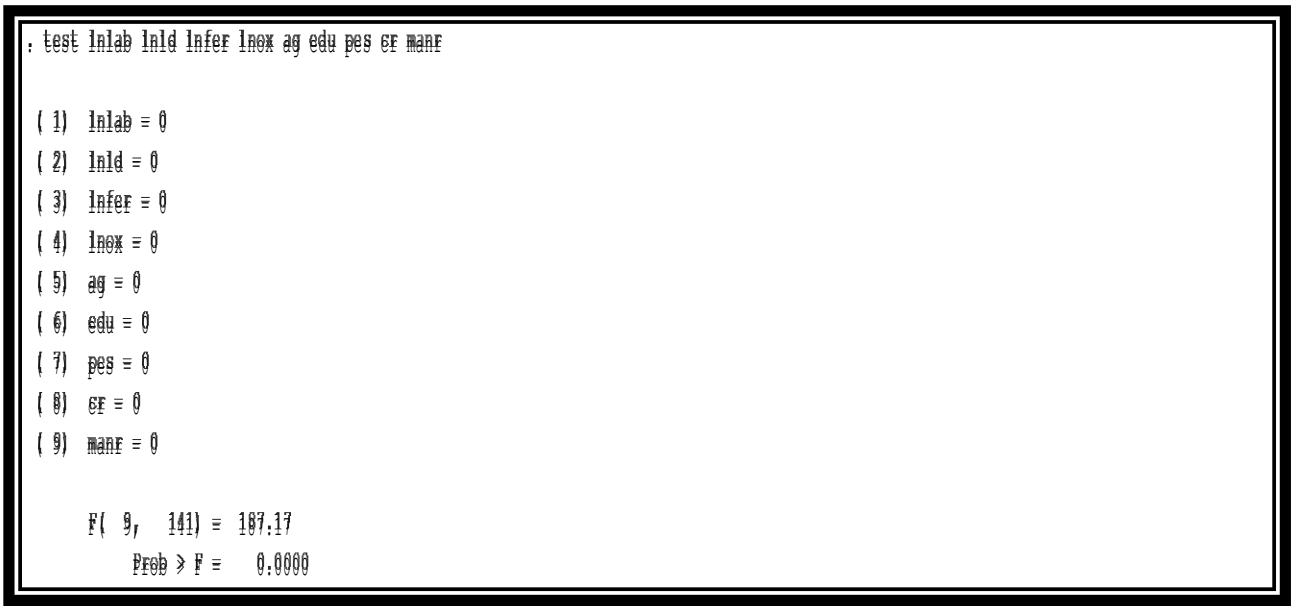
To measure the goodness of fit of the model, the researcher employed a non-parametrictest which is known as adjustedR squared (adj. R^2 Test). The value for adj R^2 for this model was found to be 0.9178 (91.8%). Hence this value assures that the model is good and the regressors explain 91.8% of variations in the model.

Overall significance of the model (F-test**):** To test the null hypothesis that all the slope coefficients are simultaneously equal to zero and the alternative hypothesis is at least one of the coefficients are different from zero, the researcher employed the 'F' statistic**..**

The value of F 187.17 (for 9 numerator degree of freedom and 141 denominator degree of freedom) is highly significant. Therefore, based on the F test, the researcher rejected the null hypothesis.

And also accordingly the likelihood ratio test statistics, result of the model is found to be (F=187.17with Prob>F = 0.000). This value results in the rejection of a null hypothesis. Meaning the model is significant overall (figure 3 and appendix *II*).

Figure 3 Overall Significance of the Model



```
. test lnlab lnld lnfer lnox ag edu pes cr manr

 ( 1)  lnlab = 0
 ( 2)  lnld = 0
 ( 3)  lnfer = 0
 ( 4)  lnox = 0
 ( 5)  ag = 0
 ( 6)  edu = 0
 ( 7)  pes = 0
 ( 8)  cr = 0
 ( 9)  manr = 0

       F(  9,   141) =  187.17
            Prob > F =    0.0000
```

Source:STATA results based on the survey of, 2013 E.C

Heteroskedasticity

It refers to situations where the variance of the residuals is unequal over a range of measured values. When running a regression analysis, Heteroskedasticity results in an unequal scatter of the residuals (also known as the error term).

In statistics, a vector of random variables is heteroscedastic if the variability of the random disturbance is different across elements of the vector. Here, variability could be quantified by the variance or any other measure of statistical dispersion. Thus hetroskedasticity is the absence of homoscedasticityabsence of constant variance of the residual.The researcher employed the Breush-Pagan test for hetroskedasticity and the model has constant variance.

Figure 4Test of Heteroskedasticitythe Model by Using Breusch Pagan Test.

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnY

         chi2(1)      =     0.18
         Prob > chi2  =   0.6693
```

Source: STATA results based on the survey of, 2013 E.C

Multicollinearity

Multicollinearity test for both continuous and dummy variables at the same time was done using Variance Inflation Factor (VIF), to check multicollinearity problem among all variables entered in the model. In addition, multicollinearity test of continues and dummy variables were checked by using variance inflation factor and coefficient, respectively.

According to (Gujarati, 2004), if the mean value of variance Inflation Factoris more than 10, it is usually considered as an indicator of serious multicollinearity. On the other hand, if the mean value of VIF is less than 10,it is usually considered as an indicator of no serious multicollinearity.

Variables individually having variance inflation factor more than 5 are believed to have serious multicollinearity problem and able to exclude as explanatory variables from the model. Variables having variance inflation factor less than 5 are believed to have no serious multicollinearity problem and able to include as explanatory variables in the model.

But in our model the mean value of variance inflation factor is 2.25 and each variables variance inflation factor is less than 5. As a result, test for multicollinearity using both methods confirmed that there was no serious linear relation among explanatory variables (Appendix 2 and Table 4).

Table 4.Test of Multicollinearity for Variables at the Same Time Using (VIF).

Variables	VIF	1/VIF
Age	3.11	0.321490
Manure	3.01	0.331778
Credit	2.96	0.337439
Pesticide	2.49	0.401275
Log labor	2.13	0.470083
Log oxen	1.87	0.535668
Education	1.76	0.567987
Log land	1.62	0.616002
Log fertilizer	1.27	0.788182
Mean value of VIF	2.25	

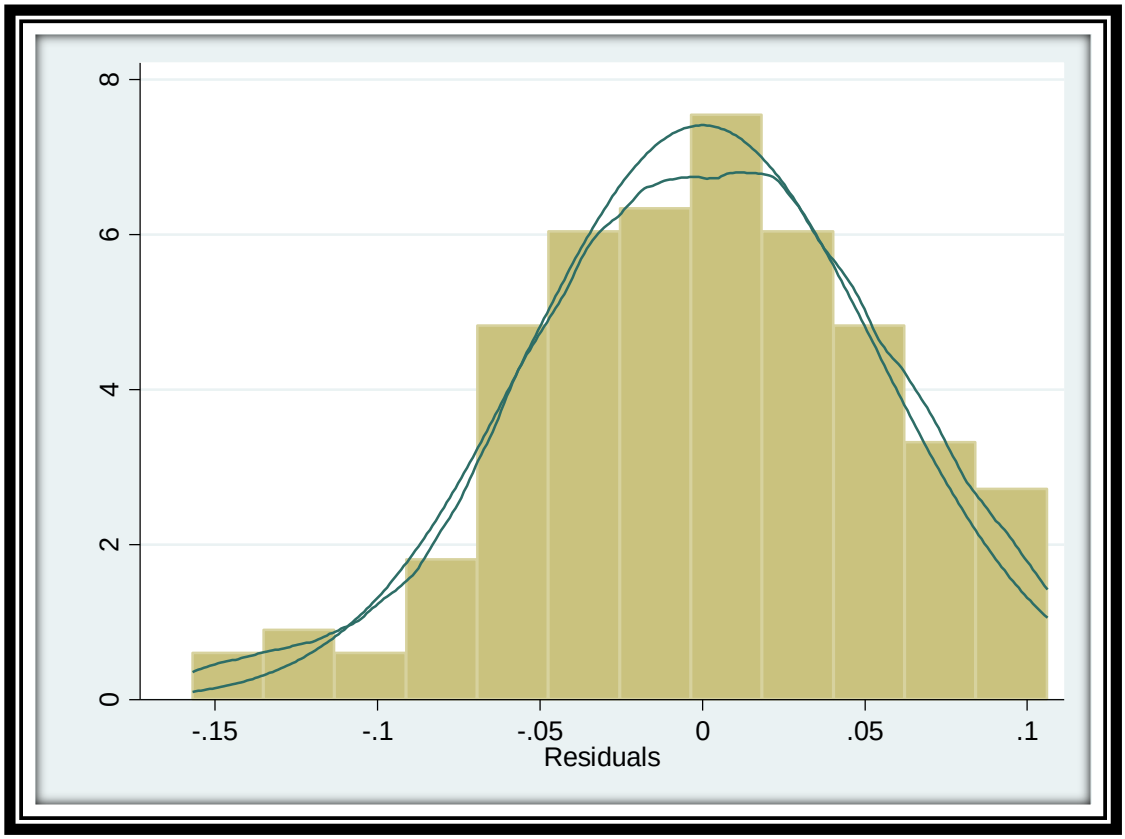
Source: STATA results based on the survey of, 2013 E.C

Normality

Normalityis the assumption that the underlying residuals are normally distributed, or approximately so. While a residual plot or normal plot of the residuals can identify non-normality, we can test.

The normal probability plot of the residuals is approximately linear supporting the condition that the error terms are normally distributed. As we have in the figure 5 the residual is approximately normally distributed.

Figure 5. Normality Test of the Residuals.



Source:STATA results based on the survey of, 2013 E.C

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Using cross sectional data, this study was conducted to determine the effect of labor, land, fertilizer, oxen, age, education, pesticide, credit and manure on teff production level/output in south Achefer district. The study used cross sectional data and Cobb-Douglass translog Model was applied.

Production/output level can be improved in two ways either by introducing new agricultural production technologies or improving the technical efficiency levels of farmers which is the possible strategies to increase the productivity of the agricultural sector in the country. Technical efficiency has remained an important subject of empirical investigation particularly in developing economies where majority of the farmers are resource poor. Alternatively, output growth may attribute to either technological progress or efficiency improvement. Improving technical efficiency of the farmer plays a great role in increasing productivity, given the current state of technology. The main objective of this study was measuring production/output level of teff producer farmers and identifying those factors which affect productivity of teff production in South Achefer district of Amhara National Regional State. Data were collected for the 2012/13E.C production season by interviewing a total of 151 sample teff producing farmers using a structured questionnaire that encompasses question related to demographic characteristics, inputs and output, institutional and farm specific characteristics. Multi- stage sampling technique was employed for selecting the respondents. Data were analysed using both descriptive statistics and econometric model.

The Cobb-Douglass translogmodel indicated that labour, cultivated area or farm size, chemical fertilizers and oxen power are significant determinants of teff output like other researchers discussed in the literature review even if there are researcher's contrary to these. The significant level of labour force is in contrary of Shakira Phiri research results. He concluded that the relationship between labour force and agricultural productivity is negative. This is due to the pressure on the agricultural land with an increase in population. But in this study it is positively affected the teff farm productivity because as labour force increases, it is important to prepare land timely and it leads to achieve more output.

Empirical study by (Wudineh, 2016) showed that farm size is negatively and significantly affect technical efficiency of the farmer in the production of cereal crops. Because as the farm size of a farmer increases the managing ability of him/her will decrease giventhe level of technology, this lead to reduce the productivity of the farmers. However, the study result showed that farm size is positively affected productivity. It shows that, as the agricultural farm size increases by one percent, teff output increases by 17.5 percent. As a result having more farm land within a household would be able to a high possibility of increase farm output.

The positive coefficients of the parameters indicate that increased use of these inputs will increase the production level to a higher extent. Hence, given that these inputs are used to their maximum potential, introduction and dissemination of these inputs will increase the production level of teffin the study area.

The socio-economic variables that are important in determining farmers` level of productivity were also identified. Accordingly, the results of model revealed; age, education, and credit found to be the major determinants of production level of the farmers in teff production.

The farmer become less efficient as he/she gets older and his ability to manage farming activities are expected to decrease. Younger farmers are tending to be more open and likely exposed to methods and techniques (Biam, 2016). But in the study area, age is positively significant to production/output level of teff. The reason is that, age of the household is the proxy for the experience of the household head in farming activities. If age of the household increases by one more year, the production/output level of the rural household shows a slightly increases by 0.56 per cent. One reason would be more a possibility of young household head to be matured and increases his/her farm practicing experience would be high which able to increase household's teff farm production/output level.

The purpose of this study is to identify major factors that determine the output level of teff in south Achefer district. And the finding shows that the issue of production/output levelis the result of different socioeconomic and demographic factors.

Productivity of the farmers can be increased through better allocation of the available resources especially: land, oxen number, labour, and fertilizer. Moreover, age should be considered in increasing resource use efficiency and agricultural productivity. This is because results showed that age is used as proxy of experience and younger farmers are technically more inefficient than older ones farm sector.

The amount of credit received was found to positively and significantly influence household productivity level. But Smallholder framers in the study area have financial constraints. This could imply that households needed external financial sources tosolve their own financial constraints. The farmers that are more educated are relatively more productive than less educated ones, in the study area.This may be due to the fact that more educated farmers have access to information and better communication media that helps them to use modern teff production technologies. Education is fundamental in improving the technical efficiency of farmers. Farmers should be inspired to improve their level of educational. Animal manures have been widely used as fertilizers in the study area. Organic fertilizers contain thebasic nutrients required by crops and it has a positive effect on output in the study area.

5.3 Recommendations

The researcher put the following recommendation based on the findings of the study.

- The attention of policy makers to mitigate the existing level of food deficiency andpoverty by improving agricultural production should not stick only to the introduction and dissemination of inputs (esp. fertilizer) but also they should give attention towards improving the existing level of efficiency. The argument here is that improvements in the use of improved technologies are expensive, require relatively longer time to achieve and farmers have serious financial problems. Moreover, the result of improvement in the use of improved technologieswill be high if it is coupled with improvement in efficiency.
- Thus, local government or other concerned bodies in the developmental activities working with the view to boost productivity of the farmers in the study area should work on improving productivity of farmers by giving especial emphasis for significant factors of production.
- There should be timely supply of fertilizer and improved seed at a reasonable price toimprove farmers' efficiency in the production of teff and other crops.
- The farmers that are more educated are relatively more productive than less educated ones, in the study area. Therefore, the regional governments need to strengthen farmers' access to education that could be implemented through expansion of farmers training centre or expansion of formal and non- formal education in the area.

- Since the highest share of respondents said that most of the time cost of the input is greater than output price. Government should encourage more innovations and creativity creation of productivities in the agricultural sectors by providing finances to research centers, conducting research courses on agricultural sectors to increase level of teff output.
- Efforts should be made on creating awareness for rural households on application of pesticide and fertilizer.
- The government should increase an access of credit for farmers without complicated collateral in order that they can increase their productivity and this would encourage more farmersto go to work on agriculture and thus decrease migrants from rural to urban. This can be done by identifying the pushing factors that expose farmers to migrate in to the urban areas and setting solutions to those pushing factors.
- Amhara Credit and Saving Institution (ACSI) and other financial institution have mandated to provide relatively high amount of credit for farmers and harmonization loan delivery with the time input required and loan payment plans with harvesting seasons.

Reference

Abera, A. (2011, May). DEMOGRAPHIC AND SOCIO-ECONOMIC DETERMINANTS OF YOUTH UNEMPLOYMENT IN DEBREBBIRHAN TOWN. *Center for Population Studies*, 78-80.

Abshoko, A. D. (2016). Determinants of Youth Unemployment; Evidence from Ethiopia. *Global Journal of HUMAN-SOCIAL SCIENCE: A Arts & Humanities - Psychology*, 4-6.

Abugamea, G. (2018, january). Determinants of Unemployment: Empirical Evidence from Palestine. (j. park, Ed.) *Munich Personal RePEc Archive, xii*, 7-10.

Adenomon, M. O.-U. (2018). Determinants of Unemployment Rate in Nigeria. *Southeast Asian Journal of Social Science*, 87-92.

Adeoti, J. O. (20013). Technological Constraint and Farmers' Vulnerability in . *Paper presented at the 7th*.

Adugna, L. (2002). "Occupation Diversification in a Unitary Household Model: Evidence from Ethiopia". *In First International Conference on the Ethiopian Economy, EEA,*.

African news. (2017). *Unemployed youth behind Ethiopia's anti-govt protests.* Addis Ababa: https://www.africanews.com/2017/11/01/ethiopia-anti-govt-protests-is-a-youth-unemployment.

Aikaeli. (2015). Impact of Modern Agricultural Technologies on Smallholder Welfare: Evidence from Tanzania and Ethiopia. *Food policy,37*, 283-295.

Aklilu. (2015). Review of literature on productive efficiency in agricultural production. *Journal of Applied Sciences Research, 5(7)*, 796-801.

Akram, N. a. (2013). Economic Reform, Growth and the Poor: Evidence from Rural Ethiopia. *Journal of Development Economics 81*, 1-24.

Alamirew., G. M. (2016). Analysis of technical efficiency of smallholder. *Journal of Science,*, 204-212.

Ali, a. K. (n.d.).

Ali, K. (n.d.).

Ali, K. H. (n.d.).

Ali, S. a. (2014). Technical efficiency of wheat production in district Peshawar, Khyber Pakhtunkhwa, Pakistan. . *Sarhad Journal of Agriculture, 30(4):*, 433-441.

Alston, J. J. (2016). *Perceived Productivity, Forgone Future.* Harare, Zimbabwe.

Anne, T. (2013). Agriculture, Growth and Poverty Reduction. UK:. *Agriculture and Oxford Policy Management.*, 36-48.

Antle, J. M. (2012). “Agricultural Productivity: measurements and. ” Chapter 2 in resource for the future.

Antwi, M. (2016). *An assessment of efficiency of small-scale farmers in Venda and Lebowa. Northern Province.* Unpublished M.Sc. (Agric Economics) Thesis. University of Pretoria, Pretoria.

Aselifew, A. (2011). Demographic and socio-economic determinants of unemployment. 53-44.

Assfaw, A. (2011). Demographic and socio-economic determinants of youths. 48.

Baah, B. (2013). Determinants of unemployment in Ghana. *african development rview*, 385-399.

Bakare. (2011, may). The Determinants of Urban Unemployment Crisis in Nigeria:. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS) 2 (3):*, 184-192.

Batu, M. M. (2016, May). Determinants of Youth Unemployment in Urban Areas of Ethiopia. *International Journal of Scientific and Research Publications, 6*, 7.

Bereket, G. (2017). *Youth unemployment and underemployment.*

Berg, M. V. (2016). Poverty and the Rural Non-Farm Economy in Oromia Ethiopia. *International Association of Agriculture Economists Conference,*.

Berhanu, A. a. (2005). Characteristics and determinants of youth unemployment, underemployment and inadequate employment in Ethiopia. *Employment Policies Unit*, 47.

Berry, R. A. (2011). Agrarian Structure and Productivity in Developing. *The Johns Hopkins University Press.*, 89-107.

Beshir, H. (2016). Technical efficiency measurement and their differential in wheat production: the case of smallholder farmers in South Wollo Zone, Ethiopia. . *International Journal of Economics, Business and Finance, 4(1)*, 1-16.

Beyene, A. D. (2008). Determinants of off-farm participation decision of farm households in Ethiopia. *Agrekon, 47(1),*, 140-161.

Biam. (2016). Economic efficiency of small scale soybean farmers in Central Agricultural Zone, Nigeria: A Cobb-Douglas stochastic frontier costfunction approach. *Journal of Development and Agricultural Economics, 8(3):*, 52-58.

Biggs, T. (2014). Assessing Export Supply Constraints: Methodology, Data, and Measurement. *Framework Paper for the AERC Collaborative Research Project on Export Supply Response* , 69-87.

Binam, J. T. (2009). Factors affecting the technical efficiency among smallholder farmers in the slash and burn agriculture zone of Cameroon. *Institute of Agricultural Research for Development (IRAD)*.

Birhan. (2015). Determinants of technical, allocative and economic efficiencies among crop producing farmers in irrigated agriculture. *African Journal of Agricultural Research, 10(20)*, 2180-2189.

Blunck. (2016). What is Competitiveness? *The Competitiveness Institute journal*.

Bogale, H. a. (2005). Determinants of poverty in rural Ethiopia, . *Quarterly Journal of International Agriculture 44 (2)*, 101-120, DLG-Verlag Frankfurt.

Byerlee, D. D. (2017). *Agriculture, Rural Development, Pro-poor Growth:*. Washington DC: World Bank.

CBMS. (2018, Jun XVI). Youth Unemployment and Entrepreneurship in Addis Aaba and Drie Dawa. *Comunity based monitoring system, 1*, 7.

Chang, H. a. (2014). *Agricultural Productivity for Sustainable Food.* Repository, originated by: Economic and Social Development Department.

Chikako, T. U. (2018). Determinants of Youth unemployment in urban Ethiopia. *International Journal on Data Science and Technology.*, 11.

Chikako, T. U. (2018). Determinants of Youth unemploymnt in urbanE thiopia.

Chikako, T. U. (2018). Multilevel Modelling of Determinants of Youth. *International Journal on Data Science and Technology.*, 11.

Chikako, T. U. (2018, Jun 5). Multilevel Modelling of Determinants of Youth. *International Journal on Data Science and Technology*, 11.

Chikako, T. U. (2018). Multilevel Modelling of Determinants of Youth Unemployment in Urban Ethiopia. *International Journal on Data Science and Technology. Vol. 4, No. 2, 2018, pp. 67-78. doi: 10.11648/j.ijdst.20180402.15*, 11.

Chirwa's. (2013). Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa. *World Development, 25(5)*, 735-747.

Coelli, T. D. (2010). *An introduction to efficiency.* Springer Science and Business Media,.

Coelli, T. D. (2015). *An Introduction to Efficiency and.* Pakistan Research Repository.: kluwer Academic Publisher.
CSA. (2012, jun 30). STATISTICAL REPORT ON THE 2012 URBAN EMPLOYMENT UNEMPLOYMENT. *trading economics, vi*, 85-94.
CSA. (2012, september). STATISTICAL REPORT ON THE 2012 URBAN EMPLOYMENT UNEMPLOYMENT. *STATISTICAL BULLETIN*.
CSA. (2014). *Agricultural sample survey: 2004/5- 2013/14 Volume.* Addis Ababa.
CSA. (2015). *Annual Agriculture Sample Survey of Farm Management Practice Report.* Addis Ababa: CSA.
CSA. (2016). *Agricultural sample survey for the season of 2014/2015:.* Addis Ababa,: CSA.
CSA. (2016). *Household Income, Consumption and Expenditure Survey Report.* Addis.
CSA. (2018). *Agricultural sample survey.* Addis Ababa: CSA.
Dagume, M. A. (2019, november 27). Determinants of youth unemployment in South Africa: evidence from the. *LLC "Consulting Publishing Company "Business Perspectives"*, 8-10.
Dang, L. B. (2015). Youth employment in Viet Nam: Characteristics, determinants and policy. *Vietnam economic press*, 74-77.
Demeke, N. T. (2015). The Productivity and Profitability of Wheat and. *Technological Progress in Ethiopian Agriculture:Proceedings of the National Workshop or Technological Progress in Ethiopian*, 57-73.
Deon, L. F. (2014). *Youth Employment in Sub-Saharan Africa.* ILO, economics. Washington DC: World Bank.
Derege, E. (2016). Youths and unemployment. 45-49.
Dhillion, S. a. (2011). Is Small farm led development still a relevant strategy for Africa and Asia? *The Journal of Agricultural Sciences, 5(3)*, 2012-2019.
Diewert, W. N. (2013). Concepts and Measures Of Productivity: An Introduction." In Services, Industries and the Knowledge Based Economy,. *In Services, Industries and the Knowledge Based Economy*, 208-223.
Dorosh, P. R. (2018). *Implications of agricultural productivity growth.* Addis Ababa.
E O Heady, O. (2018). Introduction to Agricultural Production Economics. *Ibadan*, 2018; 9-247.
EDC. (2018). Labor Market Assessment Report. *Developed for CARE Ethiopia*, 4-6.
EEA. (2005/2006). Unemployment Challenges. *REPORT ON THE ETHIOPIAN ECONOMY, V* , 246.
Eita, J. H. (2010, October). Unemployment and its impact on economy. *International Journal of Business and Management , 5*, 26-29.
Ellis, F. (2009). *Peasant Economics: Farm Households and Agrarian Developments.* Cambridge.: Second Edition Cambridge University press,.
Enaami, M. S. (2011). Multicollinearity Problem in Cobb_Douglas Production Function. *Journal of Applied Science, 11:*, 3015-3021.
Enrico, E. (2014, MAY). YOUTH UNEMPLOYMENT IN ITALY AND RUSSIA. *NATIONAL RESEARCH UNIVERSITY HIGHER SCHOOL OF ECONOMICS, 32*, 36-48.
Essa channe, O. A. (2014). Analysis of resource use. *Journal of Developing countries Study*, 30-40.
Fantu. (2015). Smallholder teff productivity and efficiency: Evidence from High-Potential Districts of Ethiopia. *A paper presented at the 29th International Conference of Agricultural Economists in Milan 8-14 August 2015.*

Firilie, R. (2005, may). An analysis of the dynamics of self-employment.". *Journal of Labor Economics*, 80-108.
Foltz, J. (2009). "Credit Market Access and Profitability in Tunisian Agriculture.". *Agricultural Economics 30*, 229-240.
Fox, D. F. (2014). *Youth Employment in sub-Seharan Africa.* Washington DC: International Bank for Reconstruction and Development.
Fufa, B. a. (2003). Stochastic maize production technology and production risk analysis in Dadar district. *East Ethiopia. Agrekon, 42 (2):*, 116-128.
Fulginiti, L. a. (2014). Agricultural productivity in developing countries. *Elsevier Science B.V. Agricultural Economics,*, p 45-51.
Fulginiti, L. a. (2015). Agricultural productivity in developing countries. *Elsevier Science B.V. Agricultural Economics*, 19 (2015), p 45-51.
Gebeyaw, T. (2011). Socio-Demographic Determinants of Urban Unemployment:. *Ethiopian Journal of Development Research Vol.33, , 33*, 26-27.
Gebreeyesus, M. (2012). Essays on Firm turnover, Growth, and Investment Behaviour. *School of Business, Economics and*, 55-67.
Gebregziabher. (2012). Technical efficiency of irrigated and rain-fed smallholder agriculture in Tigray, Ethiopia. *Journal of International Agriculture, 51(3):* , 203-226.
Gebregziabher Gebrehaweria, N. R. (2017). Technical efficiency of. *Journal of*, 203-226.
Geta, E. B. (2013). Productivity and Efficiency Analysis of Smallholder Maize Producers in Southern Ethiopia. *Journal of Hum. Ecol , 41(1)*, pp67-75 .
Getinet, H. A. (2003). The incidence of youth unemployment in urban Ethiopia. *2nd international EAF Conference* (p. 20). Addis Ababa: Jornal of economics.
Gujarati. (2004). Basic Econometrics, 4th Edition. *McGraw Hill Companies, New York*, 341-375.
Gujarati, D. N. (2004). *Basc Econometrics* (4 ed.). The McGraw−Hill companies.
Hailemaraim. (2015). *Technical efficiency in teff production: the case of Bereh District.* Haramaya.
Hailemaraim. (2015). Technical efficiency in teff production: the case of Bereh District of Ethiopia. *MSc Thesis, Haramaya University, Haramaya, Ethiopia.*
Haji, J. (2008). *Economic Efficiency and Marketing performance of vegetable production in.* Uppsala: Unpublished PhD (Economics) thesis. .
Hassen. (2016). Technical efficiency measurement and their differential in wheat production: the case of smallholder farmers in South Wollo Zone, Ethiopia. . *International Journal of Economics, Business and Finance, 4(1)*, 1-16.
Hayami, Y. a. (2008). *Agricultural Development: An International Perspective.* Johns Hopkins University Press.
Hazarika, C. a. (2016). Technical efficiency of government supported horticultural crops in Oman. *Indian Journal of Agricultural Economics, 54(2)*, 201-210.
Holden, G. a. (2013). "Efficiency and Productivity Differential Effects of Land Certificatation Program in Ethiopia. *working paper, 64 Qasi-experimental Evidence from Tigray" EFPRI-ESSP,working paper, 64*.
Hossain, M. D. (2013). The Determinants of Economic Growth in Africa: A Dynamic Causality and Panel Cointegration Analysis Economic. *Analysis & Policy, Vol. 43 No. 2.*
ILO. (2010). Global Employment Trends for Youth; Special Issue on the Impact of the Global Economic Crisis. *Youths unemployment in developing economies*, 112-122.
ILO. (2013). Global Employment Trends for Youth 2013.

ILO. (2018). ILO to pilot a youth employment services centre in Ethiopia. Addis Ababa.
J, O. (2012). "Determinants of agricultural productivity in Kenya, Kenya Agricultural Marketing and Policy Analysis Project. *Tegemeo Kenya Agricultural Research Institute*.
J, O. (2013). "Determinants of agricultural productivity in Kenya, Kenya Agricultural Marketing and Policy Analysis Project". *Tegemeo Kenya Agricultural Research Institute, .*
Jonson, B. (2015, october). youths unemployment and its impact on economic growth. *The economics daily, 8*, 26-28.
Kampen, V. a. (2014). "Evolution of Agricultural Services in Sub- . *World Bank Discussion Paper No.390*.
Kassa, A. F. (2012). UNEMPLOYMENT IN URBAN ETHIOPIA:DETERMINANTS AND IMPACT ON HOUSEHOLD WELFARE. *Ethiopian Journal of Economics, Vol XXI No. 2, October 2012*, 3.
Kelly, V. J. (2014). Improving the Measurement and. *International Development paper No 16, East Lansing*, 98-109.
Kim, H. (2016). The Translog Production Function and Variable Returns to Scale. *The Review of Economics and Statistics 74 (3):*, 546-552.
Kim, H. (2016). The Translog Production Function and Variable Returns to Scale. *The ,* : 546-552.
Kim, T. (2016). The impact of financial, human, and cultural capital on entrepreneurial entry in the United States. *Small Business Economics*, 22-25.
Kinfe Aseyehegn, C. Y. (2016). Effect of small scale irrigation on the. *The Journal of Agricultural Sciences*, 43-57.
Koutsoyiannis. (2011). The importance of use in the adoption of technology: A macro panel data analysis. *Journal of production analysis, 2(2)*, 113-126.
kreishan, O. (2010). determinants of unemployment. *namibian daily* , 83-86.
Lelisa. (1998). *The determinants of adoption, intensity, and profitability of fertilizer use:the case of Ejere district, west Shoa zone.* Addis Ababa: Unpeblished An MSc. thesis presented to the school of graduate studies of Addis Ababa University, Ethiopia. 75p.
Lockheed. (1980). Farmer education and farm efficiency: A. *Economic Development and Cultural Change,29(1)*, 37-76.
Mago, S. (2014, july). Urban Youth Unemployment in Africa. *Mediterranean Journal of Social Sciences*, 63-66.
Mathebula, I. N. (2017, september 27). DETERMINANTS OF UNEMPLOYMENT AND EARNINGS IN SOUTH AFRICA. *South Afriacan economic press*, 48-76.
Mesay Yami, T. S. (2013). Source of technical inefficiency of smallholder wheat farmers in selected. *African Journal of Agricultural Research,*, 3930-.
Miles and Huberman. (2014). Estimating Crop-Specific Production Technologies in Chinese Agriculture: A Generalized Maximum Entropy Approach. *American Journal of Agricultural Economics 83 (2)*, 378-388.
MoLSA. (2009/2010). *Labour markt information bulletin.* Addis Ababa: Central statistical agency.
MOY. (2004). National youth policy. 7-9.
Muhammad, T. M. (2019). DETERMINANTS OF UNEMPLOYMENT A CASE STUDY IN PAKISTAN. *Pakistan Economic and Social Review*, 32-33.
Mushunje, A. (2009). *Farm Efficiency and Land Reform in Zimbabwe.* University of Fort Hare.: Unpublished PhD(thesis). Department of Agricultural Economics and Extension. .

NBE. (2013). *Annual Report 2013-2014.* Addis Ababa.
NBE. (2016). *Annual Report 2013-2014.* Addis Ababa.
Ndagijimana, J. (2018, september 11). An Analysis of the Determinants of Youth Employment in Rwanda. *Jönköping International Business School (JIBS)*, 13-14.
Nehring. (2005). *The Impacts of Off-Farm Income on farmEfficiency, scale and Profitability for Corn Farms, Washington: Economic research service USDA* .
Nehring, R. (1999). *The Impacts of Off-Farm Income on farm Efficiency, scale and Profitability for Corn Farms, Washington: Economic researchservice USDA.*
Neva, F. (2006, November 3). Keynesian Theory of Involuntary Unemployment (With Diagram). *Ecoomics Discussion*.
Nwachukwu, C. I. (2017, september 24). Determinants of the Rate of Unemployment in Nigeria. *International Journal of Information Research and Review, iv*, 5-6.
OECD Manual. (n.d.). Measurement of Aggregate and industry Level Productivity Growth.
OECD Manual,. (2017). *Measurement of Aggregate and industry Level Productivity Growth.*
Ogada. (2014). Technical efficiency of Kenya's smallholder food crop farmers. *Environment, Development and Sustainability, 16(5):*, 1065-1076.
Ogada. (2016). Technical efficiency of Kenya's smallholder food crop farmers. *Environment, Development and Sustainability*, 1065-1076.
Ostrom. (2011). *Introduction to Econometrics: A Modern Approach. 4th Edition.* . : South Western Educational Publishing.
Ouedraogom. (2015). Technical and economic efficiency of rice production in the Kou Valley (Burkinafaso). *Asian Journal of Agriculture and Rural Development, 5(2):* , 53-63.
Owuor. (2013). "Determinants of agricultural productivity in Kenya, Kenya AgriculturalMarketing and Policy Analysis Project". *Tegemeo Kenya Agricultural Research Institute,*.
Palmer-Jones, S. a. (2017). It is where are you: The Spatial Determinants of Rural poverty in India,. *Agricultural Economics,*, PP 229-242.
Peace, D. ,. (2015). The Nature and Determinants of Urban Youth Unemployment in Ethiopa. *Public Policy and Administration Research www.iiste.org*, 6-7.
PHIRI, S. (2018). *DETERMINANTS OF AGRICULTURAL PRODUCTIVITY IN MALAWI.* Unpublished thesis for the award of masters degree.
PHIRI, S. (2018). *DETERMINANTS OF AGRICULTURAL PRODUCTIVITY IN MALAWI.* unpublished thesis for the award of masters degree.
Pieters, J. (2013). *Youth Employment in Developing Countries.* IZA Research Report .
Pinda, M. E. (2018). Types and Theories of Unemployment. *Profolus economics*, 2-3.
Porter. (2009). New Zealand Competitiveness. *The next Agenda. Harvard Business School, New Zealand.* .
Quintin, A. T. (2017). *Ethiopia grain and feed annual report. Report Number:.* Addis Ababa.
Rao, V. &. (2018). The Inverse Relationship between Size of Land Holdings and Agricultural Productivity. *American Journal of Agricultural Economics,*, 571-574 .
Rieffel, L. (2018). *Urban youth unemployment: A looming crisis?* Economics. Washington DC: The global econom and development.
Sabur, S. (n.d.).
Sabur, S. (2001). PESTICIDE USE, ITS IMPACT ON CROP PRODUCTION AND EVALUATION OF IPM TECHNOLOGIES IN BANGLADESH. *The Bangladesh Journal of Agricultural Economics*, 21-38.

Sackey, T. (2013). the determinants urban youths unemployment. *jornal of labour economics*, 63-69.

Sam, S. O. (2015, jun). MODELLING ECONOMIC DETERMINANTS OF YOUTH UNEMPLOYMENT IN KENYA. *Swift Journal of Economics and International finance*, 42-45.

Serneels, P. (2014). The Nature of Unemployment in Urban Ethiopia. *Center for the Study of African Economies,*, 35-37.

Shafiur, M. (2014, october 28). Determinants of Unemployment in Bangladesh. *Developing Country Studies*, 73-28.

Sharma. (2016). Determinants of technical efficiency in post- collective Chinese agriculture: Evidence from Farm-Level Data. *Journal of Comparative Economics, 28(3)*, 545-564.

Shita, A. (2018). DETERMINANTS OF URBAN YOUTH UNEMPLOYMENT; EVIDENCE FROM EAST. *International Jornal of economics*, 13.

Sisay, A. (2013). *Youth unemployment: lessons from Ethiopia.* Economics. Addis Ababa: Africa Rerewal.

SNV. (2017). *Pulling Ethiopian youth out of unemployment.* Addis Ababa.

Talegetaa, S. (2018). Determinants of Self-employment Decision on West Shoa Zone, Oromia Region, Ethiopia, East Africa. *International Journal of Sciences:*, 88-90.

Tchale, H. a. (2017). The efficiency of maize farming in Malawi: A bootstrapped translog frontier. *Faculty of Social Sciences, Kent Business School. Agri-Environment Economics.* , 35-48.

Teshita, C. (2018). Determinants of Youth Unemployment in Urban Ethiopia. *International Journal on Data Science and Technology*, 10-12.

Tessema. (2015). *The Determinants of Agricultural Productivity and Rural.* Addis Ababa.

Thomas, N. J. (2006, November 3). Theories of unemployment. *The labors daily*, 1-2.

Thomson, A. (n.d.).

Thomson, A. (2017). Agriculture, Growth and Poverty Reduction. UK. *Agriculture and* .

Tijani. (2011). Analysis of the technical efficiency of rice farms in Ijesha Land of Osun State, Nigeria. *Agrekon, 45 (2)*, 126-135.

Toit, R. (2013, july 25). Urban labor markets in Ethiopia: Challenges and ptospects. (A. Marli, Ed.) *World bank, xv*, 23-36.

Triparti. (2015). Technical efficiency of Boro rice production in Bangladesh. *Journal of Bangladesh Agricultural University, 13 (1)*, 101-108.

UN. (2004). *Strategies for Creating Urban Youth Employment: Solutions for Urban Youth.* Nirobi: Unted Nations:Department of Economic and Social Affairs.

UN. (2010). Definition of youth.

UN. (2011). Youth Employment - Youth Perspectives on the. *United Nations*, 15-18.

UN. (2013). *World Youth Report.* New York: United Nations.

UN. (2014). *World Urbanization Prospects: The 2014 Revision, CD-ROM.* Washington D.C., USA.

Urgessa, T. (2015). *The Determinants of Agricultural Productivity and Rural* . Addis Ababa.

Wangmo, K. T. (2017). Determinants of Unemployment: Characteristics and policy responces in Bhutan. *Southeast Asian Journal of Economics*, 45-46.

Wasim. (2009). Impact of pesticides use in agriculture: their benefits and hazards.

WB. (2015). *Addressing the Youth Employment Crisis Needs Urgent Global Action.* WASHINGTON: World bank.

Wiebe. (2013). Agricultural Productivity for Sustainable Food Security in Sub-Saharan Africa. *FAO Corporate Document Repository, Economic and Social development Department* .

Wiebe, K. S. (2011). Agricultural Productivity for . *FAO Corporate Document Repository*, 45-62.

WOA. (2015). *Annual report of crop production in 2013/2014.*

WOA. (2019). *Annual report of crop production in 2013/2014.* Unpublished.

Wolday. (n.d.). Improved seed marketing and adoption in Ethiopia. *Journalagricultura leconomics, 3(1);*.

Wolday, A. (1999). Improved seed marketing and adoption in Ethiopia. *Journal agricultural economics, 3(1):* , 18-37.

Wondimu Tesfaye, H. B. (2015). *Determinants of technical.*

Worku Ibrahim, M. B. (2016). *Patterns and determinants of teff.* Addis Ababa.

Wudineh. (2016). Technical efficiency of smallholder wheat farmers: The case of Welmera District. *Journal of Development and Agricultural Economics,8(2):*, 39-51.

Zafar, A. R. (2018). Determinants of unemployment in less developed countries. *SHS Web of Conferences 48, 01015 (2018) https://doi.org/10.1051/shsconf/20184801015* (p. 6). United Kingdom: 1M.Phill Scholar , School of Management sciences , National college of business and e-Commerce,.

Zepeda, L. (2015). *Agricultural Investment, Production Capacity and Productivity.* FAO .

Zhang, X. a. (2018). Estimating Crop-Specific Production Technologies in Chinese . *American Journal of* , 378-388. .

7. APPENDICES

Appendix 1: Generalregression result

```
. reg lnY lnlab lnld lnfer lnex ag edu pes cr manf

      Source |       SS       df       MS              Number of obs =     151
-------------+------------------------------           F(9, 141)     =  187.17
       Model |  5.1905106         9  .576723399         Prob > F      =  0.0000
    Residual |  .434469667      141  .003081345         R-squared     =  0.9228
-------------+------------------------------           Adj R-squared =  0.9178
       Total |  5.62498026      150  .037499868         Root MSE      =  .05551

------------------------------------------------------------------------------
         lnY |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnlab |    .121408   .0206478     5.88   0.000     .0805887    .1622272
        lnld |   .1749394   .0256434     6.82   0.000     .1242442    .2256347
       lnfer |   .0573809   .0106162     5.41   0.000     .0363934    .0783683
        lnex |   .0408015   .0174654     2.34   0.021     .0062737    .0753294
          ag |   .0055855   .0009765     5.72   0.000      .003655    .0075161
         edu |   .0128607   .0027356     4.70   0.000     .0074526    .0182688
         pes |   .0390534   .0143332     2.72   0.007     .0107176    .0673892
          cr |   .0343319   .0156525     2.19   0.030     .0033879    .0652758
        manf |   .0331424   .0159046     2.08   0.039        .0017    .0645847
       _cons |   1.551433   .0467667    33.17   0.000     1.458979    1.643888
------------------------------------------------------------------------------
```

Appendix 2 test of overall significance of the model

```
. test lnlab lnld lnfer lnox ag edu pes gr manr

 ( 1)  lnlab = 0
 ( 2)  lnld = 0
 ( 3)  lnfer = 0
 ( 4)  lnox = 0
 ( 5)  ag = 0
 ( 6)  edu = 0
 ( 7)  pes = 0
 ( 8)  gr = 0
 ( 9)  manr = 0

       F(  9,   141) =  187.17
            Prob > F =    0.0000
```

Appendix 3: Variance inflation factor of variables

```
. vif

    Variable |      VIF       1/VIF
-------------+----------------------
          ag |     3.11    0.321490
        manf |     3.01    0.331778
          cr |     2.96    0.337439
         pes |     2.49    0.401275
       lnlab |     2.13    0.470083
        lnox |     1.87    0.535668
         edu |     1.76    0.567987
        lnld |     1.62    0.616082
       lnfer |     1.27    0.788182
-------------+----------------------
    Mean VIF |     2.25
```

Appendix 4: Correlation coefficient

```
. correl lnlab lnld lnfer lnex ag edu pes cr manf
(obs=151)
```

	lnlab	lnld	lnfer	lnex	ag	edu	pes	cr	manf
lnlab	1.0000								
lnld	0.3920	1.0000							
lnfer	0.3280	0.2318	1.0000						
lnex	0.5002	0.3487	0.2395	1.0000					
ag	0.6459	0.5795	0.3951	0.6125	1.0000				
edu	0.5262	0.3888	0.2432	0.3759	0.5652	1.0000			
pes	0.5961	0.4900	0.3760	0.5579	0.6341	0.5494	1.0000		
cr	0.6380	0.5110	0.3871	0.5975	0.6928	0.5092	0.6652	1.0000	
manf	0.6205	0.5070	0.4034	0.5038	0.6893	0.5929	0.6918	0.7311	1.0000

Appendix 5: Endogeneity test of independent variables

```
. ivregress 2sls lnY lnlab lnld lnfer lnox ag edu pes cr manf

Instrumental variables (2SLS) regression          Number of obs   =        151
                                                  Wald chi2(9)    =    1803.96
                                                  Prob > chi2     =     0.0000
                                                  R-squared       =     0.9228
                                                  Root MSE        =     .05364

------------------------------------------------------------------------------
         lnY |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnlab |    .121408   .0199524     6.08   0.000     .0823021    .1605139
       lnld |   .1749394   .0247797     7.06   0.000     .1263721    .2235068
       lnfer |   .0573809   .0102586     5.59   0.000     .0372744    .0774874
       lnox |   .0408015   .0168772     2.42   0.016     .0077229    .0738801
         ag |   .0055855   .0009436     5.92   0.000      .003736    .0074351
        edu |   .0128607   .0026435     4.87   0.000     .0076796    .0180418
        pes |   .0390534   .0138505     2.82   0.005     .0119069    .0661999
         cr |   .0343319   .0151253     2.27   0.023     .0046868     .063977
       manf |   .0331424    .015369     2.16   0.031     .0030198    .0632651
      _cons |   1.551433   .0451916    34.33   0.000     1.462859    1.640007
------------------------------------------------------------------------------
(no endogenous regressors)
```

Appendix 6: Test of Heteroskedasticity

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnY

         chi2(1)      =    0.18
         Prob > chi2  =   0.6693
```

Appendix 7: Summary of Variables

```
. sum

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
           Y |       151    9.986755    1.879669         7         13
         lab |       151    2.450331    .5852491         1          3
          ld |       151    1.307947    .2523947        .5       1.75
         fer |       151     64.9006     28.3106        25        150
          ox |       151    2.019868    .6373926         1          3
-------------+--------------------------------------------------------
          ag |       151    39.58278    8.185644        24         58
         edu |       151    2.741722    2.198374         0          8
         pes |       151    .5496689    .4991026         0          1
          cr |       151    .5562914    .4984745         0          1
        manr |       151    .5827815    .4947406         0          1
-------------+--------------------------------------------------------
          lnY |       151    2.283024    .1936488  1.945911   2.564949
        lnlab |       151    .9273601    .3201578         0   1.386294
         lnld |       151    .2459704    .2251946 -.6931472   .5596158
        lnfer |       151    4.067279    .4008875  3.218876   5.010635
         lnox |       151    .6459526    .3545671         0   1.098612
```