Quest Journals
Journal of Research in Humanities and Social Science
Volume 9 ~ Issue 3 (2021)pp: 33-39
ISSN(Online):2321-9467
www.questjournals.org

Research Paper

Analysis of Technical Efficiency of Coffee Producers in Chire Woreda of Sidama Zone, Southern Ethiopia: A Stochastic Frontier Approach

LegeseNado[1], MitikuAyele[2] and BealuTukela[3]

ABSTRACT
This paper provides new estimates of coffee producing farmers' technical efficiency and its Principal determinants using Chire woreda survey data collected in 2006. To analyze data both descriptive statistics and econometric model were used. Accordingly, an attempt to measure technical efficiency of coffee producers and its determinants is made by using both stochastic frontier model and technical inefficiency model. The maximum likelihood parameter estimates showed that all input variables have positive and significant effects on production. But other variable (age of coffee tree) remained insignificant even though it has highest elasticity followed by labor and land. The analysis showed that the mean technical efficiency of farmers was 81.5%, implying that output in the study area can be increased by 18.5% at the existing level of inputs and current technology by operating at full technical efficient level. Technical inefficiency effects are modeled as a function of farmer specific socio-economic factors. The result showed that among the variables that are supposed to explain technical inefficiency, education level of farmers, age of household, distance, experience, credit access, and extension visit, fertility of soil, slope of land, proximity to market and period of cultivation are significantly influencing technical inefficiency of coffee producers. Moreover, education, distance, extension visit, proximity to market and credit access tends to increase technical efficiency of farmers whereas age of household, poor quality of soil, slope of land and period of cultivation decrease their technical efficiency, indeed.

KEYWORDS:*coffee, stochastic frontier, Technical efficiency*

Received 10 Mar, 2021; Revised: 23 Mar, 2021; Accepted 25 Mar, 2021 © The author(s) 2021. Published with open access at www.questjournals.org

I. INTRODUCTION

Coffee is the primary source of income for more than 10 million households in coffee-growing African countries. Coffee also serves as an important source of export revenues and some of these countries rural population depend on this kind income (ICC, 2015). Ethiopia's production trend is generally upward despite some downward interruptions, reaching 6.6 million bags in 2013/14. It is the world's fifth largest coffee producer next to Brazil, Vietnam, Indonesia, and Colombia and Africa's top producer, with estimated 500,000 metric tons during the coffee or marketing season for MY 2012(ICC,2014).

Moreover, the coffee subsector of Ethiopia has been and continues to be the base for the country's agricultural and economic development. Similarly, coffee in Ethiopia accounts for more than 25% of GNP, 40% of the total export earning, 60% of agricultural export, 10% of the total government revenue and about 25% of the total population of the country are dependent on production, processing, distribution, and export of coffee (MOARD, 2008).

However, around 95% of the country's total production comes from small holder farmers. Only five percent of coffee production is grown on modern plantations, which are owned by private investors or by the government. The rest is grown by smallholder farmers, and about half of that production is in backyards or

[1] Lecturer in Department of Economics, Hawassa university, Hawassa, Ethiopia. Email:legenado2005@gmail.com
[2] Assistant professor in Department of Economics, Hawassa university, Ethiopia, Email:saronmt@gmail.com

[3]Assistant professor in Department of Economics, Hawassa University, Hawassa, Ethiopia. Email:bealutkl@gmail.com

gardens (MOFED, 2010). This smallholder coffee farming has been confronted with various problems for centuries, both internal (e.g. weak markets, insufficient infrastructure, insufficient research and extension, shortage of farmland) and external (e.g. global coffee price decline, increasing food and oil prices) (Samuel and Eva, 2008).

The decline in market share and price has significant impacts on productivity since the high price motivates farmers to produce more and more production efficiently and vice versa. Efficiency is an important factor to increase productivity farmers in coffee production.

Even though Ethiopia has a good potential to increase coffee production and productivity as it is endowed with suitable elevation, temperature, soil fertility and sufficient rainfall in coffee growing belts of the country, the average yield per hectare remains very low stagnating at 0.7-0.8 MT per hectare. This low productivity of coffee affects the world price and consequently, from 1997 to 2002 world coffee prices declined reaching their lowest point, in 2003 when coffee prices started to slowly increase until present (ICO, 2002).

Thus, in a country where resource constraint is the main problem of economic development and the rate of technological adoption is low, technical efficiency improvements in coffee production seems to be more advantageous.

In addition to this, regarding to the technical efficiency of coffee producers rarely the research has conducted in the Sidama zone, particularly in Chire woreda. Therefore, this study intended to examine factors affecting the level of technical efficiency of coffee producers and to estimate level of technical efficiency of coffee producers in the study area. To that end, the research questions that assist the researcher to undertake this study are formed in this section. These are:- 1. What is the technical efficiency level of coffee producing farmer in Chire woreda?
2. What are the factors affecting the technical efficiency of coffee producers in Chire woreda?

Objective of the Study

The general objective of the study was to identify factors affecting the level of technical efficiency of coffee producers and its implication for increased productivity of coffee producers in Chire woreda. The specific objectives were**:** 1). to estimate the level of farmer-specific technical efficiency of coffee producers in Chire woreda. 2). to identify factors affecting technical efficiencies of coffee producers in Chire woreda.

II. METHODOLOGY

The study area: The study was conducted in Chire woreda, Sidama Zone, Southern Nations Nationalities and Peoples Region (SNNPR), Ethiopia, during 2014/15 main coffee season.The *woreda* has 16 *kebeles*. The capital city of the *Woreda* is Chire which located at about 211km south of Hawassa and 484 km from Addis Abeba. Chire*Woreda* covers the area of 39,300 hectare with total population of 146,548 out of which 73,660 are males and the rest 72,888 are females (CWFEDS, 2014). The topography of the site is largely plain. The dominant Farming system is a cereal based semi-intensive rain fed mixed farming with livestock production. The major crops grown in the study area include enset and coffee as annual crop, maize in belg, and barley, wheat, sorghum, and legumes are grown in meher seasons.

Moreover, Coffee and maize is the main important cash crop of the woreda. Based on Woreda Agriculture sector report (2013), 14,103,354kg of only washed coffee were produced in this woreda in the year ending in 2013. This represents 29.6% of the Zone's output, and makes Chire one of the two top producers of this crop, along with the Bansa Woreda. In fact from sixteen kebeles that found Chire Woreda, ten of them are specialized in producing coffee production which produces altogether around 88.7percent of coffee produced in this area.

Large portion of these kebeles are located in WoineDega climatic conditions with altitude ranging between 1600m to 1800m above sea level.

Sampling procedures: Since the different kebeles have different amount of coffee production that produced in coffee seasons and they differ in both in terms of size and variability of coffee output, the stratified sampling technique was applied for selection of each five kebeles. Accordingly, 195 farmers that own matured coffee trees collected from those kebeles as total sample size. After the kebeles being selected, the final sample units were calculated by proportional sampling technique to the sampling frame of respective kebeles until the required number of sample size allocated.

Sample size determination: The number of households who owned matured coffee is different in different kebeles and they produce different level of coffee production. In this case it is reasonable to take larger samples from kebeles with higher number of coffee owners and smaller sample from the less number of coffee owners. Accordingly, sample size was computed according to the formula developed by Yamane (1967).

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

Where n is the sample size, N is the population size (total number coffee producers in the study area), and e is the level of precision. n = 195 is the total sample size planned to be covered. TheSample Size (n) for Precision (e) of $\pm 7\%$ where confidence level is 95% would be $n = \frac{N}{1+N\ (e)\ 2} = \frac{4600}{1+4600\,(0.07)\ 2} = \frac{4600}{23.54} = 195.41 = \sim 195$The selected sample size was identified from five kebeles byproportionate random sampling.

III. METHODS OF DATA ANALYSIS

To address the objectives of the research and to analyze the data, both descriptive statics and Trans log stochastic production frontier model were used to analyze technical efficiency of farmers in the study area.

Efficiency Estimation

Technical efficiencyrefers to the physical relation between resources and outcome. It also refers to the ability to avoid wastage either by producing as much output as technology and input usage allow or by using as little input as required by technology and output production. There are two techniques of efficiency measurement: - (1) Non-parametric and (2) Parametric. In non parametric approach, no functional form is imposed on the production frontier and no assumption is made on the error term. However, this method has disadvantages over: firstly, one cannot test for the best specification; secondly, it does not take measurement errors and random effects into account (it supposes that every deviation from the frontier is due to the firm's inefficiency); thirdly, the number of efficient firms on the frontier tends to increase with the number of inputs and output variables and fourthly, results are sensitive to the selection of inputs and outputs.

The second approach, on the other hand, is called parametric approach. The stochastic frontier production function estimation would depend on this approach. It was independently and simultaneously proposed by ($Aigneretal.$, 1977) and ($MeeusenandVandanBroeck$, 1977).

Unlike envelope analysis, the stochastic frontier approach enables us: one, we can test for the best specification; two, it takes measurement errors and random effects into account (composed error approach). Thus deviation from efficient frontier is not only measurement error but also management inefficiency. In contrast to the envelop analysis, this approach depends on econometric estimation procedure. The stochastic frontiers method is used in this study. This choice was made on the basis of the variability of agricultural production, which is attributable to climatic hazards, plant pathology and insect pests, on the one hand, and, management inefficiencies on the other.

As far as the functional form of the stochastic production function is concerned, estimation of the stochastic production function requires a particular functional form of the production function to be imposed. A range of functional forms for the production function frontier are available, with the most frequently used being a Trans log function, which is a second order (all cross-terms included) log-linear form.

As broadly described in Khalil (2005), the Trans log function is an attractive flexible function. This function has both linear and quadratic terms with the ability of using more than two factor inputs. Moreover, this is a relatively flexible functional form, as it does not impose assumptions about constant elasticity of production nor elasticity of substitution between inputs. Basically, trans log functional form is used in this study; to show the interaction effects of factor inputs in the coffee production.

Specification of Trans log stochastic frontier production model

The stochastic frontier production function that assumed Trans log form is given as:

$LnY_j=\beta 0+\sum_{i=1}^{4} \beta iLnXij + 1/2\sum_{i=1}^{4}\sum_{k=1}^{4} \beta ikLnXijLnXkj + x_5 + v_j - u_j$ (1)

Where *ln* designates a natural logarithm and subscripts *i*and *j*, respectively, represent the inputs *i*used by farm *j*

Y= is the observed output of the i^{th} farmer on the j^{th}farm in kg

X_1= Area under matured coffee trees (ha)

X_2= human labor used in total hours of work. X_3= amount of depreciation of agricultural equipments used in coffee production or capital (in birr)

X_4= fertilizer (quantity of organic composite used in Kg)

X_5= age of coffee trees:-is other variable (factor) that affect production of the coffee

β = is a (Kx1) vector of unknown parameter to be estimated. **Sources of Technical Inefficiency**

The level of technical efficiency is estimated as:

$TE_i = \frac{\text{observed output}}{\text{potential maximum output}} = \frac{qi}{\exp(xi\beta)} = \frac{\exp(xi\beta - ui)}{\exp(xi\beta)}$ (2)

$= \exp(-u_i),\ 0 \le TE_i \le 1$ (3)

In this section, the distribution of ui=(E ui/ei) is derived and discussed fromstochastic frontier model With the help of one step approach given the assumptions zero mean, unknown variance δv^2 and non negative random term, ui. $ui$is non-negative random variable, associated with technical inefficiency of production, which are assumed to be independently distributed, such that uiis obtained by truncation (at zero) of the normal distribution with mean μi (under truncated normal distribution) and variance δu^2.

Where the mean of ui, μi is defined by the equation of the socioeconomic factor (Coelli, 1995) hypothesized as determinants of TE, can be stated as:-

$$\mu i = \delta_0 + \delta_1 Z_1 + \delta_2 z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \delta_9 Z_9 + \delta_{10} Z_{10} + \delta_{11} z_{11} + \delta_{12} Z_{12} + \delta_{13} Z_{13} + \delta_{14} Z_{14} + \delta_{15} Z_{15} + \delta_{16} Z_{16} + \delta_{17} Z_{17} + \delta_{18} Z_{18} + wi (4)$$

Where; μi is the mean of error term under truncated normal distribution, Z's represents socioeconomic factors supposed to be the determinants of technical inefficiency component. Where δi's are parameters denoted the coefficient of technical inefficiency effects.

IV. RESULTS AND DISCUSSIONS

Econometric Results

Stochastic Frontier Production Function Results

In the frontier model, the coefficients of all inputs allocated to production of coffee were positive and significantly contributing the optimum level of output. Therefore, by increasing these inputs at optimum level we can increase technical efficiency of coffee producers since those inputs have potential to increase actual output.

Table 1: Maximum likelihood results of Trans log stochastic production function

Variable	parameter	Coefficients	Jackknife Standard error
Constant	β_0	-5.348602	5.777304
ln(land)	β_1	. 9259352*	1.071519
Ln(capital)	β_2	1.721474*	.9859616
Ln(labor)	β_3	1.40525*	1.444994
Ln(fertilizer)	β_4	.1489786*	.0780694
age of coffee	β_5	.0047745	.0047962
$(Lnland)^2$	β_6	.0146287	.0415744
$(Lnlabor)^2$	β_7	.0236754	.0364064
$(lncapital)^2$	β_8	-.0275442	.0558664
$(Lnfertilizer)^2$	β_9	-.0344923	.0378812
Lnland*lnlabor	β_{10}	.1225767	.061543
Lnland*lncapital	β_{11}	-.0055966	.0768397
Lnland*lnfertilizer	$\square_{12}$	-.0553657	.052513
Lncapital*lnlabor	$\square_{13}$	-.1025731	.0585109
Lncapital*lnfertilizer	$\square_{14}$	.0962153	.0865686
Lnlabor*lnfertilizer	$\square_{15}$	.0219795	.0577066
Variance parameters			
Lamda ($\frac{\delta u}{\delta v}$)	ʎ	4.955486	.5523838
Sigma-v	□	.0716507	.5429273
Sigma-u	□	.3550641	.0201925
Gamma ($ʎ^2/1+ʎ^2$)	γ	.9608715	
$Sigma^2$	$\square^2$	.126343	.0171359

Source: own survey result (2016) * show significant at one percent of level of significance.

As indicated in the table above, most of the variables determining technical inefficiency were statistically significant. The estimates of Lamda ʎ is 4.95 (the variance parameter showing the ratio between the normal error term and half normal positive error term), which indicates that the one side error term u dominates the symmetric error v, so the variation of actual output of coffee production mainly comes from differences in farmer's practice (mismanagement of farm) rather than random variability.

Moreover, this verifies the fact that there are measurable inefficiencies in coffee production probably caused by differences in socio-economic characteristic of the households and their management practices. The parameter gamma is lies between 0 and 1; with value equal to 0 means that technical inefficiency is not present and ordinary least square estimation would be an adequate representation and a value close or equal to one implying that the frontier model is appropriate the estimate of gamma. (Ephraim, 2003).

The maximum likelihood estimates for the parameter gamma (γ), furthermore, explains that around 96% of variation in the model are caused by technical inefficiency.

This indicates that from total variation of output in coffee production, 96% of the variation is due to inefficiency effects of farmer's specific attributes and rest 4% is due to random error. This means that the major problem for the deviation of output from the potential level is due to the inefficiency error, ui and not due to the random error, vi beyond control of farmers. Similarly variance is also 0.35 which are significantly different from zero, indicating that a good fit and correctness of specified distribution.

Factors Affecting Technical efficiency

Table (2) shows that 10 variables such as education level of farmers, age of household, distance to plot, experience, credit access, and extension visit, fertility of soil, slope of land, proximity to market and period of cultivation were significantly affecting technical inefficiency of coffee producers.

The other variables such as family pressure, livestock ownership, sex of household, coffee disease, cereal crop production, soil fertility, membership in organization and variety of coffee planted were not significant. Moreover, relative to other variables distance to plot, slope of land, period of cultivation, education, and off farm income more significantly affect the technical efficiency of coffee producers.

Education of household head: The educational level of producers is the main socio economic variable which was negative and significantly affected technical inefficiency. This indicates that farmers who have spent many years in formal education are more likely efficient in coffee production. This could be attributed to more educated farmers may have better access to extension services, financial institutions and market information. Furthermore, such farmers respond fast to new technologies and appreciate correct management practices like timely planting and weeding, the correct amount of fertilizer to be applied, correct seed rate and general management of the farm. Similar results were obtained by Alemayehu (2010), Nchare (2008) and Weir and Knight (2000).

Table 2 Estimated parameters of the inefficiency effects model

Inefficiency model	coefficients	Jackknife standard error	t-ratio	p-value
Constant	.1647115*	.0317237	5.19	0.0000
Family pressure	.0000499	.0003817	-0.57	0.47
Sex of household	0.0038	0.0050	-0.75	0.45
Age of household	0.00038**	0.0002	2.34	0.019
Education	-0.00119**	0.000548	-2.19	0.029
Experience	.000993 *	.0002614	3.8	0.000
Livestock ownership	0.00022	0.00018	1.17	0.243
Coffee disease	0.00172	0.00335	0.51	0.607
Off farm income	4.99e-07**	2.47e-07	-2.12	0.043
Credit access	-1.99e-06*	5.06e-07	-2.69	0.000
Distance to plot	-.0387355*	0.01231	-3.89	0.000
Extension visit	-0.00036**	0.00017	-2.09	0.037
Proximity to MRT	-0.00236**	0.00196	-1.20	0.032
Ferti soil (poor soil)	-.0039808	.0025493	-1.58	0.118
Slope of land	0.004560**	0.00191	2.40	0.016
Period of cultivation	0.00886*	003401	2.60	0.009
Variety of coffee plant	0.003045	0.0035	0.87	0.385
Membership in organiz	0.011476	0.01262	0.91	0.363

Source: own survey result (2016). *, ** and *** show significance at 1%, 5% and 10% respectively.

Age of Household Head: The coefficient estimated for the age variable has a positive sign, implying that old farmers are technically inefficient than younger ones. This result can be explained in terms of adoption of modern technologies. Similarly, older farmer s are less likely to have contact with extension workers and are equally less inclined to adopt new techniques and modern inputs, whereas younger farmers, by virtue of their greater opportunities for formal education, may be more skilful in the search for information and the application of new techniques.

This, in return, will improve their level of technical efficiency. This resultin line with the Nchare (2008) on the analysis of factors affecting technical efficiency of Arabica coffee producers in Cameroon.

Access to credit: It is hypothesized that households who have got credit access is more efficient than their counter parts. The result shows that credit access is found to have positive and significant effect (at 5% level of significance) on farmers' technical efficiency in production. This implies that credit availability shifts the cash constraint outwards and thus enables farmers to make timely purchases of inputs that they cannot afford otherwise from their own resources and enhances the use of agricultural inputs that leads to higher efficiency. This result is also similar to those obtained by Bravo-Ureta and Evenson (1994), Nchare (2008), Alemayehu (2010) and Obwona (2005).

Extension visit: The coefficient estimated for the variable indicating contact with extension workers has a negative sign, implying that the technical inefficiency diminishes with the number of visits made to the plantation by extension workers. Actually, regular contacts with these workers facilitate the practical use of modern techniques and adoption of agronomic norms of production. Similarly Owenetal (2001) on his analyzing of the impact of extension services on agricultural production in Zimbabwe, found that farmers 'access to extension services increases the value of their output by 15%.

Proximity to the market: It is proxied by the distance between plot and the most nearest market center in hour. It is another variable that has negative and significant effect on inefficiency of farmers, reflecting that those farmers who are close to market centers are technically more efficient than farmers away from nearest market center. This implies that farmers near market center could get more hot and vital market information and may also participate in other income generating activities that could ease resource used in the maintenance of matured coffee trees and thereby enhance technical efficiency. This finding line with Alemu et al (2008) on technical efficiency of farming systems across agro-ecological zones in Ethiopia: an application of stochastic frontier analysis.

Distance to plot: The more distant the farmer plot from home, the more technically efficient the farmer is. This could be attributed to the fact that; the level of close supervision may be so strong when the plots are far away from home since farmers are more eager to follow up far farm than nearby them.

Off farm income: It is significantly and positively explaining technical inefficiency of coffee producers in Chire woreda; indicating that coffee producers who have more off farm income are tending to be more inefficient. This is may be due to the farmers who have more off farm income may not gave due emphasis on coffee production. Moreover, farmers might use off farm income as an alternative income to the income they received from coffee production. This result was in line with the study undertaken by Nichare (2007).

Period of maintenance: is also supposed to affects the level of production. As it was supposed the coefficient of period of cultivation in the inefficiency model is positive and significantly affects inefficiency at one percent level of significance. This means that period of cultivation is very important variable that affects technical efficiency though it has not been included inefficiency model so far. The sign of this variable shows that in the study area farmers were not managing and following up their farm on time and, hence the period of cultivation has potential to decrease the technical efficiency of the farmers. This idea also backed by the descriptive statistics (62% of the respondents maintain/cultivate their farm after three months). Therefore, this result further shows those farmers who don't manage their farm on time couldn't harvest large amount of production and hence decrease efficiency of coffee producers.

Experience: It indicates that inefficiency increases with the number of years spent in coffee production. In effect, descriptive statistics show that coffee is grown by ageing producers (41 years old on the average), while the number of years spent in coffee production averages 17 years. This ageing of farmers has harmful consequences for the recommended cultural methods and consequently, for the productivity of coffee plantations (Table 4.1 descriptive statistics). Here, farmers become more and more experienced with their age.

Slope of land: The coefficient of slope of land in the inefficiency effect model is positive and its sign was expected. This variable is significantly affects inefficiency model at 5% of level of significance. So slope of the land affect level of production. For instance steep plots are usually subject to water erosion. As a result, they are likely to be of lower productivity. To take the effect of efficiency of different topography of the plot, an index was constructed based on the respondents' judgments. Accordingly, it affects level of coffee production negatively and technical efficiency as well. This result in line with the result was achieved by Alemayehu (2010) on technical efficiency of coffee producers in Jimma Zone.

V. CONCLUSION AND RECOMMENDATION

Conclusions

The estimated technical efficiency of coffee producers in the study area ranged from 70% to 93% with mean technical efficiency 81.5%. These empirical findings show that efficiencies were not much varying among the sample farmers. This is happened because of in the study area; farmers use similar technologies and have the same farming attributes.

The significant value of gamma 96% , reveals the fact that a high level of technical inefficiency exists among the sampled farmers. The wide variation in technical efficiency is an indication that most of the farmers are still using their resources inefficiently in the production process and there still exists opportunities for increasing their crop production by improving their current level of technical efficiency.

Relative to other variables distance to plot, slope of land, period of cultivation, education, and fertility of soil more significantly affect the technical efficiency of coffee producers. Others are not significantly different from zero at the 5% level of significance. Nevertheless, the variable signs such as the age of the farmer, cereal crop production, family pressure and contact with extension workers are in accordance with the expectations. The educational level of producers is the main socio economic variable that significantly affects the technical inefficiency of farmers. Accordingly, it has a negative and significant effect on technical inefficiency. This result shows that farmers who have spent many years in formal education are more likely efficient in coffee production.

In this study, proximity to the market negatively explaining the inefficiency of farmers, reflecting that those farmers who are close to market centers are technically more efficient than farmers away from nearest market center. These farmers may invest time through income they could get away from coffee farming given that farmers near market may participate on various income generating activities. Similarly, Access to credit also has a negative influence on technical inefficiency. Actually, it reduces the financial difficulties farmers face at the beginning of the crop year, thus enabling them to buy inputs.

VI. RECOMMENDATIONS

The efficiency with which farmers use available resources and improved technology is important in agricultural production. This implies that increased efficiency is associated with the quality of resources used, as well as their quantity and increased resource mobilization and efficient use help to account for productivity increase. Therefore, the attention of policy makers to mitigate the existing level of low economic growth and poverty by improving agricultural productivity should not stick only to the introduction and dissemination of modern agricultural technologies but they should also give due attention towards improving the existing level of inefficiency of farmers.

Moreover, improvements in the agricultural productivity in the use of modern technologies are expensive, require relatively longer time to achieve and farmers have serious financial problems to afford them. In addition to this , the result of increment of productivity and production of agricultural sector by using improved technologies will be high if it is coupled with the improvement of the existing level of inefficiency of farmers.

Since access to credit has negative effect on technical inefficiency of farmers, government should encourage financial institutions like omo microfinance to provide financial support which in turn help the farmers for purchasing inputs.

REFERENCES

[1]. Aigner D.J., Lovell C.A.K., Schmidt. (1977). Formulation and estimation of stochastic frontier production functions. *Journal of Econometrics 6:* , 21-37.

[2]. Alemayehu Ethiopia. (2010). *Analysis of factors affecting technical efficiency of coffee producers in Jimma Zone : A stochasgtic frontier analysis.* Addis Abeba: Faculty of Business and Economics , Addis Abeba Unoiversity.

[3]. Alemu, Nuppenuua and Bolland. (2009). Technical effeciency of farming systems across agro ecological zones in Ethiopia: an application of stochastic frontier approach. *Agricultural Journal, 4* , 112-125.

[4]. CWFEDS. (2014). *Survey of the Chire Woreda Finance and Economic Development sector.* Chire.

[5]. Economic Research and Policy Analysis . (2008). Analysis of coffee supply, production, utilization and Marketing issues challenges in Ethiopia. *Ethiopia commodity Exchange Authority Vol.1* .

[6]. ICC. (2014). 4th ICO World Coffee Conference, proposal received from Ethiopia. *International coffee Council 112th session 3-7 March 2014.* London, United Kingdom: International coffee organization.

[7]. ICC. (2015). *Sustainability of the coffee sector in Africa.* London, United Kingdom: International coffee organization, Fab 2015.

[8]. ICO/CFC. (2000). *Marketing and trading policies and systems in selected coffee producing countries: Ethiopa country profile.* New York: International coffee orgnaization/ common fund for commudities.

[9]. Meeusen.w and Van Den Broeck.J. (1977). Efficiency estimation from Cobb-douglas production functions with composed error. *International economic Review, 18,2* , 435-444.

[10]. Samuel Gebreselassie and Eva Ludit. (2008). Agricultural Commercialisation in Coffee Growing areas of Ethiopia. *Future agricultures* .

[11]. Weir and Knight . (2004). *Education Externalities in rural Ethiopia : Evidence from average and production function.* New York: working paper CSAEWPS, University of Oxford.