

Economic Efficiency of Smallholder Farmers in Maize Production in Gudeya Bila District, Oromia National Regional State, Ethiopia: Parametric Approach

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Abstract Agriculture in Ethiopia is characterized with low productivity. To improve this problem either introduction of modern technologies or improving the efficiency of farmers is an important. Improving efficiency of the farmer has received the greatest attention as it is more cost effective than introducing new technologies. The aim of this study was to analyze levels of technical (TE), allocative (AE) and economic efficiency (EE) of smallholder farmers and factor affecting efficiency levels of farmers in maize production in the study area. To meet the stated objectives primary data were collected using structured questionnaires from 154 randomly selected sample households during the 2017/18 production year. Stochastic production frontier model was used to estimate technical, allocative and economic efficiency level where as Tobit model was used to identify factors affecting efficiency level. The mean technical, allocative, economic efficiency were 71.65%, 70.06% and 49.89%, respectively. Thus the results reveal that exist considerable levels of inefficiencies in maize production in study area. The Tobit model results revealed that education levels, family size, farm size, frequency of extension contact, uses of credit and participation in off/non-farm activities had a significant positive effect on technical efficiency. Livestock holding and participation in off/non-farm activities had positive effect and distance of maize plot from home were found to had negative effect on allocative efficiency while education levels, family size, uses of credit, extension contact and participation in off/non-farm activities were found to had positive effect and distance of maize plot from home is negative influence on economic efficiency. The result indicated that there exists a room to increase the efficiency of maize producers in the study area. For realizing significant economic efficiency gains policies and strategies of the government should be directed towards increasing farmer's education and livestock holding, promoting off/non-farm activities, facilitating credit and extension service.

Keywords: *technical, allocative and economic efficiency, tobit*

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1. Introduction

Agricultural sector plays crucial role in Sub Saharan Africa as, it is reflected on its high share in GDP, employment generation and prioritization in the development agenda. Likewise, the economy of Ethiopia is based on agriculture, which accounts for 36.3% of GDP and over 70% of exports earning [1]. It also generates employment of 73% to the total population and supplies 70% of the raw-material requirements of local industries [2,3] reported that total value of agricultural output has grown markedly over the past decade due to area expansion. However, gap between actual agricultural

production and potential for increasing its productivity still persists [4]. Maize is the most important staple cereal crop supplying over 40% daily calorie intake and consumed directly as human food in different forms in rural Ethiopia [5]. The rapid growth in population and urbanization increase the demand for more food as well as for industrial in Ethiopia. Consequently, maize remains a strategic crop to meet this demand [6]. Maize is the major staple food crops both in terms of area planted and volume of production obtained in 2016/2017 production year. From the total grain cultivated areas 12.57 million ha, 81.27% of ha were covered by cereals which produce 87.41% of the total production of 290.38 million quintal. The same source showed that, from the total area of cereals allocated maize covered 20.89%

producing 30.91% quintals with the yield of 36.74 quintal per hectare [7].

Ethiopia is one of the struggler in terms of agricultural production in the face of ever rising population growth rate that unable to meet reliable food security [8]. To address this, it needs boosting of agricultural productivity and improves living standard of farmers either through use of modern inputs technology or decreasing the present level of inefficiency of farmers [9,10,11]. Maize yield levels in Ethiopia are still very low caused by institutional, social and economic factor, risk issue and suboptimal crop management [12]. Several efficiency studies have been conducted in different part of Ethiopia. However much of them are limited to technical efficiency which does not full represent overall efficiency. As far as the author is concerned, there is no similar empirical works that has been undertaken to estimate the level of technical, allocative and economic efficiency and factors that affect efficiency of smallholder maize producer in the study area. Therefore, this study intended to fill this information and knowledge gaps in study area.

2. Research Methodology

2.1. Description of the Study Area

This study was carried out in Gudeya Bila district, which is one of the 17 districts located in the East Wollega zone of Oromia National Regional State in the Western part of Ethiopia. It encompasses agro-ecologies of highland, mid-altitude and lowland with proportion of 17.6% and 55.8% and 26.6%, respectively. Moreover, the temperature of the district varies between 11°C to 23°C. The district experienced an annual average rainfall of 1400 to 2000 mm. The farming system in the district is mainly mixed crop-livestock production. Most farmers in the district undertake both crop production and livestock rearing activities. Maize is one of the major cereals grown in the district. Apart from maize, the major crops grown in the district include sorghum, wheat, and teff, barley, and Niger seed.

2.2. Sampling Techniques and Sample Size Determination

Two stages random sampling technique was used to select sample household for this study. In first stage out of 13 kebeles exist in the district three kebeles were randomly selected. In second stage 154 samples household were selected by simple random sampling by lottery method from three kebeles household taking into account probability proportional. The sample size was determined based on the following formula given by Yamane [13].

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

Where, n is sample size, N is number of maize producing households in the district which is 8765 and e is the desired level of precision which was taken to be 8%.

Table 1. Total number of households and sample households in the study area

Name of kebele	Total number of households	Sample proportion (%)	Sample
Darbas	379	33	51
Tibe	173	15	23
Haro Gudisa	608	52	80
Total	1160	100	154

2.3. Sources and Methods of Data Collection

Structured questionnaire was first pilot tested to collect primary data from sample respondent. Then the questions were asked aid of trained enumerators under close supervision of the researcher. Focus Group Discussion also was made on issues related to production efficiency among maize dominant farmers. Secondary data collected from different journal, internet, published research and bureau of agriculture of the district.

2.4. Methods of Data Analysis

In this study, both descriptive and econometric models were used to analysis the data collected from sample farm households. In econometric estimation method Stochastic frontier approach was employed to estimate level of technical, allocative and economic efficiency and Tobit model was used to identify factors that affect the efficiency level of the maize farmers.

Efficiency measurement: Stochastic frontier model was employed to estimate parameters of production function and level of efficiency. This is because of the fact that this technique accounts for measuring inefficiency factors and technical errors occurring during measurement and observation [14]. The Cobb-Douglas functional form has most attractive feature for is its simplicity. Even though Cobb-Douglas model assumes unitary elasticity of substitution, constant production elasticity and constant factor demand; the interest is to analyze the efficiency measurement and not analyzing the general structure of production function. Hence, it will have adequate representation of the technology and insignificant impact on measurement of efficiency [15]. Besides, according to [16], in smallholders farming, the technology is unlikely to be substantially affected by variable returns to scale and therefore it is better to use Cobb-Douglas production function than Translog function. Functional form (Cobb-Douglas) that better fit the data was selected after testing the null hypotheses using the generalized likelihood ratio test.

Cobb Douglas stochastic frontier model used for this study is specified in the following form:

$$\ln Y_i = \beta_0 + \sum_{j=1}^6 b_j \ln X_{ij} + e_{ij} \quad (2)$$

Where ln– Denotes the natural logarithm; j – Represents the number of inputs used ; i – Represents the ith maize producers in the sample; Y_i – is observed maize output; x_{ij} Denotes jth farm input variables such as seed, land, NPS, urea, oxen power, labor β₀, b_j – Stands for the vector of

unknown parameters to be estimated; ei – Is a composed disturbance term made up of two elements $(v_i - u_i)$. The random error v_i – stochastic effects beyond the farmer's control and u_i capture the technical inefficiency.

Assuming that the production function in equation (2) is self- dual (eg. Cobb-Douglas), the dual cost function of the Cobb-Douglas production function can be specified as: the cost frontier function is also specified as;

$$\ln C_i = \beta_0 + \sum_{i=1}^n (\alpha_j \ln w_j + a_j \ln Y^*). \quad (3)$$

Given input oriented function, the efficient cost function can be specified as follows:

$$\min \sum_X C = \sum_{j=1}^6 w_j X_j. \quad (4)$$

Subjects to

$$Y^* = \hat{A} \prod X_j^{\beta_j}$$

where $\hat{A} = \text{Exp}(\beta_0)$.

The solution for the problem in the above equation is the basis for driving dual cost frontier. Substituting the input demand equations derived using shepherd's lemma (4) and Yield adjusted for stochastic noise (predicted value of yield) in the minimization problem above, the dual cost function can be written as follows:

$$C(Y_i^*, W) = H Y_i^{*\mu} \prod_j W_j^{\alpha_j} \quad (5)$$

$$a_j = \mu \hat{\beta}_n$$

$$\mu = \left(\sum_n \hat{\beta}_n \right)^{-1}$$

$$H = \frac{1}{\mu} \left(\hat{A} \prod_n \hat{\beta}_n \right)^{-\mu}.$$

According to [17], the explained cost measures enable to estimate AE and further EE.

We can define the farm-specific technical efficiency in terms of observed output (Y_i) to the corresponding frontier output (Y_i^*) using the existing technology.

$$TE_i = \frac{W' X_{it}}{W' X_i} = \frac{Y_i}{Y_i^*}. \quad (6)$$

The farm specific economic efficiency is defined as the ratio of minimum observed total production cost (C^*) to actual total production cost (C).

$$EE_i = \frac{W' X_{ie}}{W' X_i} = \frac{C^*}{C}. \quad (7)$$

Following Farrell [18], the AE index can be derived from Equations (6) and (7) as Follows:

$$AE_i = \frac{W' X_{ie}}{W' X_{it}} = \frac{EE_i}{TE_i}. \quad (8)$$

Determinants of efficiency

Following Gujarati [19] Tobit regression is specified as:

$$y_i^* = \delta_0 + \delta_m Z_{im} + \mu \quad (9)$$

Where y_i^* – latent variable representing the TE/AE/EE of i^{th} farm; Z_{im} represents farm specific factors affecting efficiency of i^{th} farm.

McDonald and Moffitt [20] proposed useful decomposition techniques of total marginal effects. Based on the likelihood function of the model stated in equation (9), the total marginal effect divided into the three marginal effects as follows:

1. The unconditional expected value of the dependent variable:

$$\frac{\partial E(y)}{\partial x_j} = [\phi(Z_U) - \phi(Z_L)] \frac{\partial E(y)^*}{\partial x_j} + \frac{\partial [\phi(Z_U) - \phi(Z_L)]}{\partial x_j} + \frac{\partial (1 - \phi(Z_U))}{\partial x_j} \quad (10)$$

2. The expected value of the dependent variable conditional upon being between the limits:

$$\frac{\partial E(y^*)}{\partial x_j} = \beta_k \left[1 + \frac{\{Z_L \phi(Z_L) - Z_U \phi(Z_U)\}}{\{\phi(Z_U) - \phi(Z_L)\}} \right] - \left[\frac{\{\phi(Z_L) - \phi(Z_U)\}^2}{\{\phi(Z_U) - \phi(Z_L)\}^2} \right] \quad (11)$$

3. The probability of being between the limits:

$$\frac{\partial [\phi(Z_U) - \phi(Z_L)]}{\partial x_j} = \frac{\beta_m}{\sigma} \cdot [\varphi(Z_L) - \varphi(Z_U)] \quad (12)$$

Where $\phi(\cdot)$ = the cumulative normal distribution, $\varphi(\cdot)$ = the normal density function, $Z_L = -\beta'X/\sigma$ and $Z_U = (1 - \beta'X)/\sigma$ are standardized variables that came from the likelihood function given the limits of y^* , and σ = standard deviation of the model.

3. Results and Discussion

Descriptive statistics of production function variables:

On average, sample farmers obtained 23.05 quintal of maize. The average land area allocated to maize production (owned shared and rented land) by household was 0.80 ha and ranged from 0.23 ha to 2.5 ha. The amount of seed that sampled households used were 16.34 kg on average. Like other inputs, human labor and oxen power inputs were also important, given a traditional farming system in the study area. Sampled households, on average, used 69.58 man equivalent labor and 18.61 oxen days for the production of maize during 2017/18 production season. Sample farmer households also on average, used 70.64 kg and 135.06 kg of NPS and urea respectively.

Table 2. Descriptive statistics of variables used in production function

Variables	Unit	Mean	Std.deviation	Minimum	maximum
OUTPUT	Quintal	23.05	14.63	3	70
SEED	Kilogram	16.34	9.94	4	65
LAND	Hectare	0.80	0.49	0.23	2.5
NPS	Kilogram	70.64	45.57	15	250
UREA	Kilogram	135.06	84.53	25	400
OXEN	Oxen-day	18.61	10.05	5	49
LABOR	Man-day	69.58	37.47	15.6	195.5

Source: Own survey (2018).

Table 3. Maize production constraints

Variables	Frequency	Percent
Soil factor	38	24.7
Seed productivity problem	21	13.6
Weed infestation	11	7.1
Poor land preparation	24	15.6
Shortage of oxen	9	5.8
Labor constraint	15	9.7
Shortage of land	10	6.5
American Gerry	26	16.9
Total	154	100.0

Source: Own survey (2018).

Maize Production constraints: Soil factors were the major problem. About 24.7% of respondents reported soil factor was the problem that they were facing whereas 16.9% were facing American Gerry. According to FGD American Gerry is a recently occurred disease that affects the yield of their maize crop that needs the immediate control of disease. In addition to this, 15.6% and 13.6% of the respondent faces poor land preparation and seed productivity problem respectively in the study area.

Econometric Model Outputs

In SPF method it is possible to test various hypotheses using maximum likelihood ratio test, which were not possible in non-parametric models. Therefore, the following tests were carried using the generalized Likelihood Ratio $LR = -2[L(H0) - L(H1)]$, where $L(H0)$ and $L(H1)$ are the values of log likelihood functions under the null and alternative hypothesis, respectively. Functional form that can better fit to the data, existence of the inefficiency component of the total error term of the stochastic production function, whether the technical efficiency levels were better estimated using a half normal or a truncated normal distribution u and all coefficients of the inefficiency effect model are simultaneously equal to zero.

Estimation of production and cost functions: From the total of six variables considered in the production function, three inputs (land, seed and labor) had a significant effect in explaining the variation in maize yield among farmers. The coefficients of the production function are

interpreted as elasticity. If there is a one percent increase in the size of land, amount of seed and amount of labor would increase maize production by 0.311%, 0.2804%, 0.1423% respectively, suggests that maize production was responsive to land, seed and labor in the study area. The scale coefficient was calculated to be 1.0341, indicating increasing returns to scale. The ratio of the standard error of $u(\delta u)$ to standard error $v(\delta v)$ known as lambda (λ), was 2.54. Depending on the value of lambda gamma value (γ) was 86.6%. It also shows that about 86.6% of the variations in output of maize are caused by technical inefficiency.

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The dual cost function which was derived analytically from the stochastic production function is given as follows basis for computing allocative and economic efficiency:

$$\begin{aligned} \ln Cmi = & 2.66 + 0.0299 \ln w_1 + 0.3195 \ln w_2 \\ & + 0.0089 \ln w_3 + 0.1641 \ln w_4 + 0.0775 \ln w_5 \\ & + 0.0145 \ln w_6 + 0.4755 \ln Y^* \end{aligned}$$

Where $ICmi$ is minimum cost of maize production; w_1 refers to the price of seed per kg, w_2 is cost of land per ha; w_3 is cost of NPS per kg; w_4 is cost of urea per kg; w_5 is cost of oxen per day; w_6 is cost of labor per day Y^* is output adjusted for any statistical noise; i^{th} refers to the i^{th} sample household.

Table 4. Generalized likelihood ratio test of hypotheses for parameters of stochastic production frontier

Hypothesis	Degree of freedom	LH0	LH1	LR	Critical χ^2	Decision
$H_0 : \beta_7 = \beta_8 = \beta_{27} = 0$	21	-44.01	--30.26	28.72	32.67	Accept Ho
$H_0 : \gamma = 0$	1	-51.05	-44.01	14.08	3.84	Reject Ho
$H_0 : \mu = 0$	1	-44.01	-43.68	0.66	3.84	Accept Ho
$H_0 : \delta_1 = \delta_2 = \delta_{12} = 0$	12	-44.01	-29.35	29.32	21.0261	Reject Ho

Source: Own computation (2018).

Table 5. Estimation of the Cobb-Douglas frontier production function

Variables	MLE	
	Coefficients	Std. Err
Constant	1.0135*	0.5325
LN(SEED)	0.2804***	0.0951
LN(LAND)	0.3110***	0.1032
LN(NPS)	0.0742	0.0706
LN(UREA)	0.0867	0.0688
LN(OXEN)	0.1395	0.0860
LN(LABOR)	0.1423*	0.0800
$\delta^2 = \delta_v^2 + \delta_u^2$	0.2453***	0.0526
$\lambda = \delta'u / \delta v$	2.54***	0.1107
Gamma (γ)	0.866	
Log likelihood	-44.01	
Return to scale	1.0341	

Note: * and *** refers to 10% and 1% significance level, respectively.
Source: Own computation (2018).

Efficiency score: The mean technical efficiency level of 71.65% shows that maize producing could increase the current maize output by 28.35% using the existing technology. The mean allocative efficiency of farmers in the study area was 70.06% indicating that on average, maize producer households can save 29.94% of their

current cost of inputs if resources are efficiently utilized. Mean economic efficiency level of sample households was 49.89% shows that an economically efficient household can reduce his/her maize production cost by 50.11%. The low level of EE was the total effect of both technical and allocative inefficiencies.

Determinants of efficiency in maize production: The estimates of Tobit model showed that among the 12 total variables entered in the model, variables namely education level, family size, farm size, frequency of extension contacts, distance of maize plot from the home, livestock holding, credit and participation in off/non-farm activities were found to be statistically significant factors affecting the level of efficiency of smallholder farmers in maize production in the study area.

Table 6. Summary statistics of efficiency score of sample households

Variables	Observation	Mean	Std.deviation	Min	max
TE	154	0.7165	0.1471	0.3054	0.9353
AE	154	0.7006	0.1297	0.2855	0.9462
EE	154	0.4989	0.1307	0.1856	0.8396

Source: Own computation (2018).

Table 7. Determinant of efficiency in maize production

Variables	Coefficient (Standard error)	TE		AE		EE	
		Coefficient	ME	Coefficient (Standard error)	ME	Coefficient (Standard error)	ME
Education level	0.01223*** 0.00337	0.01165	0.00991	-0.00452	-0.00398	0.00542*	0.00515
		0.00887	0.00321	-0.00195	-0.00195	0.00310	0.00025
		0.01611	0.01370	0.00594	0.00523	0.01725**	0.01714
Family size(ME)	0.01691** 0.00821	0.01226	0.00792	0.00257	0.00257	0.00765	0.00082
		0.02436	0.02071	-0.0047	-0.00418	0.01358	0.01638
		0.01854	0.01258	-0.00205	-0.00205	0.01213	0.00065
Farm size	0.02556* 0.01335	-0.00369	0.00596*	0.00582	0.00526	0.00200	0.00198
		-0.00314	0.00313	0.00526	0.00526	0.00301	0.00190
		-0.00281	0.00258	0.00258	0.00258	0.00009	0.00009
Livestock holding	-0.00388 0.00324	-0.00017	-0.00207**	-0.00202	-0.00182	-0.00164*	-0.00163
		-0.00015	0.00096	-0.00182	-0.00182	0.00092	-0.00156
		-0.00013	0.00096	-0.00089	-0.00089	0.00092	-0.00008
Distance to plot	0.00435*** 0.00113	0.00415	-0.00105	-0.00102	-0.00092	0.00208**	0.00206
		0.00353	0.00108	-0.00092	-0.00092	0.00104	0.00197
		0.00316	0.00108	-0.00045	-0.00045	0.00104	0.00009
Extension contact	0.06890*** 0.02221	0.06597	-0.0003	-0.00030	-0.00027	0.04938**	0.04905
		0.05667	0.02121	-0.00027	-0.00027	0.02047	0.04673
		0.04453	0.02121	-0.00013	-0.00013	0.02047	0.00368
Credit	0.05107** 0.02253	0.04867	0.03816*	0.03728	0.03368	0.05889***	0.05850
		0.04144	0.02165	0.03368	0.03368	0.02091	0.05577
		0.03657	0.02165	0.01634	0.01634	0.02091	0.00337

Note: *, **and *** significant at 10%, 5% and 1% level of significance, respectively
Source: Own computation (2018).

Note: Those computed marginal effects are $\frac{\partial E(y)}{\partial X_j}$ (total change), $\frac{\partial E(y^*)}{\partial X_j}$ (Expected change) and $\frac{\partial(\varphi(Z_U - Z_L))}{\partial X_j}$ (Change in probability) for

their respective significant coefficient of determinant are discussed in this study. The discussions about the significant variables are given below: The coefficient education was positive effect on TE and EE at 1% and 10% level of significance. This could be because; more educated farmers were capable to identify, interpret and react to new information and improves their knowledge and managerial skill. Moreover, a one year increase in educational level of the household head increases the probability of the farmer being technically and economically efficient by 0.89% and 0.025% and change in the expected value of TE and EE by 0.99% and 0.51% with an overall increase in the probability and levels of TE and EE by 1.17 and 0.54% respectively. This result was consistent with the research done by Samuel *et al.* [21] in Kenya and Mustefa *et al.* [22] in southwestern part of Ethiopia.

Family size on both TE and EE is positive and statistically significant at 5% significance level .because family labor is the main input in crop production as the farmer has large family size would manage crop plots on time and may able to use appropriate input combinations by using their own labor. Moreover, the computed marginal effect of family size showed that a one person change in the number of family in man equivalent would increase the probability of farmer being technically and economically efficient by 1.22 and 0.08% and change the expected value of TE and EE by 1.37%, and 1.64% with an overall increase in the probability and the level of efficiencies by 1.61 and 1.71%, respectively. This result is similar with the findings of [23].

Farm size had positive relation with technical efficiency at 10% level of significance. This is mainly justified on the view that those farmers with large farm size can better diversify their crops and the better chance for maize to be planted on fertile soils and have the capacity to use compatible technologies that could increase the efficiency of the farmer. Moreover, a unit change in farm size would result in 1.85% change in the probability of a farmer being technically efficient and the expected value of TE by 2.07% with an overall increase in the probability and the level of efficiency by 2.44%. This finding was in line with results obtained by [24].

Livestock holding (TLU) was positive and had a significant influence on AE at 10% level. The result reveal that having largest number of livestock holding helps to shifts cash constraint, provide manure and to satisfy all needs of farmers in the study area. Each unit increase in the value of TLU would increase the probability of a farmer being allocatively by 0.26% and the expected value of AE by about 0.53% with an overall increase in the probability and the level of efficiencies by 0.58%. This finding was consistent with the result obtained by [9,25].

Distance of maize plot from farm household is negative and significant at 5% and 10% levels of significance on both AE and EE respectively. This relation may be because farmers living near the production site follow up whole day their maize plot that enables to better manage farms which leads to better achievement of their efficiency. Unit change distance of plot from home would decrease the probability of a farmer being allocatively and economically efficient by 0.09 and 0.008% and the expected value of AE and EE decrease by 0.18 and 0.16% with an overall decrease in the probability and the level of efficiencies by 0.2 and 0.16% respectively. This is in line with [26].

Frequency of extension contact was positive and significantly affected the level of technical and economic efficiencies at 1% and 5% level of significance respectively. Extension services offer guidance to the farmers related to the use of various resources such as fertilizer and provide consultancy services in managing their scarce resources more efficiently. Each increase in the frequency of extension contact would increase the probability of a farmers being technically and economically efficient by 0.32 and 0.009% and the expected value of TE and EE by about 0.35 and 0.19% with an overall increase in the probability and the expected level of efficiencies by 0.42 and 0.2%, respectively. Abdulai, *et al.* [27] found similar result in northern Ghana .

Credit use had a positive sign and statistically significant effect on both TE and EE level at 1% and 5% level of significance. This due to the reason that use of credit allows a household to enhance efficiency by removing money constraints which may affect their ability to apply inputs, implements farm management decisions on time. Moreover, a change in the dummy variable representing the uses credit by the household ordered from 0 to 1 would increase the probability of the farmers being technically and economically efficient by about 4.45 and 0.37% and change the expected value of TE and EE by about 5.67 and 4.67% with an overall increase in the probability and the level of efficiencies by 6.59 and 4.9%, respectively. Hassen [28] also found positive relationship between credit and efficiency of smallholder farmers in wheat production in South Wollo. Etim and Okon [29] found similar result a positive relationship between credit and efficiency in maize farmers in Nigeria.

Off/non-farm activity was positive sign and statistically significant at 5%, 10% and 1% level of significance effect with respect to TE, AE, and EE respectively as expected. The reason is the income obtained from such activities could be used for the purchase of agricultural inputs and supplement financing of household expenditures which they cannot provide from the farm income hence increases their efficiency. Moreover, a change in the dummy variable representing the participation in off/non-farm activities by the household ordered from 0 to 1 would increase the probability of the farmers being technically, allocatively and economically efficient by 3.66, 1.63 and 0.34% and change the expected value of TE, AE and EE by about 4.14, 3.37 and 5.58% with an overall increase in the probability and the level of efficiencies by 4.87, 3.73 and 5.85%, respectively. This result is in line with the findings of [25,30].

4. Summary and Conclusion

This study was conducted to analyze technical, allocative and economic efficiencies and identifies factors that affect efficiency of smallholder maize producers in Gudeya Bila district, Oromia National Regional State, Ethiopia. Primary data source were collected using structured questionnaire from 154 sample household. The stochastic frontier production function and self-dual cost function indicates that the average TE, AE and EE value of the sample households was 71.65%, 70.06% and 49.89% respectively. According to the Tobit regression model result variables namely education level, family size, farm size, frequency of extension contacts, distance of maize plot from the home, livestock holding, credit and participation in off/non-farm activities were found to be statistically significant factors affecting the level of efficiency of smallholder farmers in maize production in the study area. The main conclusion stemming from the analysis of the efficiency of maize production is that, maize producers in the study area are not operating at full TE, AE and EE levels and there exists the room to improve the level of technical, allocative and economic efficiency of maize producers in the study area. Finally based on the result of the study following recommendations are drawn:

The first on is Since considerable variability in all efficiencies score less efficient farmers increase their efficiency level by adopting the practices of relatively efficient farmers.

Second government and NGOs should have designed educational opportunities to the rural population both formal and non-formal education, farmers training centers as farmer education .Third, design appropriate policy and strategies for improving livestock production systems by solving the shortage of feed and health services which in turn will enhance the efficiency. Fourth Government and NGOs should have to intensify extension and different agricultural technical vocational education and training colleges should specialize development agent by specific crop since it may be difficult to development agent to give advice for all crops at one specific production season.

Fifth Government should have to establish adequate rural finance institutions at affordable interest rate and facilitating the available micro-finance institutions such Oromia credit and saving Share Company and Wasasa.

Sixth Rural development strategies should not only emphasize on increasing agricultural production but simultaneous attention should be given to promote off/non-farm.

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