PRODUCTION EFFICIENCY AND ITS DETERMINANTS IN CASSAVA–BASED PRODUCTION IN OGUN, STATE NIGERIA

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ABSTRACT

This study assessed production efficiency and its determinants in cassava-based production in Ogun State. Multistage sampling procedure was used to select 174 cassava-based farmers in a cross-sectional survey. Data were analyzed using descriptive statistics, Stochastic Production Frontier (SPF) and Stochastic Cost Function (SCF) models. Results revealed that 79.3% of the cassava-based farmers were male, 89.1% were married, while 35.6% had primary education. Also, the mean age, farming experience, farm and household sizes of the farmers were 50 years, 22.9 years, 3 hectares and 6 persons respectively. The mean technical, allocative and economic efficiencies of the farmers were 0.8054, 0.8414 and 0.6835 respectively. Furthermore, farm size, quantity of fertilizer, cassava stem cutting, quantity of insecticide were the significant factors influencing cassava outputs ($p<0.01$) while household size, educational status, credit use and extension contact decreased the technical inefficiency of the farmers ($p<0.01$). Stochastic cost function showed that prices of cassava stem cutting, price of fertilizer, price of herbicide and price of insecticide were the significant determinants of the total cost of production ($p<0.05$) while credit use, extension contact, sex and educational status increased cost efficiency ($p<0.05$). The study concluded that the farmers were not fully efficient in their resource allocation; therefore, there is allowance for improvement through intensive collaboration with extension services and required institutions. The study therefore advocated for adequate credit facilities and extension services to be made available to cassava-based farmers in the study area in order to increase their production efficiency.

Keywords: Cassava-based Farmers, Production Efficiency, Stochastic Frontier, Nigeria

INTRODUCTION

Agricultural sector in Nigeria has over time become an important sector of the economy. It has remained the main sector of Nigerian economy despite the discovery of oil in commercial quantities and its attendant boom since 1970s. For example, despite agricultural sector neglect by government at the emergence of oil in 1970s, the sector remained the major employment segment of the economy thereby employing over 60% of the unemployed workforce in the country, reduces extreme poverty and as well promotes the growth of the economy (Oji-Okoro, 2011; Olajide *et al.*, 2012). The sector's contribution to total real gross domestic product (RGDP) ranges from 30% to 42%, and has as well engaged over 65% of the country's total workforce.

Agriculture constitutes a significant sector of Nigeria's economy, and is significant in terms of employment of labour, contribution to Gross Domestic Product (GDP) and main source of foreign exchange earnings (Emeka, 2007; Oyakhilomen and

Zibah, 2014). In countries where the share of agriculture in overall employment is large, broad-based growth in agricultural incomes is essential to stimulate growth in the overall economy, including the non-farm sectors selling to rural people. Hence, the ability of agriculture to generate overall GDP growth and its comparative advantage in reducing poverty will vary from country to country (FAO, 2012).

The average annual rates of growth in food crop production have also declined over the years (Amaza and Olayemi, 2002; CBN, 2003; FAO, 2003; World Bank, 2003; FAO, 2018). Despite its importance, agriculture in Nigeria is still faced with numerous problems such as inadequate funding, non-availability of complimentary inputs in the right quantity and quality, under-developed marketing system and poor and inadequate infrastructural facilities for production which in turn warrants farmers' need for credit (Fakayode, *et al.*, 2008; Oni, 2013).

Cassava is an important and the most widely consumed staple food in Nigeria. It is a starchy root tuber which contributes to the staple of millions worldwide, many of whom are in sub-Saharan Africa (SSA). Cassava breeds from Latin America but was introduced to Africa by the Portuguese in the sixteen century as a possibly useful crop (Akinpelu *et al*., 2011). It was reported that about 121 million tonnes of cassava was produced by Africa (Parkes *et al*., 2013). Globally, cassava production and consumption has substantially increased over the past few years with sub-Saharan Africa having the highest growth of 48.3 million tonnes in 1980 to 95.3 million tonnes in 2011 (Egesi *et al*., 2006; FAO 2013). This growth is championed by Nigeria which is the largest producer of cassava followed by Ghana (FAO, 2013). Cassava is a very versatile commodity with numerous uses and by-products. The roots are processed for human and industrial consumption. Various products can be gotten from cassava which includes garri, cassava flour, wet pulp, starch, smoked cassava balls, dried cassava among others (Truman *et al.*, 2004).

However, agricultural production involves risks and farmers have to adapt or adjust their farming practices so as to avoid loss since poor management of risks can result in crop failures leading to low production and unstable income. To deal with this problem, diversification into production of other crops and livestock by farmers has been recognized as a means to ensure stable income (Ali, 2004; Oni, 2013). Intercropping cassava with other food crops such as cocoyam, yam, maize etc as mean of diversification can also ensure food security and income stability (Aneani *et al.*, 2007).

Thus, the potential of cassava production to meet local demand, and lift rural people out of hunger and poverty has been severely curtailed due to the low efficiency of production. In order to improve the quality and quantity of cassava production and the efficiency of operation, as well as reduce the drudgery and tedium associated with traditional or crude way of its production, there is need to critically examine its production. This paper, therefore, broadly aim to analyze the production efficiency and its determinants in cassava based production in Ogun State, while specific objectives considered in order to achieve the broad objective include, to (i) describe the socio-economic characteristic of the cassava based farmers in the study area (ii) estimate production efficiency of the cassava based farmers in Ogun State.

MATERIALS AND METHOD

The Study Area

The study was carried out in Ogun State, Nigeria. The State has 20 Local Government Areas. It lies approximately between latitude 6.2°N and 7.8°N and longitude 3.0°E and 5.0°E. It falls within the humid tropical lowland region with two distinct seasons. The short dry season lasts for four months usually from November to February. Average annual rainfall ranges from 1, 200mm in the Northern part to 1, 470mm in the Southern part. The monthly temperature ranges from 23°C in July to 32°C in February. The northern part of the state is mainly of derived savannah vegetation while the central part falls in the rainforest belt. The southern part has mangrove swamp vegetation. Ogun State is predominantly made up of farmers, food crop such as maize, cassava, yam, cocoyam, soya bean are extensively produced in the State. Ogun State is endowed with fertile soil, making it possible to support the growth of food crop, economic crops and livestock. The State shares boundary with the Republic of Benin in the West, Lagos State and Atlantic Ocean in the South, Ondo State in the East and Oyo State in the North. Ogun State covers a land area of 16, 762 sq km with a population of 3, 728, 098 (NPC, 2006). For administrative convenience, the state has been divided into four agricultural zones by the Ogun State Agricultural Development Programme (OGADEP). These include Abeokuta, Ijebu Ode, Remo and Ikene zones.

Sampling procedure

Multistage sampling procedure was used. Stage one was a random selection of two zones from the four Agricultural Development Programme (OGADEP) zones which are Ilaro, and Abeokuta in Ogun State. The second stage was a random selection of 3 agricultural blocks from each of the selected zones. The third stage was a random selection of 3 cell from each block. The fourth stage was a random selection of 10 cassava-based farmers from each cell, thereby giving a total of 180 farmers.

Analytical Techniques

The data collected were subjected to descriptive and econometric analyses

Stochastic Frontier Production Function

Since Farrell's proposition, a great deal of effort has been directed towards the estimation of frontier models of a production technology and obtaining production efficiency measures. The types of model include non-parametric deterministic models, deterministic full frontier models, stochastic full frontier models and stochastic frontier models. The basic concept of a stochastic frontier production function as proposed by Aigner *et al.* (1977) and Meeusen and Van den Broeck (1977) is that the disturbance component of these frontiers is composed of a systematic random variable which captures the effects of weather, and other factors outside the control of the economic agent and a one-sided disturbance which measures technical efficiency (Aigner *et al.*, 1977; Kumbhakar and Lovell, 2000).

The stochastic frontier production function model for estimating farm level technical efficiency is specified as:

$$Y_i = f(X_i; \beta_i) + \varepsilon_i \quad (1)$$

Where:

$i = 1,2,..., n$,

Y_i = Output of the i^{th} farm,

X_i = Vector of inputs quantities used by the i^{th} farm,

β_i= vectors of unknown parameters to be estimated.

$f(X_i; \beta_i)$ = Production function (Cobb-Douglas, Translog, etc.)

ε_i error terms that is composed of two elements, that is, $\varepsilon_i = V_i — U_i$ which represents the traditional deterministic production function formulation.

$$Y = f(X;\beta) + v—u \qquad (2)$$

V_i = Assumed independent distributed random errors. It is the random variable that accounts for the random variations in output by factors which are beyond the control of the farm such as diseases outbreak, weather, measurement errors and is assumed to be independent, identical and normally distributed with mean of zero and constant variance $\{V_i \sim N(0, \sigma_v^2)\}$ and independent of U_i given the stochastic structure of the frontier.

U_i = Technical inefficiency effects. It is the second component of the error term, a non-negative random variable associated with technical inefficiency in production (allowing the actual production to fall below the frontier but without attributing all short falls in output from the frontier as inefficiency), and is assumed to be independently, identically and normally distributed $\{U_i \; [N|(0, \sigma_u^2)]\}$ and independent of V_i. Also, the technical inefficiency effects in the stochastic frontier above are expressed in terms of various explanatory variables (assumed to be related to farm and farmers related socio-economic characteristics) which include the socioeconomic characteristics such as age, sex, etc.

This is given by: -

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \text{-----------} + \delta_n Z_n \qquad (3)$$

$\delta_0, \delta_1, \delta_2 \ldots\ldots \delta_n$, are inefficiency parameters and the $Z_1, Z_2 \ldots Z_n$ are the related socio economic characteristics.

$$\sigma^2 = \sigma_u^2 + \sigma_v^2 \qquad (4)$$

$$\text{Furthermore } \gamma = \sigma_u^2 / \sigma^2 \qquad (5)$$

The variance ratio parameter gamma (γ) according to Battesse and Cora (1977) is the total output attained at the frontier which is attributed to technical efficiency and has a value between zero and one. Similarly, ($1-\gamma$) measures the technical inefficiency of the firms.

The variance ratio parameter γ (Gamma) has two important characteristics:

(i) When σ_v^2 tends to zero, then u is the predominant error in equation (2) and 'γ' tends to 1 (i.e. $\gamma=(0\leq \gamma \leq 1)$), implying that the output of the sampled farmers differs from the maximum output mainly because of the difference in technical inefficiency.

(ii) When σ_u^2 tends to zero, then the symmetric error v is the predominant error in equation (2) and so γ tends to 0.

Thus, based on the value of 'γ, asserted that it is possible to identify whether the difference between a farmers' output and the efficient output is principally due to random errors (γ tends to 0) or the inefficient use of resources (γ tends to 1).

Following Jondrow *et al.* (1982), the technical efficiency estimation is given by the mean of conditional distribution of inefficiency term U_i given ε_i and thus defined by:

$$E\,(Ui|\varepsilon i) = ((\sigma u\, \sigma v)/\sigma)\frac{f\left(\varepsilon_i\lambda/_{\sigma}\right)}{1-f^{\varepsilon_i\lambda}/_{\sigma}} - \frac{\varepsilon_i\lambda}{\sigma} \qquad (6)$$

Here, the parameter lambda (λ) = σ_u/σ_v (i.e $\sqrt{\gamma/(1-\gamma)}$) is expected to be greater than one with such a result indicating a good fit for the model and the correctness of the specified distributional assumptions for V_1, and U_1, estimators for β's variance parameters $\sigma 2 = \sigma_u^2 + \sigma_v^2$ while f and F represents the standard normal density and cumulative distribution function respectively evaluated at $\varepsilon_i\lambda/\sigma$.

The farm specific technical efficiency is defined in terms of observed output (Y_i) to the corresponding frontier output (Y_i*) using the available technology derived from the result of equation (6) above as:

(TE) $=Y_i/Y_i^* = f(X_i;\beta) \exp(V_i-U_i), / f(X_i;\beta_i) \exp(V_i) = \operatorname{Exp}(-U_i)$ (7)

Where:
Y_i=Observed output
Y_i*= Frontier output
TE takes values within the interval zero and one (i.e. between 0 and 1), where 1 indicates a fully efficient farm.
A Cobb-Douglas production form of the frontier that was used for this study was presented as follows:

$$\ln Y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \beta_6 \ln x_6 + V_i - U_i \quad (8)$$

Where Y_i = output of farmers (grain equivalent in kg)
X_1 = farm size (ha)
X_2 = cassava cuttings (kg)
X_3 = Fertilizer (kg)
X_4 = herbicide (litres)
X_5 = Insecticide (litres)
X_6 = labour (man day)
The inefficiency model was represented by U_i which was defined as

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 + \varepsilon_0 \quad (9)$$

Where
Ui = Technical inefficiency
Z_1 = Age of the cassava-based farmer (years)
Z_2 = Sex (Male=1, 0 otherwise)
Z_3 = Marital status = (married=1, otherwise =0)
Z_4 = Household Size (no)
Z_5 = educational status (years)
Z_6 = Farming Experience (years)
Z_7 = Credit use (yes=1, 0 otherwise)
Z_8=Extension contacts ((years =1,0therwise =0)
And δ1, δ2……..δ8 are the parameters to be estimated
The Cobb-Douglas cost frontier function for the Cassava-based farmers is specified a

$$Ln\, C_i = a_0 + a_1 lnP_{1i} + a_2 lnP_{2i} + a_3 lnP_{3i} + a_4 lnP_{4i} + a_5 lnP_{5i} + a_6 lnP_{6i} + V_i + \mu_i \quad (10),$$

Where: C_i = Total input cost of the i[th] farms (naira per hectare)
P1i = Rent on land per hectare (naira per hectare)
P2i = Price of cassava stem cuttings (naira per hectare)
P3i =Price of fertilizer per Kg (naira per hectare)
P4i = Average price of herbicides per litre (naira per hectare)
P5i = Average price of insecticide per litre (naira per hectare)
P6i = Wage rate of labor per man day (naira per hectare)
V_i = Random variability in the production that cannot be influenced by the farmer
μ_i = deviation from maximum potential output attributed to technical inefficiency
a_0 = Intercept
$a_1 - a_6$ = Production
The stochastic frontier cost functions model for estimating farm level overall economic efficiency is specified as:

$$C_i=g(Y_i, P_i; \alpha_i)+ \varepsilon_i \quad (11)$$

Where:
i = 1,2…n, C_i represents total production cost, g is a suitable functional form such as Cobb- Douglas; Y_i represents output produced, P_i represents prices of inputs, α represents the parameters of the cost function and ε_i represents the error term that is composed of two elements, that is, $\varepsilon_i = V_i + U_i$.

$C_i = g(Y_i, P_i; \alpha_i) + V_i / +U_i$ (12)

Here V_i and U_i are as defined earlier. However, because inefficiencies are assumed to always increase costs, error components have positive signs (Coelli *et al.*, 1998).

The farm specific economic efficiency (EE) is defined as the ratio of minimum observed total production cost (C_i*) to actual total production cost (C_i) using the result of equation 6 above. That is:

$$EE = \frac{C_i^*}{C_i} = \frac{E(C_i|u_i=0, Y_i P_i)}{E(Y_i|u_i, Y_i P_i)} = E[Exp(-U_i|\varepsilon)] \quad (13)$$

The farm level efficiency was obtained using the relationship

EE =1/Cost efficiency.

Hence economic efficiency (EE) is the inverse of cost efficiency (CE) while farm level allocative efficiency was obtained using the relationship

Allocative efficiency (AE) =EE/TE

RESULTS AND DISCUSSION

Respondents' Socioeconomic Characteristics

The studies revealed that majority of the Cassava-based farmers are still in their economic age with a mean age of 50 years and have potential for higher income generation and positive return. In terms of sex, it was revealed that 79.3% of the farmers are males. This shows active involvement of men in farming in the study area. The findings of this study showed that majority (89.1%) of the farmers were married. This implies that the farmers have additional responsibility. In a traditional rural setting, a wife is a good source of family labor in food crop production whose activities begin from decision making on production to processing and marketing of farm produce. The findings of the study showed that the mean household size for the cassava-based farm was approximately 6 persons. Majority (73%) of the farmers had between 5 and 10 household members. This may be an indication that more members of household are available for farming at the expense of formal education. However, (35.6%) of the cassava-based farmers had primary education. The mean farming experience was 23 years; this implies that the farmers are relatively experienced. Majority of the male farmers are married with high level of illiteracy. Also majority (64.4%) got their credit through cooperative society.

Determinants of Production Function of the Cassava-based Farmers

The result of the Maximum Likelihood Estimates (MLE) of the production function of Cassava-based farmers is presented in Table 1. The variance parameters, sigma-squared and gamma were 0.4407 ($p<0.01$) and 0.999 ($p<0.01$) respectively. The gamma value implies that about 99% of the variation in output of Cassava-based farmer is due to the differences in their technical inefficiency. Thus, inefficiency effects were present and made significant contribution to the efficiency of the Cassava-based farmers. The parameter estimates of the production function of Cassava-based farmers showed that farm size ($p<0.01$), cassava cutting ($p<0.01$), fertilizer ($p<0.01$) and insecticide ($p<0.01$) have positive significant influence on the farm output. This implies that a unit increase in the utilization of these inputs will lead to increase in the farm output, all other things being equal. The negative signs of the coefficients of labor ($p<0.01$) and herbicide ($p<0.01$) showed that these inputs are over-utilized. This implies that an increase in the level of labour used will not increase output of Cassava-based farmer in the study area .This findings is in line with (Akinbode *et al.*, (2011).

Factors affecting inefficiency of Cassava-based farmer, the contribution of farmer's personal characteristics: (age, years of formal education, farming experience, household size, sex and extension contact) and credit use were also examined. The sign of the coefficients of these variables has important policy implications as positive sign implies negative effect on efficiency while negative sign signifies a positive effect on efficiency.

TABLE 1: MAXIMUM LIKELIHOOD ESTIMATE OF STOCHASTIC FRONTIER PRODUCTION FUNCTION OF CASSAVA-BASED FARMERS

Variables	Parameter	Co-efficient	t-value
Constant	β_0	10.2638	0.8
Farm size	β_1	0.8331***	5.65
Cassava cutting	β_2	0.7832***	16.23
Fertilizer	β_3	0.0852***	3.55
Herbicide	β_4	-0.2573***	-3.7
Insecticide	β_5	0.7012***	7.44
Labour	β_6	-0.4263***	-4.71
INEFFICIENCY MODEL			
Constant	δ_0	5.8734	0.458
Age	δ_1	-0.0455***	-6.87
Sex	δ_2	0.1004	0.74
Marital status	δ_3	-0.0497	-0.28
Household size	δ_4	-0.0772***	-2.85
Educational status	δ_5	-0.08093***	-6.92
Farming Experience	δ_6	0.0012	0.21
Credit use	δ_7	-0.5927***	-3.96
Extension contact	δ_8	-0.0348***	-3.524
DIAGNOSTIC STATIATICS			
Sigma square	δ^2	0.4407***	9.272
Gamma	Γ	0.999***	-4.387
Log-likelihood		0.00017	

Source: Field survey 2015 *, **and * indicate 10%, 5%and 1%**

Findings revealed that increase in educational level (p<0.01), household size (p<0.01), credit use (p<0.01), age (p<0.01), and frequency of extension contact (p<0.01) will increase the farm efficiency. Also Cassava-based farmers with large household size are more efficient than those with few household sizes, and the higher the level of education of the farmers the more efficient they are. This agree with Ogundari and Ojo (2007) who reported that education and credit increase technical efficiency of food crop farmers. Cassava-based farmer that use credit are more efficient than those who do not use. This agrees with Chizari and Zare (2000) who found that the effect of credit on agricultural production is positive and significant. This result further agrees with Onumah *et al.* (2013) who concluded that access to credit is one of the factors found to reduce inefficiency among producers. This shows that credit accessibility is vital in improving the performance of Cassava-based production.

Determinants of Production Cost Function of the Cassava-based Farmer

The result of the maximum likelihood estimates of the Stochastic Frontier Cost Function is presented in Table 2, the sigma-square was 0.46623 (p<0.05), attesting to the good fit of the model. Also, the variance ratio (gamma) revealed that inefficiency effects exist among Cassava-based farmers as shown by the gamma value of 0.98 (p<0.01).

TABLE 2: MAXIMUM LIKELIHOOD ESTIMATE OF STOCHASTIC FRONTIER OF COST FUNCTION OF CASSAVA-BASED FARMERS

Variables	Co-efficient	t-value
Constant	8.9661***	18.29
Rent	0.0067	0.6
Price of cassava cutting	0.3811***	4.37
price of fertilizer	0.02615**	2.54
price of herbicide	0.0314**	2.07
Price of insecticide	0.05735***	2.61
price of labour	0.01314*	1.91
INEFFICIENCY MODEL		
Constant	0.00224**	-2.079
Age	0.0543	1.622
Sex	-0.0351**	-2.06
Marital status	0.041	1.61
Household size	-0.1866	-1.51
Educational status	0.4127**	2.28
Farming Experience	0.02386	1.01
Credit use	-0.758**	-1.98
Extension contact	-0.2653**	-2.26
DIAGNOSTIC STATIATICS		
Sigma square	0.46623**	2.38
Gamma	0.9873***	162.72
Log-likelihood	152.81***	

Source: Field survey 2015 *, ** and* indicate 10%, 5% and 1%**

This implies that about 98% of the variation in total production cost is due to differences in their cost inefficiency. Labour wage (p<0.10), price of fertilizer, price of herbicide (p<0.05), price of insecticide (p<0.01), and price of cassava cuttings (p<0.01) conform to the *a priori* expectation with positive signs. The magnitude of the labour wage rate, price of fertilize, price of herbicide, price of insecticide, and price of cassava cuttings implies that increase in the unit cost of these variables will lead to an increase in the total cost of production.

Factors affecting efficiency of Cassava-based farmer, the contribution of farmer's personal characteristics: (age, years of formal education, farming experience, household size, sex, extension contact) and credit use to farm inefficiency was also examined. The sign of the coefficients of these variables has important policy implications as positive sign implies negative effect on cost efficiency while negative sign signifies a positive effect on efficiency. The findings revealed that credit use (p<0.05), extension contact (p<0.05), sex (p<0.05), education (p<0.05) have a positive effect on efficiency. This implies that Farmers who claimed to have frequent contact with extension agents tend to be more efficient than those who claimed otherwise. Furthermore, male farmers were more efficient than female farmers. In addition, the efficiency of the farmers increases with increased level of education. Cassava-based farmer that use credit are more efficient than those who did not use credit. This agrees with Chizari and Zare (2000) in their research which showed that the effect of credit on agricultural production is positive and significant.

Efficiency Scores of Cassava-based Farmers

Table 3 presents the results of frequency distribution of technical efficiency, allocative efficiency and economic efficiency of cassava-based farmers in the study area. The predicted technical efficiency differs substantially among the cassava-based farmers, ranking from 0.486 to 0.9732 with a mean of 0.81. This result shows that the farmers have not yet reached the frontier level in production in the study area by 2.68%. Also, the Cassava-based farmers were able to obtain about 81% of potential output from their combination of input mix. This implies there is room for improvement in their technical efficiency by 19%.

The allocative efficiency of the farmers in the study area is also presented in Table 3 and it ranges between 0.113 and 0.9662 with a mean allocative efficiency of 0.8415. This implies that if the average farmers in the sample was to achieve allocative efficiency level of cost most efficient counterpart, the average farmer could realize 13.53% cost saving (i.e. $\left(1-\frac{0.8415}{0.9662}\right)*100)$) has a mean efficiency of 0.84.

The mean economic efficiency for the cassava based-farms was 0.6836. That is the respondents were 68% economic efficient. The evidence from these results shows that, to achieve higher economic efficiency in cassava-based farming there is room for improvement in their economic efficiency by 32%.

TABLE 3: DISTRIBUTION OF CASSAVA-BASED FARMERS BY TECHNICAL, ECONOMICAL AND ALLOCATIVE EFFICIENCY

	Technical efficiency		**Allocative efficiency**		**Economic efficiency**	
Frequency indices	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
≤ .3.0	0	0	6	3.42	8	4.56
0.31-0.40	0	0	3	1.71	8	4.56
0.41-0.50	2	1.14	4	2.28	13	7.42
0.51-0.60	7	3.99	5	2.85	25	14.27
0.61-0.70	22	12.54	13	7.41	29	16.55
0.71-0.80	50	28.5	18	11.07	38	21.71
0.81-0.90	67	39.01	36	20.53	46	26.93
≥ 0.90	26	14.82	89	50.73	7	4
Mean	0.805429		0.841469		0.683562	
Minimum	0.4864		0.113		0.092	
Maximum	0.9732		0.9662		0.9993	
Total	**174**	**100**	**174**	**100**	**174**	**100**

Source: Field survey, 2015

CONCLUSION

The study concludes that majority of the Cassava-based farmers are still in their economic age and have potential for higher income generation and positive return. The stochastic frontier analysis result showed that the cassava-based farmers are 81%, 84% and 68% technical efficient, allocative efficient and economic efficient respectively. Meanwhile, decisions in the transformation of physical inputs to outputs appeared imperfect. The outcome of the stochastic production function showed that farm size, cassava cutting, fertilizer and insecticide are the main factors influencing their farm output. The results of stochastic frontier analyses revealed that there was inefficiency among the Cassava-based farmers in Ogun state; hence, there is potential to improve Cassava-based farmers output. Evidence from this study reveals that increase in educational level, household size, credit use, age, labour and frequency of extension visit are the factors affecting farm efficiency in the study area.The findings also revealed that credit use, extension contact, sex, and educational status of the farmers have a positive effect on their efficiency. The study therefore advocates for adequate credit facilities to be made available to cassava-based farmers in the study area in order to increase their production efficiency. Given the significance of extension contact as an important factor affecting the three types of efficiency considered in this study, extension training which may improve technical knowledge of the cassava-based farmers and increase their production efficiency.

REFERENCES

Aigner, D. J., Lovell, C. A. K. and Schmidt, P. (1977). Formulation and Estimation of Stochastic Frontier Production Function Models. *Journal of Econometrics*, 6(1): 21-32.

Akinbode, S. O., Dipeolu, A. O. and Ayinde, I. A. (2011). An Examination of Technical, Allocative and Economic Efficiency in Ofada Rice Farming in Ogun state, Nigeria. *African Journal of Agricultural Research*, 6(28): 6027-6035.

Akinpelu, A.O., Amamgbo, L.E.F., Olojede, A.O. and Oyekale, A.S. (2011). Health implications of cassava production and consumption. *Journal of Agriculture and Social Research (JASR)*, *11*(1): 118-125.

Ali, M. (2004). Agricultural Diversification and International Competitiveness. Tokyo, Japan: The Asian Productivity Organization. pp. 1-3. From <http://www.apo-tokyo. org,> (Retrieved on November, 2012).

Amaza, P. S. and Olayemi, J. K. (2002). Analysis of Technical Inefficiency in Food Crop Production in Gombe State, Nigeria. *Applied Economics Letter*, 9(1): 51-54.

Aneani, F., Anchirinah, V. M., Owusu-Ansah, F. and Asamoah, M. (2007). An analysis of the extent and determinants of crop diversification by cocoa (*Theobroma cacao*) farmers in Ghana. *African Journal of Agricultural Research*, 6(18): 4277-4287**.**

Battesse, G. E and Cora, G. S. (1977). Estimation of a Productions Frontier Model, with Application to the Pastoral Zone of Eastern Australian. *Australian Journal of Agricultural Economics*, 21(3): 169 – 179.

CBN (Central Bank of Nigeria) (2003). Annual Report and Statement of Accounts. A CBN Publication, Abuja.

CBN (Central bank of Nigeria) (2005). Microfinance Policy, Regulatory and Supervisory Framework for Nigeria. Central bank of Nigeria. https://www.cbn.gov.ng/OUT/PUBLICATIONS/GUIDELINES/DFD/2006/MICROFINANCE%20POLICY.PDF (Retrieved on November 12,2012)

Chizari, A. H., and Zare, A. (2000). Assessing the Effect of Agricultural Bank Credit on Production in Khorassan Province of Iran. *Agricultural Economics and Development*, 32(1): 62-92.

Coelli, T. J., Prasado-Rao, D. S., and Battesse, G. E. (1998). An introduction to efficiency and productivity Analysis. Kluwer Academic Publishers, Boston/Dordrecht.

Egesi, C., Mbanaso, E., Ogbe, F., Okogbenin, E. and Fregene, M. (2006). Development of cassava varieties with high value root quality through induced mutations and marker-aided breeding. *NRCRI, Umudike Annual Report, 2006*: 2-6.

Emeka, O. (2007). Improving the Agricultural Sector toward Economics Development and Poverty Reduction in Nigeria. CBN Bulletin 4: 23-56

Fakayode, B. S, Omotesho, O. A., Tosho, A. B. and Ajayi, P. D. (2008). An Economic Survey of Rural Infrastructures and Agricultural Productivity Profiles in Nigeria. *European Journal of Social Sciences* 7(2).

FAO (2003). Online Statistical Database. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO (2004). Online Statistical Database. Rome, Italy: Food and Agriculture Organization of the United Nations. From <http://www.fao.org/> (Retrieved on August, 2012).

FAO (2013). *Save and Grow: Cassava: a guide to sustainable production intensification*. 2013, 6-18. Food and Agriculture Organization of the United Nations.

FAO (2018). The State of Agricultural Commodity Markets 2018. Agricultural trade, climate change and food security. Rome.

Jondrow, J., Lovelli, C. A. K., Materov, I. S and Schmidt, P. (1982). On the Estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model. *Journal of Econometrics*, 19: 233-238

Kumbhakar, S. C. and Lovel, C. K. (2000). A Stochastic Frontier Analysis. Cambridge University Press

Meeusen, W. and van den Broeck, J. (1977). Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error. *International Economic Review*, 18: 435-44.

Ogundari, K. and Ojo, S. O. (2007). Economic Efficiency of Small Scale Cassava-based Production in Nigeria: A stochastic frontier approach. *Journal of Social Science*, 142: 123-130.

Oji-Okoro, I. (2011). Analysis of the Contribution of Agricultural Sector on the Nigerian Economic Development. *World Review of Business Research*. 1(1): 191-200.

Olajide, O. T., Akinlabi, B. H. and Tijani, A. A. (2012). Agriculture resource and economic growth in Nigeria. *European Scientific Journal*, 8(22): 98-112.

Oni, T. O. (2013). Challenges and Prospects of Agriculture in Nigeria: The way forward. *Journal of Economics and Sustainable Development*, 4(16), 37-45

Onumah, J. A., Al-Hassan, R. M. and Onumah, E. E. (2013). Productivity and Technical Efficiency of Cocoa Production in Eastern Ghana CSIR-Science and Technology Policy Research Institute Accra-Ghana *Journal of Economics and Sustainable Development* 4(4).

Onumah., E. E. and Acquah, H. D. (2010). Frontier Analysis of Aquaculture Farms in the Southern Sector of Ghana. *World Applied Sciences Journal*, 9(7): 826-835.

Oyakhilomen, O. and Zibah, R. G. (2014). Agricultural Production and Economic Growth in Nigeria: Implication for Rural Poverty Alleviation. *Quarterly Journal of International Agriculture*, 53(3): 207-223

Parkes, E. Y., Fregene, M., Dixon, A., Boakye-Peprah, B., and Labuschagne, M. T. (2013). Combining ability of cassava genotypes for cassava mosaic disease and cassava bacterial blight, yield and its related components in two ecological zones in Ghana. *Euphytica*, 194(1): 13-24.

Truman, P.P., Daphnes, S.T., Lateef, S. and Malachy, O. A. (2004). The Global Cassava Development Strategy, A Cassava Industrial Revolution in Nigeria. The Potential for a New Industrial Crop". International Fund for Agricultural Development Food and Agriculture Organization of the United Nations, p. 9, 16