Technical, allocative and economic efficiency of cassava producers in oyo state of Nigeria.

Ogunniyi l.T

Department of Agricultural Economics, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria

Corresponding Author email: titiogunniyi@yahoo.com

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Abstract

The study evaluates technical, allocative and economic analysis of cassava production in Oyo State of Nigeria. Data were collected by the use of multistage random sampling with the help of well-structured questionnaire and interview schedule. Using farm level data, the study estimates a stochastic frontier production and cost functions model, which was used to predict the farm level technical and economic efficiencies. The study also used descriptive statistics and multiple regression analysis to analyze the data. The result of the socio-economic characteristics shows that most of the respondents were in their active age with a mean of 47.3 years. The mean year of education was 7.2 years which is an indication that majority of them had primary education. Majority of the respondents has been into cassava production for a longer period with the mean year of farming experience of 21.3 years. The result of the Cobb-Douglas stochastic frontier production function revealed that the relationship between output and cassava cutting material and farm size were statistically significant and positive in the study area. The return to scale (RTS) was 0.54 in the study area. This indicates a positive decreasing return to scale and that cassava production was in stage II of the production region where resources and production were believed to be efficient. Predicted technical efficiency and economic efficiency are the basis for estimating allocative efficiency of the farms. The mean technical efficiency for the study area was 0.542 while the mean allocative efficiency was 0.953. The combined effect of technical and allocative factors shows that the average economic efficiency level for the farmers was 0.515. From the results, it can be concluded that cassava-based farmers in Oyo State have higher ability to maximize profit (AE) than to produce larger quantities of output from the same quantities of measurable inputs (TE).

Key words: cassava, economic, efficiency, production, cost

Introduction

Nigeria is one of the most developed countries in Africa. Agriculture is the largest sector of the economy, accounting for about 42 percent of total GDP (Trading Economics, 2012). This is because it offers employment to the vast majority of our people (almost 70 to 75 per cent of the working population) and it is an activity that permeates the length and breadth of this country (Osinowo, 2012). Agricultural exports are negligible and represent about 0.2 per cent of total exports. Agriculture is the most assured engine of growth and development and a reliable key to industrialization. Nigeria is the largest producer of cassava in the world (Ogbe and Olojede, 2003). Cassava is grown throughout the tropic and could be regarded as the most important root crop in terms of area cultivated and total production. It is a very important staple food consumed in different forms by millions of Nigerians.

Nigerian cassava production, the largest in the world is one-third more than the production in Brazil and almost double the production in Indonesia and Thailand. Cassava production in other African countries, the Democratic Republic of the Congo, Ghana, Madagascar, Mozambique, Tanzania and Uganda appears small in comparison to Nigeria’s substantial output. The Food and Agriculture Organization of the United Nations (FAO) in Rome (FAO, 2004) estimated approximately 34 million tons of cassava produced in Nigeria in 2002. The trend for cassava production reported by the Central Bank of Nigeria mirrored the FAO data until 1996 and thereafter increased to the highest estimated production of 37 million tons in 2000 (FMANR, 1997). The third series had the most conservative estimate of production at 28 million tonnes in 2002. Project
Coordinating Unit (PCU) data collates state level data provided by the Agricultural Development Programme (ADP) offices in each state (PCU, 2003). In comparison with other crops, cassava production ranks first in Nigeria followed by yam production, at 27 million tons and sorghum at 7 million tons. Several production and post-harvest constraints have limited cassava’s contribution to agricultural growth. A total of 17 cassava varieties have been released in Nigeria (FDA/FMARD, 2005).

Most of the varieties released have multiplication problems. Out growers are often denied good prices for cassava tubers at the end of the growing season, which discourages cultivation. And while some of the varieties are high yielding, they score low on other parameters such as early maturity or resistance to drought, pests, and disease. On-farm costs of cassava production are still very high at the small-scale level in Nigeria. Agrochemicals are important in cassava production for the control of cassava mosaic virus, bacterial blights, and anthracnose, among other diseases. But agrochemicals often must be imported, and at a prohibitive cost. As a result, fertilizers and insecticides are rarely applied to recommended levels. Because cassava is known to respond to a lower application of fertilizers than crops such as maize and rice, farmers are more likely to allocate their limited budgets for costly fertilizers away from cassava and toward more fertilizer-intensive crops. The major variable costs are cassava cuttings and herbicides (Phillip et al., 2009).

There is a high positive correlation between the increase in cassava production and the estimated demand for the commodity (Adeniji et al., 1997). Over the years, cassava has been transformed into a number of products both for households and industrial uses. The household consumption of cassava has increased, even in the northern states of Nigeria, where cereals are the staple foods of the people. Although figures of the estimated demand for cassava and its products are not readily available, there are strong indications of the positive increase in the demand for the commodity. There are indications that the demand for cassava, particularly at the household level, as staple food, tends to outweigh the demands for its industrial use. Since farmers are unable to meet the demands of industries, some industries have engaged in the direct production of cassava as the raw material for their value added products.

In a bid to address the demand and supply gap, governments, at various times have come up with policies and programmes. However, these policies regarding cassava production have been observed to be inconsistent. In some years, trade liberalization favoured cassava production and cassava products, while in other years government policies did not favor the cassava industry and cassava would be included among prohibited exportable commodities. This inconsistency does not encourage sustainable development of the crop. Thus, these inconsistencies in policy have raised a number of pertinent questions among policy makers and researchers. For example, there is need to examine the reasons why domestic cassava production lag behind the demand for the commodity in Nigeria. One of the possible reasons, which may explain this lag, is the issue of efficiency of the cassava farmers in the use of resources.

The term efficiency is often used synonymously with that of productivity, the most common measures of which relate output to some single input (Lund and Hill, 1979). According to (Lovell,1993), the term efficiency refers to the comparison between the real or observed values of input(s) and output(s) with the optimal values of input(s) and maximal output(s) used in a particular production process. Efficiency is achieved by minimizing the resources required for producing a given output. Moreover, according to the optimal values, two types of efficiency can be distinguished as technical efficiency and allocative efficiency.

Efficiency is considered as technical, if optimal values are defined in terms of the maximum level of output, given the level of input, in terms of the production frontier. In other words, technical efficiency is achieved by producing at the production frontier. If the optimal values are based on the selection of the mix of inputs, such that a given level of output is produced at the lowest possible cost, given the respective input prices, then the term efficiency can be referred to allocative efficiency (Lovell, 1993).

The role of efficiency in increasing agricultural output has been widely recognized in both developed and the developing countries of the world (Trans et al., 1993; Shehu and Mshelia, 2007; Giroh and Adebayo, 2009). A study on efficiency in cassava production is important for several reasons. One, measuring efficiency of cassava producers and identifying the factors impacting on it will provide indications for the formulation of economic policies likely to improve producer efficiency and output. Secondly, at the micro-level, improved efficiency helps to increase the levels of income through increased profit and reduction in poverty. Thirdly, given the high costs of cassava production and its low productivity, knowledge of the economic efficiency levels will provide guidelines to governments on how to improve output by farmers. Finally, whereas a number of studies have been undertaken regarding measuring the efficiency of cassava production in Nigeria, very few of such studies have used the stochastic frontier approach on cassava-based cropping.

The objective of this study is to examine the technical, allocative and economic efficiency of cassava producer in Oyo State of Nigeria using the stochastic frontier approach.

Materials and Methods

The study was carried out in Oyo State of Nigeria. Oyo state has a population of 5,591,585 people (NPC,2006). The target population of the study was cassava producers in Oyo State. A multi-stage random sampling technique was employed to select the sample population of the study. Four agricultural zones were taken as the sampling units for the first stage of sampling. At the second stage, two local government areas (LGAs) were randomly selected to represent the zone, giving a total
of eight LGAs. The last stage of the sampling procedure involved the purposive selection of 253 cassava–based farmers relative to the number of local government area in the zone. Primary data were collected using a structured questionnaire for literate producers and an interview schedule for illiterate producers. The questionnaire was developed by me, subjected to face validity and was pilot tested.

Descriptive statistics, stochastic frontier production function and multiple regression analysis were used to analyze the data collected for this study.

For the purpose of this study, the specific models that were estimated are:
A Cobb-Douglas production frontier function in its log transformation (Coelli, 1994).

\[
\ln Y_i = \ln A + \sum \beta_i \ln X_i + V - U \quad \text{------- 1}
\]

Where
- \( Y \) = Total farm output (kg)
- \( X_1 \) = The area devoted to cassava production (ha);
- \( X_2 \) = Quantity of cassava cuttings used (bundle)
- \( X_3 \) = Family and hired labour used in cassava production (man-days)
- \( X_4 \) = Quantity of fertilizer used (kg)
- \( X_5 \) = Quantity of agrochemicals (litre)
- \( X_6 \) = Total expenditures on farm tools used for the year.

\( A \) and \( \beta_i \) are parameters to be estimated (i = 1, 2... 6)

\( V_i \) = Is a two-sided, normally distributed random error

\( U_i \) = Is a one-sided efficiency component with a half-normal distribution where \( U_i \) is defined by

\[
U_i = \delta_0 + \sum \delta_i Z_i \quad \text{................................. 2}
\]

Where
- \( Z_1 \) = The number of years of formal schooling completed by the farmer
- \( Z_2 \) = Farming experience in cassava production in years
- \( Z_3 \) = Age of the cassava farmer in years
- \( Z_4 \) = Availability of extension service measured by the number of contact with extension agents

\( \delta_0 \) and \( \delta_i \) are parameters to be estimated (i = 1, 2, ..., 4) together with the variance parameter.

\[
\sigma^2_v = \sigma^2_v + \sigma^2_u
\]

\[
\sigma^2 = \sigma^2_v + \sigma^2_u
\]

\[
\lambda = \sigma_u / \sigma_v
\]

The parameters of the stochastic frontier functions were estimated by the method of maximum likelihood, using the computer program FRONTIER version 4.1 (Coelli, 1994).

From the stochastic production function specified in equation (2) above, the technical efficiency of farm can be written as

\[
TE = \frac{Y}{Y^*} = f(x_i; \beta) \exp(V_i - U_i) / f(x_i; \beta) \exp (V_i)
\]

Where \( Y \) = observed output

\( Y^* \) = This can also be corresponding frontier output.

TE = \( \exp (-U_i) \) \quad \text{------------------------ 3}

Technical efficiency was measured on a scale of 0 to 1. A value of 1 indicates that farm \( i \) displays complete TE while a value of zero indicates level of inefficiency. Technical efficiency is in effect an expression of the farmer’s ability to achieve results comparable to those indicated by the production frontier.

A transformed Cobb-Douglas cost frontier function

\[
\ln C = \beta_0 + \sum \beta_i \ln P_i + \beta_7 \ln Y^* + V_i + U_i \quad \text{...........(4)}
\]

Where
- \( C \) = the cost of cassava production per farm (₦)
- \( P_1 \) = the average rent per hectare of land (₦);
- \( P_2 \) = the price per bundle of cassava cuttings used (₦);
- \( P_3 \) = the average daily wage rate per man-days of labour (₦);
- \( P_4 \) = the average price per kg of fertilizer used (₦);
- \( P_5 \) = the average price of agrochemicals (₦);
- \( P_6 \) = the depreciated cost of farm tools (₦); and

\( Y^* \) = the total farm output measured in kg and adjusted for any statistical noise.
This can also be corresponding frontier output.

NOTE: In stochastic cost function, Y* is added as an independent variable (Coelli, 1996/97; Ogundari and Ojo, 2006; Ogundari et al., 2006). Note that the inefficiency effect is added in the cost frontier, rather than subtracted, as in the case for the stochastic frontier production function. This is because the cost function represents minimum cost, whereas the production function represents the maximum output. Also, unlike the production frontier approach, this inefficiency represents total economic inefficiency, which equals the technical inefficiency (not getting enough output from the input) plus the allocative inefficiency (not using the inputs or producing the outputs in the correct proportions). Such a cost frontier is estimated for the United Kingdom Higher Education (UK HE) sector, although they do not investigate the determinants of inefficiency (Izadi et al., 2002).

Hence farm – level economic efficiency (EE) was obtained using the relationship:

\[ EE = \frac{1}{Cost\ efficiency\ (CE)} \]

That is EE is the inverse of CE

Hence a measure of farm specific allocation efficiency (AE) is thus obtained from technical and economic efficiencies as:

\[ AE = EE/TE\]  
(Martins and Taylor, 2003).

A Cobb-Douglas functional form was used to specify the stochastic production frontier, which is the basis for deriving the cost frontier and the related efficiency measures. The use of a single equation model in equations (1) and (4) is justified by assuming that Nigerian farmers maximize expected profits (Kopp and Smith,1980; Bravo-Ureta and Rieger, 1990; Caves and Barton, 1990). Despite its well-known limitations, the Cobb-Douglas production function was chosen because the methodology employed requires that the production function be self-dual, that is, allowing an examination of economic efficiency. It is also worth stating that this functional form has been widely used in farm efficiency analyses for both developing and developed countries.

Results

Summary Statistics

Table 1 shows that the mean quantity of cassava cuttings planted were 29.52 bundles per hectare with a standard deviation of 118.9 bundles per hectare. Farm sizes in Nigeria have been classified as small, medium and large scales if they fall into categories of less than 5 ha, between 5ha and 10ha, and more than 10ha, respectively (Upton, 1972). The majority (98.4%) of cassava-based farmers was in the category of small scale farmers with farm holdings less than 5ha of farmland (Table 1). The mean farm size of respondents was 1.6ha.

According to Table 1, the mean age of respondents was 47.3years. Also, the mean year of education was 7.2 years with a minimum of no education (0 years) and a maximum of 23 years.

The average years of farming experience of the respondents was 21.3years with a mean family size of 9.1 members.

Most of the respondents have contact with extension agent with a mean frequency of extension visit per year of 13.8 times.

Maximum Likelihood Estimates of Stochastic Frontier

The results of estimates of production and cost functions are presented in Table 2. The estimate of the parameters of the stochastic frontier production model reveals that all the estimated coefficients of the variables of the production function were positive except for that of fertilizer and equipment. The two significant variables are farm size and cuttings at 5% level of significance. The estimate of sigma square of 235.498 was significant different from zero at 5% level. The estimated gamma parameter of 0.814 indicates that 81.4% of the total variation in cassava output was due to differences in their technical efficiency. The Return to Scale (RTS) was 0.54, which indicates a positive but decreasing return to scale.

The result of the stochastic frontier cost function in Table 2 reveals that all the independent variables gave a positive coefficient. The significant variables are rent, cost of cuttings, cost of labour, cost of agrochemicals and output at 5% level of significance.

Technical efficiency (TE) indices range from 0.000432 to 1 with a mean value of 0.542 (Table 3). This means that for an average efficient farmer to achieve the TE level of its most efficient counterpart, the farmer could realize about 45.8% cost savings or increase in production. The least efficient farmer in the State of Oyo, can now save a cost or increase production by 99.9% to achieve the required TE level of the most efficient farmer in the state.

The mean allocative efficiency (AE) of the sample is 0.953, with a low of 0.0159 and a high of 1. This result implies that if an average farmer in the Oyo State was to achieve the AE level of its most efficient counterpart, then that average farmer could realize about 4.7% cost savings or increase in production. The most allocatively inefficient farmer in the state can now save cost or increase production by 98.4%.

The combined effect of technical and allocative factors shows that the average economic efficiency levels for the farmers in the study area was 0.515. A similar calculation of TE and AE shows that for an average farmer to reach the...
economic efficiency level of its most efficient counterpart in the study area, the farmer could experience about 48.5 percent cost savings. The same computation for the most inefficient farmers suggests a gain of 99.9% in economic efficiency.

**Efficiency Indexes and Some Selected Socio – Economic Variable**

The effect of some selected socio-economic variables on efficiency indexes in table 4 reveal that education and experience have a negative and significant influence on economic and technical efficiency, while extension visits have a positive and significant influence on economic and technical efficiency. None of the variable shows any significant relationship with allocative efficiency.

**Discussion**

The mean quantity of cassava cuttings planted fell below the recommended amount of cuttings per hectare (35 – 50 bundles per hectare). This implies that the plant population may not be optimum and their output would be less than the expected output. This may result in inefficiency on the part of cassava farmers in their production activities.

The average age of the farmers indicates that cassava production is dominated by active and energetic middle-aged farmers. The average age was however tending towards the declining productivity class of greater than 50 years (Ogundele and Okoruwa, 2006). This implies that except the occupation witnesses the injection of young able farmers, in the next one decade, many cassava-based farmers would have reached the declining productivity level and cassava-based farming will suffer a setback. The low level of education observed among the respondents of this study is indicative that adequate levels of education are likely to influence the level of technology adoption and skill acquisition to improve technical efficiency. This may, in a way, reflect in their choice of inputs and output as well as influence their utilization of existing inputs (Azhar,1991). In essence, the majority of the farmers has longer years of experience in cassava production and could be described as well experienced in the business. This finding agrees with (Ajibefun et al., 1996; Alabi et al., 2006a; Alabi et al., 2006b; Ogundari and Ojo,2007). The family size of cassava-based farmers can either be an asset or liability. If the majority of the family members are employable on the farms, they can be a source of farm labour. However, if the majority of farming family members are dependents, they may affect the flow of investment capital into their farming business, which instead could be used to support the farming business. Logistically, the bigger the family member size, the bigger the amount of money needed to support and maintain the family and hence, the lesser the investment capital available to those farmers because of low disposable income. The result of small farm sizes is in consonance with that of (Awoyemi and Kehinde,2005), who reported an average of 0.52 ha in a study carried out on cassava production in Southwestern Nigeria and that of (Ogundari and Ojo, 2006) who reported an average of 0.89ha in a study carried out on cassava production in Osun State.

The positive and significant relationship of farm size and cuttings with output indicates that these variables are significant determinants of cassava output and should be sustained. As these variables increase cassava yields also increase. The coefficient of farm size (0.388) is inelastic. This implies that increasing the farm size by one hectare will bring about a 38.8% increase in the output of cassava growers in the area. Similarly, increasing the quantity of cuttings (0.160) by one bundle will increase cassava output by 16%. This finding is consistent with the study by (Ogundari and Ojo, 2006) where farm size had a positive relationship with output. The return to scale (RTS) estimate indicates that cassava production was in stage II of the production region in the study area where resources and production were believed to be efficient. Hence, it is advisable that the production units should maintain the level of input utilization at this stage as this will ensure maximum output from a given level of input, ceteris paribus. Ogundari and Ojo, (2006) reported return to scale of 0.84. The log likelihood function estimated to be -888.64, represents the values that maximize the joint densities in the estimated model. The high variance parameter (δ2) and gamma (γ) close to one indicate that the inefficiency effects are highly significant in the analysis of the output of cassava production in the study area (if the gamma is zero, the variance of the inefficiency effect is zero, which reduces the model to a traditional average response function). The economic efficiency analysis of cassava farmers revealed that there was cost inefficiency effects in cassava production as confirmed by the significance of the gamma value of 0.999 at 5% level. This implies that 100% of the variation in the total production cost is due to differences in their cost efficiencies.

**Conclusion**

The study estimated farm level economic efficiency and its determinants using stochastic parametric method of estimation. The stochastic frontier production function approach using maximum likelihood (ML) procedure was used to estimate the model and predict the individual technical, allocative and economic efficiency. The result shows that cuttings and farm size are positive determinants of output.

The mean efficiency scores indicate that there is scope for increasing cassava production by 45.8 %( TE), 4.7 %( AE) and 48.5 %( EE) with the present technology in the study area.

It was evident from this study that economic efficiency of the farmers could be improved substantially and that technical inefficiency constitutes a less? serious problem than allocative inefficiency. Allocative efficiency appears to be more significant than technical efficiency as a source of gains in economic efficiency.
The analysis of technical, allocative and economic efficiency revealed that cassava-based farmers were not presently operating on the frontier. Productivity improvements can be achieved by implementing policies such as improved farmers’ access to extension services and technical assistance, to ensure farmers use the existing technology more efficiently. This would make farmers operate more closely to the existing frontier. Also, research efforts directed towards the generation of new technology should not be neglected because a productivity gain stemming from technological innovation remains critically important.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output(tons/ha)</td>
<td>13.7</td>
<td>0.6</td>
<td>25</td>
<td>16.7</td>
</tr>
<tr>
<td>Farm size (ha)</td>
<td>1.6</td>
<td>0.5</td>
<td>15</td>
<td>1.3</td>
</tr>
<tr>
<td>Cuttings (bundle/ha)</td>
<td>29.5</td>
<td>2</td>
<td>80</td>
<td>118.9</td>
</tr>
<tr>
<td>Labour (man days/ha)</td>
<td>456.6</td>
<td>15</td>
<td>950</td>
<td>797.7</td>
</tr>
<tr>
<td>Fertilizer (kg/ha)</td>
<td>265</td>
<td>20</td>
<td>300</td>
<td>217.9</td>
</tr>
<tr>
<td>Equipment (litre/ha)</td>
<td>5.2</td>
<td>1</td>
<td>10</td>
<td>5.1</td>
</tr>
<tr>
<td>Cuttings</td>
<td>2843.3</td>
<td>349.19</td>
<td>12247.37</td>
<td>5202.8</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>3175.25</td>
<td>200</td>
<td>8700</td>
<td>2450.16</td>
</tr>
<tr>
<td>Labour</td>
<td>1852.55</td>
<td>215</td>
<td>57500</td>
<td>1944.00</td>
</tr>
<tr>
<td>Cutting</td>
<td>4427.07</td>
<td>217.75</td>
<td>12000</td>
<td>2167</td>
</tr>
<tr>
<td>Labour</td>
<td>49430.78</td>
<td>11000</td>
<td>237015</td>
<td>30460.00</td>
</tr>
<tr>
<td>Rent</td>
<td>1569.23</td>
<td>200</td>
<td>2383.33</td>
<td>933.33</td>
</tr>
<tr>
<td>Age (years)</td>
<td>47.3</td>
<td>25</td>
<td>78</td>
<td>11.2</td>
</tr>
<tr>
<td>Education (years)</td>
<td>7.2</td>
<td>0</td>
<td>23</td>
<td>5.4</td>
</tr>
<tr>
<td>Experience (years)</td>
<td>21.3</td>
<td>2</td>
<td>47</td>
<td>15.4</td>
</tr>
<tr>
<td>Family size (Number)</td>
<td>9.1</td>
<td>1</td>
<td>25</td>
<td>3.6</td>
</tr>
<tr>
<td>Extension visit (Number)</td>
<td>13.8</td>
<td>1</td>
<td>17</td>
<td>8.8</td>
</tr>
</tbody>
</table>

### Table 2. Maximum Likelihood Estimate of Stochastic Frontier Models

<table>
<thead>
<tr>
<th>Production function</th>
<th>Parameters</th>
<th>Coefficients</th>
<th>Cost function</th>
<th>Variable</th>
<th>Parameters</th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>β₀</td>
<td>24.387(5.451)**</td>
<td>Constant</td>
<td>β₀</td>
<td>-305.884(7.332)</td>
<td></td>
</tr>
<tr>
<td>Farm size</td>
<td>β₁</td>
<td>0.386(5.339)**</td>
<td>Rent</td>
<td>β₁</td>
<td>0.270(1.973)*</td>
<td></td>
</tr>
<tr>
<td>Cutting</td>
<td>β₂</td>
<td>0.160(3.333)*</td>
<td>Cost of Cutting</td>
<td>β₂</td>
<td>1.082(7.994)*</td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>β₃</td>
<td>0.011(0.240)</td>
<td>Cost of Labour</td>
<td>β₃</td>
<td>0.070(2.421)*</td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td>β₄</td>
<td>-0.031(-0.333)</td>
<td>Cost of Fertilizer</td>
<td>β₄</td>
<td>0.194(1.002)</td>
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<tr>
<td>Agrochemicals</td>
<td>β₅</td>
<td>0.049(0.617)</td>
<td>Agrochemical cost</td>
<td>β₅</td>
<td>0.666(2.174)*</td>
<td></td>
</tr>
<tr>
<td>Equipments</td>
<td>β₆</td>
<td>-0.058(-1.309)</td>
<td>Cost of equipment</td>
<td>β₆</td>
<td>0.357(1.447)</td>
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<tr>
<td></td>
<td>β₇</td>
<td>235.4(3.429)*</td>
<td>Output</td>
<td>β₇</td>
<td>172.476(3.260)*</td>
<td></td>
</tr>
<tr>
<td>Sigma – square</td>
<td>σ²</td>
<td>0.814(11.956)*</td>
<td>Sigma – square</td>
<td>σ²</td>
<td>333.239(3.312)*</td>
<td></td>
</tr>
<tr>
<td>Gamma</td>
<td>γ</td>
<td>0.814(11.956)*</td>
<td>Gamma</td>
<td>γ</td>
<td>0.999(5.276)*</td>
<td></td>
</tr>
<tr>
<td>Log – Likelihood function</td>
<td>-888.64</td>
<td>253(100)</td>
<td>Total</td>
<td>253(100)</td>
<td>253(100)</td>
<td></td>
</tr>
<tr>
<td>Return to Scale</td>
<td>0.54</td>
<td>0.54</td>
<td>Mean</td>
<td>0.54</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimum</td>
<td>0.004</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maximum</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Average (Save in cost)</td>
<td>45.8%</td>
<td>4.7%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Least (Save in cost)</td>
<td>99.9%</td>
<td>98.4%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2008

Figures in parentheses are t – ratio

* Estimates are significant at 5% level of significances

### Table 3. Frequency distribution of technical, allocative and economic efficiency of cassava farmers

<table>
<thead>
<tr>
<th>Efficiency Level</th>
<th>Technical Efficiency</th>
<th>Allocative Efficiency</th>
<th>Economic Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10</td>
<td>34(13.4)</td>
<td>4(1.6)</td>
<td>36(14.2)</td>
</tr>
<tr>
<td>10 – 20</td>
<td>37(14.6)</td>
<td>1(0.4)</td>
<td>35(13.8)</td>
</tr>
<tr>
<td>21 – 30</td>
<td>33(13)</td>
<td>4(1.6)</td>
<td>33(13)</td>
</tr>
<tr>
<td>31 – 40</td>
<td>14(5.6)</td>
<td>0</td>
<td>14(5.6)</td>
</tr>
<tr>
<td>41 – 50</td>
<td>7(2.8)</td>
<td>0</td>
<td>17(6.7)</td>
</tr>
<tr>
<td>51 – 60</td>
<td>7(2.8)</td>
<td>0</td>
<td>12(4.8)</td>
</tr>
<tr>
<td>61 – 70</td>
<td>9(3.6)</td>
<td>2(0.8)</td>
<td>9(3.6)</td>
</tr>
<tr>
<td>71 – 80</td>
<td>9(3.6)</td>
<td>1(0.4)</td>
<td>9(3.6)</td>
</tr>
<tr>
<td>81 – 90</td>
<td>24(9.6)</td>
<td>7(2.8)</td>
<td>24(9.6)</td>
</tr>
<tr>
<td>&gt; 90</td>
<td>79(31.2)</td>
<td>234(92.5)</td>
<td>64(25.6)</td>
</tr>
<tr>
<td>Total</td>
<td>253(100)</td>
<td>253(100)</td>
<td>253(100)</td>
</tr>
<tr>
<td>Mean</td>
<td>0.542</td>
<td>0.953</td>
<td>0.515</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.0004</td>
<td>0.016</td>
<td>0.0004</td>
</tr>
<tr>
<td>Maximum</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Average (Save in cost)</td>
<td>45.8%</td>
<td>4.7%</td>
<td>48.5%</td>
</tr>
<tr>
<td>Least (Save in cost)</td>
<td>99.9%</td>
<td>98.4%</td>
<td>99.9%</td>
</tr>
</tbody>
</table>

Source: Data Analysis, 2008.

Figures in Parentheses are the Percentages
Table 4. Ordinary least square Regression result of relationship between efficiency indices and some selected socio-economic variable

<table>
<thead>
<tr>
<th>Efficiency Level</th>
<th>Technical Efficiency</th>
<th>Allocative Efficiency</th>
<th>Economic Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.704(3.538)</td>
<td>0.760(3.864)</td>
<td>0.930(10.926)</td>
</tr>
<tr>
<td>Education</td>
<td>-0.150(-2.256)*</td>
<td>-0.179(-2.727)*</td>
<td>0.036(1.279)</td>
</tr>
<tr>
<td>Experience</td>
<td>-0.048(-1.985)*</td>
<td>-0.052(-1.994)*</td>
<td>0.005(0.453)</td>
</tr>
<tr>
<td>Age</td>
<td>0.003(0.103)</td>
<td>-0.001(-0.045)</td>
<td>0.008(0.47)</td>
</tr>
<tr>
<td>Extension Visit</td>
<td>0.081(2.032)*</td>
<td>0.084(2.144)*</td>
<td>0.09(0.554)</td>
</tr>
<tr>
<td>F – test</td>
<td>2.070*</td>
<td>2.543</td>
<td>0.822</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.034</td>
<td>0.049</td>
<td>0.006</td>
</tr>
</tbody>
</table>

Source: Data Analysis, 2008
* Figures in Parentheses are the t – ratio
* Estimate is significant at 5% level

References


Ogbie FO, Olojede AO. 2003. Economic performance of improved cassava variety (NR8082) and local best (NWAIBIBI) conference paper.


Osinoow O. 2012. Agriculture is the largest contributor to Nigeria’s GDP. News Agency of Nigeria, NAN-H-32.


