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COMPARATIVE ANALYSIS OF TECHNICAL EFFICIENCY OF BENEFICIARY AND NON-BENEFICIARY FOOD CROP FARMERS OF BANK OF AGRICULTURE IN OGUN STATE, NIGERIA

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ABSTRACT

This study compared the technical efficiency of beneficiary and non-beneficiary food crop farmers of Bank of Agriculture in Ogun State. Samples of 240 food crop farmers collected in a multistage sampling process were used for the study. The data collected were analyzed using descriptive statistics, probit regression analysis and stochastic frontier analysis. The findings revealed that loan beneficiary food crop farmers had more experienced than the non-beneficiaries. The probit regression result revealed that age, years of formal education and farming experience increase the likelihood of loan acquisition among food crop farmers but the likelihood decreases as the farmers grow older. The stochastic frontier production function revealed that farm output increases with farm size, and planting material but decreases with farm labour and fertilizer. Labour and fertilizer are over-utilized among the food crop farmers. Education, extension service and loan increase the technical efficiency of the farmers. The mean technical efficiency of 86 percent and 79 percent showed that there is potential to increase output by 14 percent and 21 percent by the loan beneficiaries and non-beneficiaries, respectively. Lastly, the loan beneficiary food crop farmers are technically efficient than their non-beneficiaries' counterparts as revealed by the test of mean. Policy option requires the food crop farmers to expand their farm size to ensure efficient utilization of productive resources. Finally, formal education and adult literacy education should be encouraged among food crop farmers especially the non-loan users as education increases the likelihood of loan acquisition and to afford the farmers the benefit of agricultural loan.

Keywords: technical efficiency, food crop farmers, agricultural loan, beneficiary, non-beneficiary.

INTRODUCTION

Efficiency is one of the most widely used concepts in economics. The scarcity of resources is the major factor that makes the improvement in efficiency so important to an economic agent or to a society (Jema, 2008). The conceptualization and measurement of efficiency relies on the specification of a production function which represents the maximum output attainable from the use of a given level of inputs. Technical efficiency is the ability of the farmer to produce maximum output from a given level of inputs (Bravo-Uretra and Antonio, 1997). In order to enhance high efficiency through the use of technological innovations, access to adequate loan becomes imperative. According to Rahji (2000), loan is a basic tool of production which provides the farmers with capital to mobilize resources and appropriately combine same to achieve high efficiency. This suggests that a strong link exists between efficiency and loan availability to farmers.

To enhance the flow of financial services to Nigeria's rural areas, government has, in the past initiated a series of publicly-financial micro/rural credit programmes and policies targeted at the poor who are mostly small-holder food crop farmers (CBN, 2005). In year 2000, government merged the Nigerian Agricultural and Cooperative Bank (NACB), Family Economic Advancement Programme (FEAP) and Peoples' Bank of Nigeria (PBN) to form the Nigerian Agricultural Cooperative and Rural Development Bank Limited (NACRDB) to enhance the provision of finance to the agricultural sector. In year 2010, the nomenclature of NACRDB was changed to Bank of Agriculture (BOA). Government also created the National Poverty Eradication Programme (NAPEP) in 2003 with the mandate of providing financial services to the poor.

Whether these instituted publicly-financing micro/rural credit programmes and policies achieved the set goals remains an important policy question. The Central Bank of Nigeria (2005), equally asserted that in Nigeria, like in most developing countries, the formal financial system provides services to only 35 percent of the economically active population while the remaining 65 percent are excluded from access to the financial services. These 65 percent are often served by the informal sectors through Non-governmental Organization Microfinance Institutions (NGO-MFIs), money lenders, friends, relatives and credit unions (CBN, 2005).

The short fall in the provision of financial services to the poor, who are mostly small-holder food crop farmers had undoubtedly affected the agricultural

production in Nigeria. Therefore, little progress had been recorded in agricultural production due to Government's efforts geared towards ensuring food security. This is reflected in the contribution of agriculture to the Gross Domestic Product (GDP) which increases slightly annually from 39.43 percent in 1991 to 42.1 percent in 2008 with crop production accounting for the largest proportion; 25.34 percent in 1981, 32.50 percent in 2004 and 34.2 percent in 2008 (CBN, 2005; CBN, 2008).

A strong and an efficient agricultural sector would enable a country to feed its growing population, generate employment, earn foreign exchange and provide raw materials for industries. The agricultural sector has a multiplier effect on any nation's socio-economic and industrial fabric because of the multifunctional nature of agriculture. This is obvious, since agriculture still employs the larger percentage of the population, contributing 42.1 percent of the real GDP and remains the most viable sector among the oil and non-oil sectors (CBN, 2008). The provisional data from the National Bureau of Statistics (NBS) showed that the GDP, measured at 1990 constant basic prices, stood at N674.9 billion in 2008 indicating a growth rate of 6.4 percent with agriculture accounted for almost half of the GDP growth rate, contributing about 2.8 percentage points (CBN, 2008). However, in year 2010, the GDP growth rate was estimated at 8.29 percent with agriculture accounted for about 2.39 percent (CBN, 2010). This shows a decline in the contribution of agriculture to the GDP growth rate.

In Nigeria, it was estimated that the annual food supply would have to increase at an average annual rate of 5.9 percent to meet the food demand and reduce food importation significantly (Amaza *et al.*, 2006). It was also reported that the production of food in Nigeria has not increased at the rate that can meet the ever-increasing population. While food production increases at the rate of 2.5 percent food demand increases at the rate of more than 3.5 percent due to the high rate of population growth of 2.83 percent (CBN, 2004). The reality is that Nigeria has not been able to attain self-sufficiency in food production, despite increasing land area put into food production annually. The constraints to the rapid growth of food production seem to mainly be that of low crop yields, and resource-use efficiency attributable to inefficient farm management and inadequate finance.

Jhingan (1997) observed that an economy can grow but it may not develop because poverty, unemployment and inequalities may continue to persist due to low production efficiency, absence of technological and structural changes. The efficiency with which farmers use available resources and improved technology is important in agricultural production (Rahji, 2005). High production efficiency is associated with the quality of resources used, as well as their quantity and increased resource mobilization and efficient use help to account for productivity increase. Given the low income of the small-scale food crop farmers, only little can be expected from their savings. Similarly, most financial institutions are reluctant to grant loans to the farmers who form the bulk of rural inhabitants because of the nature of agriculture in Nigeria.

Ekpebu (2006) observed that the performance of the agricultural sector has been unsatisfying over the years due to insufficient funding or loan facilities, inadequate infrastructural facilities, low technology base, high cost of farm inputs and inadequate extension services. The low agricultural output in Nigeria is revealed, according to Amaza and Olayemi (2002), by the actual yields of major crops compared to the potential yields, implying that there is scope for additional increase of output from the existing hectares of food crops if resources are properly harnessed and efficiently allocated. Amaza and Olayemi (2002) also reported that existing low level of output in food crops production is a reflection of low level of technical efficiency, and that increased output is directly related to high efficiency arising from not only the optimal combination of inputs but also the given state of technology.

Consequently, demand for agricultural loan to boost production became so high among food crop farmers. The importance of agricultural loan is in the fact that it removes the financial constraints of farmers thereby increasing the likelihood of adoption of new technologies which often involve additional expenditures on improved farm inputs. Food crop farmers in Nigeria are faced with loan problems from both formal and informal sources (CBN, 2005). Some of these problems viewed from the side of the non-institutional sources: credit supply is generally scarce, unreliable and subsequently very expensive. It is believed that interest rates charged by local money lenders are excessive. Apart from the high interest charged, farmers do lose their crops, farmland, houses and other valuable assets when they are unable to pay back the loan and high interest rate to the money lenders. In addition, loans from friends and relatives are generally small and of short duration. On the part of the formal financial institutions, loan terms and loan rationing mechanisms have posed a major constraint to small-holder food crop farmers. Some farmers are therefore automatically excluded from benefiting from loan.

As these loan constraints are viewed to bring about food insecurity, subsidies and agricultural loan have been advocated. In view of this, the Bank of Agriculture and few commercial banks have occasionally introduced and implemented some kind of loan advancement to needy farmers as a way of promoting greater agricultural production efficiency through empowering farmers to procure essential inputs. However, many credit institutions have complained of their seemingly inability to recover loans disbursed to farmers. On the other hand, most farmers have complained of inadequate loan availability. As a consequence, most of the small-scale farmers still operate at a subsistence level. The question remains that are the few loan beneficiaries operating at a high efficient level than their non-beneficiaries counterparts? Are the farmers utilizing the loan to acquire improved farm inputs for production? As government is awake to addressing the welfare issues affecting the grass root people, efficient

agricultural loan availability to farmers remain the key to realizing these objectives. It is against this background that this study seeks to provide answers to the above questions and thus motivation for this study to identify the determinants of loan acquisition from BOA and examine the variation in the technical efficiency of the BOA loan beneficiary and non-beneficiary food crop farmers.

METHODOLOGY

The study area

The study was carried out in Ogun state, Nigeria. The state has 20 local government areas. It lies approximately between latitude 3^o 30 N and 4^o 30 N and longitude 6^o 30 E and 7^o 30 E. It falls within the humid tropical lowland region with two distinct seasons. The shorter 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 23^0 C in July to 32^0C in February. The mean daily sunshine hours ranges between 3.8 and 6.8. Relative humidity ranges between 76 percent and 95 percent coinciding with dry and wet season respectively. 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 endowed with fertile soil, making it possible to support the growth of food crops, economic crops and livestock. The state shares boundary with 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, Ilaro and Ikenne zones. Eight (8) branch offices of the BOA are spread across the four OGADEP zones in the state.

Sampling technique

Multistage sampling technique was employed to select the primary data used for the study. The first stage involved the purposive selection of one OGADEP block known for high food crop production from each of the OGADEP zone where the BOA branch offices are situated. The second stage involved a purposive selection of two cells, believed to be the food basket of each of the selected blocks. In the third stage, 15 beneficiaries of the BOA were randomly selected from each cell. In addition, 15 non-beneficiaries were randomly selected from each cell selected in stage two. These procedures lead to a selection of 120 loan beneficiaries and 120 non-beneficiaries, given a total of 240 food crop farmers used for the study. The range of data collected covered farmers' specific characteristics as well as inputs and output used in production. Small-holder food crop farmers in Nigeria usually practice mixed farming system and the predominantly cultivated food crops include cassava, maize, yam, melon, cocoyam and vegetables which are classified as either cassava-based or yam-based farming system depending on whether yam or cassava is the dominant crop. In the study area cassava is majorly intercropped with maize, and for this reason, cassava-maize (cassava-based) farmers were selected as the representatives of food crop farmers. Labour input for women and children was converted to men equivalent using an adjusted factor of 0.75 and 0.33 for women and children, respectively (Upton, 1996). The quantity of outputs of crops was obtained in their local measures and then converted to kilogramme. The output in kilogramme was later converted to Grain Equivalent using the conversion factor by Kormawa (1999). This was done to allow output aggregation as well as allowing for a technical relationship between inputs and outputs to be estimated for the crop mixture.

Analytical techniques

The data collected were subjected to descriptive and econometric analysis.

Probit regression model

For the probit model, it is assumed that an individual is faced with two alternatives, food crop farmers acquire loan from the Bank of Agriculture (BOA) or not. Therefore, probit model was developed to determine the characteristics that influence the probability that a food crop farmer acquires loan. The general model, as observed by Paul (2008) and Matshe and Young (2004) is given below. The dependent variable is a dummy, that is:

C_i = 1, if food crop farmers acquire loan and C_i = 0 otherwise.

$$P_i (C_i=1) = F(K_i) = 1/\sqrt{2\pi} \int_{-\infty}^{ki} \exp(u^2/2)\, du + u_i \quad (1)$$

Where, the unobservable K_i is a linear combination of the observable explanatory variables.

$$K_i = \alpha_o + \sum_{J=1}^{n} \alpha_j X_j + u \quad (2)$$

In the above equation, P_i is the probability that the food crop farmers acquire loan. F (*Ki*) is the standard cumulative function, n is the number of explanatory variables, K_i is the unobservable level of stimulus for the ith food crop farmers, K_i* is the critical or threshold level of the index K_i and u_i is random variable; u is normally distributed (N (0, δ2).
The probit model is represented as:

$$K_i = \alpha_o + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \alpha_3 X_{3i} + \alpha_4 X_{4i} + \alpha_5 X_{5i} + \alpha_6 X_{6i} + \alpha_7 X_{7i} + \alpha_8 X_{8i} + \mu_i \quad (3)$$

Where

K_i = (= 1 if the food crop farmer is a loan beneficiary, = 0 non-beneficiary)
The explanatory variables are:

X_{1i} = Age of farmers (year)
X_{2i} = Farm size (hectare)
X_{3i} = Years of formal education (year)
X_{4i} = Farming experience (year)
X_{5i} = Household size (number)
X_{6i} = Gender (Male = 1, Female = 0)
X_{7i} = Marital Status (Married = 1, Otherwise = 0)
X_{8i} = Income from farming (Naira)
ui = Random error term

The probit model assumes that the error term is a normally distributed random variable so that the probability that K_i is less than (or equal to) K_i* can be computed from the cumulative normal probability function.

The stochastic frontier production function

The Stochastic frontier production function model of Cobb-Douglas functional form was employed to estimate the farm level technical efficiency of the food crop farmers. The Cobb-Douglas functional form was used because the functional form meets the requirement of being self-dual and it has been used for many studies relating to development agriculture. The Cobb-Douglas production functional form is expressed as:

$$Y_i = f(X_i;\beta) \exp V_I - \mu_i \quad (4)$$

The technical efficiency of individual farmers is defined in terms of the ratio of observed output (Y_i) to the corresponding frontier output (Y_i*) conditioned on the level of input used by the farmers (Battese and Coeli, 1988). Hence, the technical efficiency (TE_i) of the farmer is expressed as:

$$TE_i = Y_i/Y_i^* = f(X_i;\beta) \exp (V_I - \mu_i) / f(X_i;\beta) \exp V = \exp(-\mu_i) \quad (5)$$

TE ranges between 0 and 1

The same production technology assumed for the two categories of farmers was specified by the Cobb-Douglas frontier production function defined as follows:

$$\ln Y_i = \beta o + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + V_i - \mu_i \quad (6)$$

Where

Y_i = Farm output (Grain Equivalent) from farm i
X_{1i} = Farm size (hectare)
X_{2i} = Farm labour (man days)
X_{3i} = Planting materials (₦)
X_{4i} = Fertilizer (kg)
X_{5i} = Herbicides (litre)
V_i = Random variability in the production that cannot be influenced by the farmer. V_is are assumed to be independent and identically distributed random errors having normal N ~$(0, \delta_v^2)$ distribution and independent of μi
μ_i = Deviation from maximum potential output attributed to technical inefficiency. The μ_is are assumed to be non - negative truncation of the half - normal distribution N~ $(\mu, \delta\mu^2)$
β_0 = Intercept
β_1 - β_6 = Production function parameters to be estimated
i = 1, 2, 3, --- n farms

The technical inefficiency effects, μi is defined as:

$$\mu i = \delta_0 + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 \quad (7)$$

μi is the inefficiency effect, Z_1 is age of the farmer (years), Z_2 is educational level of farmer (years), Z_3 is farming experience (years), Z_4 is household size, Z_5 is gender of farmer (male = 1, female = 0) and Z_6 is number of contact with the extension agent within the cropping season and Z_7 is loan status (loan beneficiary = 1, non-beneficiary = 0). The δ_0 and δi coefficients are un-known parameters to be estimated along with the variance parameters δ^2 andγ.

The variances of the random errors, δ_v^2 and that of the technical and cost inefficiency effects $\delta\mu^2$ and overall variance of the model δ^2 are related. Thus $\delta^2 = \delta v^2 + \delta\mu^2$. The sigma-squared ($\delta^2$) indicates the goodness of fit and the correctness of the distributional form assumed for the composite error term. The ratio $\gamma = \delta\mu^2/\delta^2$, measures the total variation of output from the frontier which can be attributed to technical or cost inefficiency. The sigma-squared (δ^2) and the gamma (γ) coefficients are the diagnostic statistics that indicate the relevance of the use of the stochastic production frontier function and the correctness of the assumption made on the distribution form of the error term. The estimates of all the parameters of the stochastic frontier production function and the inefficiency model were simultaneously obtained using the program FRONTIER version 4.1 (Coelli, 1996).

Test of difference of mean was used to determine the variation in the mean technical efficiency of the loan beneficiary and non-beneficiary food crop farmers. The formula goes thus:

$$t = \frac{\overline{X}_A - \overline{X}_B}{\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_2^2}{n_2}}} \quad (7)$$

$\overline{X}_A$ = Mean technical efficiency of loan beneficiary food crop farmers
$\overline{X}_B$ = Mean technical efficiency of the non-beneficiary food crop farmers
δ_1^2 = Variance of technical efficiency of the loan beneficiary food crop farmers
δ_2^2 = Variance of technical efficiency of the non - beneficiary food crop farmers
n_1 = Number of loan beneficiary food crop farmers
n_2 = Number of non-beneficiary food crop farmers

RESULTS AND DISCUSSIONS

Description of the socio-economic characteristics of food crop farmers

The distribution of socio-economic characteristics of food crop farmers is presented in Table-1. The mean ages of the farmers were 50 years and 49.24 years for the loan beneficiaries and non-beneficiaries, respectively. This implies that majority of the farmers are still in their active age and are therefore expected to be productive for available resources, *ceteris paribus*. In terms of gender, the study revealed that 93.3 percent are males while 6.7 percent are females among the loan beneficiaries, and 85.8 percent and 14.2 percent were males and females among the non-beneficiaries, respectively. This shows active involvement of men in farming in the study area. The findings also revealed that majority (87.5 percent) of the loan beneficiaries and (83.3 per cent) of the non-beneficiaries are married. The implication of this is that in the traditional rural setting a wife is a good source of family labour in food crop production whose activities begin from decision making on production to processing and marketing of farm produce. The findings further revealed that the mean household size for the farm household in the study area was approximately 7 persons for the loan beneficiaries and non-beneficiaries, respectively. This may imply that more members of the household are available as family labour at the expense of formal education.

In addition, the study revealed that majority (77.4 percent) of the loan beneficiaries had formal education while 68.3 percent of non-beneficiaries who had formal education. This implies that large proportion of the non-beneficiaries with no formal education may have less awareness about the benefit of loan in agricultural production. In contrast, majority of the loan beneficiaries had formal education and this may increase their level of awareness in terms of the likely benefits of loan to boost production. In terms of years of farming experience, the loan-beneficiary food crop farmers were more experienced than their non-beneficiaries' counterpart. The mean farming experience was 28.31 years and 24.92 years for loan beneficiaries and non-beneficiaries, respectively. The study also revealed that large proportion 32.5 percent of the loan beneficiary met extension personnel quarterly as against 31.7 percent of the non-beneficiary who met with extension officers once in six months. Extension service to farmers is an important incentive in farm production as it aids information dissemination and adoption of innovation.

Table-1. Distribution of socio-economic characteristics of food crop farmers.

Variables	Beneficiaries			Non-beneficiaries		
	Frequency	Percentage	Mean	Frequency	Percentage	Mean
Age (Year)						
34 or less	8	6.7		11	9.2	
35-44	17	14.2		27	22.5	
45-54	64	53.3	50	48	40	49.24
55-64	26	21.7		24	20	
Above 64	5	4.2		10	8.3	
Sex						
Male	112	93.3		103	85.8	
Female	8	6.7		17	14.2	
Marital status						
Single	1	0.8		4	3.3	
Married	105	87.5		100	83.3	
Divorced	4	3.3		10	8.3	
Widow	10	8.3		6	5.0	
Household size						
1-5	19	15.8		26	21.6	
6-10	95	79.1	7	90	75	7
Above 10	6	4.9		4	3.4	
Educational level						
No formal education	22	18.3		35	29.2	
Primary education	33	27.5		42	35	
Secondary education	50	41.6		33	27.5	
Post secondary education	10	8.3		7	5.8	
Adult education	5	4.1		3	2.5	
Farming experience						
20 or less	36	30.0		48	40.0	
21-30	40	33.4		39	32.5	
31-40	26	21.7	28.31	27	22.5	24.92
Above 40	18	14.9		6	5	
Extension contact						
No visit	5	4.2		26	21.7	
Forth nightly	3	2.5		2	1.7	
Monthly	30	25		8	6.7	
Quarterly	39	32.5		11	9.2	
Once in six month	37	30.8		38	31.7	
Once in a Year	6	5.0		35	29.2	

Source: Computed from field survey data, 2011

Determinants of loan acquisition among food crop farmers

The probit regression result of the determinants of loan acquisition among food crop farmers is as presented in Table-2. The coefficient of the likelihood ratio Chi-square of 49.1 is significant at 1 percent indicating a good fit for the estimated probit model. The result showed that farm size, education, farming experience, marital status and income from farming have positive influence on the likelihood of acquiring loan among the food crop farmers. Respondents' age, education and farming experience were found to be significant at 1 percent level each and thus influence the likelihood of loan acquisition. The sign of the age variable implies that demand for loan among food crop farmers decline with age as the farmers grow older. This result conforms with the findings of Paul (2008) who reported that demand for loan increases with age up to a certain point and then starts to decline. The sign of the education and farming experience implies that these variables positively impact loan demand and acquisition. Additional year of education and farming experience will increase the likelihood of acquiring loan by food crop farmers by 0.09 and 0.08, respectively. This result is also in conformity with the findings of Paul (2008). The marginal effects revealed that the probability that a food crop farmer will acquire loan decreases as the farmers' grow older. However, the probability that a food crop farmer will acquire loan increases with increase in their level of education and farming experience. Additional year of education and farming experience will increase the probability of loan acquisition by food crop farmers by 0.0346 and 0.0334, respectively.

Table-2. Probit model result on the determinants of loan acquisition among food crop farmers.

Variable	Maximum likelihood estimates	Marginal effects
Constant	-0.0412	-0.0164
	(0.6820)	(0.2722)
Age	-0.0607***	-0.0242***
	(0.0189)	(0.0075)
Farm size	0.2146	0.0856
	(0.1658)	(0.0661)
Education	0.0868***	0.0346***
	(0.0207)	(0.0082)
Farming experience	0.0838***	0.0334***
	(0.0181)	(0.0072)
Household size	-0.05118	-0.0204
	(0.0458)	(0.0183)
Sex	-0.1170	-0.0467
	(0.3170)	(0.1265)
Marital status	0.2025	0.0807
	(0.2770)	(0.1109)
Farming income	$0.1137E^{-05}$	$0.4537E^{-06}$
	$(0.9938E^{-06})$	$(0.3964E^{-06})$
Log likelihood	-141.78	
Chi-square	49.14***	

*** implies significant at 1 percent. Figures in the parentheses are the standard errors
Source: Computed from Field Survey Data, 2011.

Maximum likelihood estimates of the production function of loan beneficiary and non-beneficiary food crop farmers

The results of the Maximum Likelihood Estimates (MLE) of the production function of Bank of Agriculture loan beneficiary and non- beneficiary food crop farmers are presented in Table-3. The variance parameters for sigma- square (δ^2) and gamma (γ) are estimated at 0.20 and 0.97 and were significant at 1 percent in each case. The sigma-square attests to the goodness of fit and correctness of the distributional form assumed for the composite error term while the gamma indicates the systematic influences that are unexplained by the production function and the dominant sources of random errors. This implies that about 97 percent of the

variation in output of the farmers is due to the differences in their technical inefficiency.

All the coefficients of production function have the expected signs except labour input and fertilizer. The results showed that farm size (X_1), planting material (X_3) and herbicide (X_5) have positive effect on farm output while labour and fertilizer have negative effect on farm output. While farm size, labour and planting material were significant at 1 percent, fertilizer was significant at 5 percent. The findings showed that herbicide do not exert any significant influence on farm output of the farmers. However, the negative sign of the coefficients of labour and fertilizer is an indication that these inputs are over-utilized among the food crop farmers.

The contribution of farmers' socio-economic characteristics including age, years of formal education, farming experience, household size, sex, extension contact and loan to farm inefficiency was also examined. The signs of the coefficients of these variables have important policy implications as positive sign implies negative effect on farm efficiency while negative sign signifies a positive effect on farm efficiency. The inefficiency model revealed that education ($p<0.01$), extension contact ($p<0.01$) and loan ($p<0.01$) have positive significant effect on the technical efficiency of the farmers. This result is in conformity with the findings of Ogundari and Ojo (2007) who reported that education and loan increase the technical efficiency of food crop farmers. Thus inefficiency effects exist and have significant influence on farmers' technical efficiency.

Table-3. Maximum likelihood estimates of the stochastic frontier production function for the loan beneficiary and non-beneficiary cassava farmers.

Variable	Coefficient	Standard error	T-value
Production function			
Constant	6.1761***	0.4399	14.03
Farm size (X_1)	0.6395***	0.0499	12.81
Labour (X_2)	-0.0117***	0.0024	-4.72
Planting material cost(X_3)	0.3252***	0.0485	6.71
Fertilizer (X_4)	-0.0034**	0.0017	-2.01
Herbicide (X_5)	0.0009	0.0017	0.51
Inefficiency model			
Constant	-0.6021***	0.1172	-5.1
Age (Z_1)	0.0191	0.0208	0.93
Education (Z_2)	-0.0116***	0.0021	-5.54
Farming experience (Z_3)	-0.0314	0.0337	-0.93
Household size (Z_4)	-0.0610	0.0601	-1.01
Sex (Z_5)	0.0007	0.0137	0.05
Extension contact (Z_6)	-0.0433***	0.0044	-9.73
Loan status (Z_7)	-0.3080***	0.0321	-9.58
Diagnostic statistics			
Sigma square (δ^2)	0.2064***	0.0221	9.3
Gamma (γ)	0.97***	0.0229	42.63

*** implies significant at 1 percent, ** implies significant at 5 percent, * implies significant at 10 percent.
Source: Computed from field survey data, 2011.

Technical efficiency estimates of the loan beneficiary and non-beneficiary food crop farmers

The frequency distribution of the technical efficiency estimates of the Bank of Agriculture loan beneficiary and non-beneficiary food crop farmers is presented in Table-4. The same production technology (frontier) was assumed for the two categories of farmers as a basis for comparing the efficiency level of the two farmers' groups. The result revealed that majority (50 percent) of the loan beneficiaries have their technical efficiency above 0.90 while the remaining 50 percent have their technical efficiency falling below 0.90 but above

0.50. The result gives a mean technical efficiency of 0.86 which implies that the loan beneficiaries have potential to increase their output by 14 percent. On the other hand, 33.33 percent of the non-beneficiaries have their technical efficiency above 0.90 while majority (66.67 percent) has their technical efficiency below 0.90 but above 0.47. The result gives a mean technical efficiency of 0.79 implying the non-beneficiaries have potential to increase their technical efficiency level by 21 percent. The mean output oriented efficiency of 86 percent for beneficiaries and 79 percent for non-beneficiaries showed that the non-beneficiaries have more potential for technical efficiency increase while the beneficiaries are more technically efficient as the farmers operate on the same frontier.

Table-4. Distribution of technical efficiency estimates of loan beneficiary and non-beneficiary food crop farmers.

	Beneficiaries		**Non-beneficiaries**	
Class	**Frequency**	**Percentage**	**Frequency**	**Percentage**
≤0.50	-	-	3	2.50
0.51-0.60	05	4.16	13	10.83
0.61-0.70	06	5.00	15	12.50
0.71-.080	18	15.00	18	15.00
0.81-0.90	31	25.83	31	25.83
>0.90	60	50.00	40	33.33
Total	120	100	120	100
Mean	0.86		0.79	
Minimum	0.52		0.47	
Maximum	0.96		0.95	

Source: Computed from field survey data, 2011

Test of mean efficiency difference between the loan beneficiary and non-beneficiary food crop farmers

The result of test of mean technical efficiency difference between the loan beneficiary and non-beneficiary food crop farmers is presented in Table-5. The result of the t-test showed that there is a significant difference (α 0.01) between the technical efficiency of the two categories of the farmers. This signifies that the loan beneficiary food crop farmers produced more output from a given level of inputs than the non-beneficiaries. This variation may be attributed to availability of loan to boost production among the loan beneficiaries.

Table-5. Test of mean technical efficiency difference between the loan beneficiary and non-beneficiary food crop farmers.

	Mean efficiency	**Standard deviation**	**N**	**DF**	**T-Value**	**Decision**
Beneficiaries	0.86	0.1064	120	238	3.63***	Reject H_o
Non-beneficiaries	0.79	0.1446	120			

Source: Computed from field survey data, 2011

CONCLUSIONS AND RECOMMENDATION

The findings revealed that loan beneficiary food crop farmers are more educated than non-beneficiaries. It was also revealed that access to loan aids farm expansion among the loan beneficiaries. The probit regression result revealed that age; years of formal education and farming experience have significant effect on the likelihood of loan acquisition. This implies that as any of these variables is strengthened, the likelihood of acquiring loan to enhance food crop production will be increased but decreases as the farmers grow older. The stochastic production function revealed that farm output increases with farm size, planting material and herbicide but decreases with labour and fertilizer. The sign of the coefficient of the farm labour and fertilizer showed that these variables are over-utilized among the food crop farmers. Education, extension service and loan had positive effect on the technical efficiency of the food crop farmers. The mean output oriented efficiency of 86 percent and 79 percent showed that there is potential to increase output by 14 percent and 21 percent by the loan beneficiaries and non-beneficiaries, respectively. Above all, the loan beneficiary food crop farmers are technically efficient than their non-beneficiaries' counterparts. Policy option requires the food

crop farmers to reduce the use of labour and fertilizer. Also, farm expansion is recommended to ensure efficient utilization of labour and fertilizer. Finally, formal education and adult literacy education should be encouraged among farmers as education increases the likelihood of loan acquisition and to afford the farmers the benefit of agricultural loan.

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