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RELATIVE TECHNICAL EFFICIENCY OF CREDIT AND NON-CREDIT USER CROP FARMERS

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ABSTRACT

Credit has become a prominent resource in agricultural production in Nigeria in an effort to redress resource poverty endemic among the farming populace. Formal and informal credit schemes have been established, however, their success in addressing the credit needs of food crop farmers remains a matter of debate. This study was designed to examine the impact of rural credit on resource use in arable crop production in Imo State of Nigeria. Primary data collected from random samples of 132 arable crop farmers consisting of 57 credit using and 75 non-credit using farmers were used. Data were analysed using the stochastic frontier production function modeling. It is evident that credit using farmers are more technically efficient than their non-credit using counterparts. Age of the farmer, household size, level of formal education, farming experience and membership of farmer associations/cooperatives were statistically significant factors influencing technical efficiency. The ranges of technical efficiency were 0.311 to 0.951 for the credit using farmers, and 0.311 to 0.941 for the non-credit using farmers. The mean technical efficiency for the 10 worst performing farmers was 0.157 for the credit users and 0.185 for the non-credit users. Values for the 10 best performing farmers were 0.749 for credit and 0.886 for the non-credit users. It would take an average credit using farmer 64 percent cost savings and an average non-credit using farmer 50 percent cost savings to become the best performing farmers in their respective groups. Based on these results, appropriate policies and programmes that could strengthen the farmers' participation in rural credit markets and for enhancing their efficiency in resource use are recommended.

Key Words: Nigeria, resource utilisation, rural finance schemes, stochastic model

RÉSUMÉ

Le crédit est devenu une ressource remarquable dans la production agricole au Nigeria dans un effort destiné à attaquer la pauvreté de ressources qui est endémique au sein de la populace. Des systèmes de crédit tant formels qu'informels ont été établis ; néanmoins, leur succès demeure en question en ce qui concerne la satisfaction de besoins de crédit chez les cultivateurs de cultures vivrières. Cette étude était conçue en vue d'examiner l'impact du crédit rural sur l'utilisation de ressources dans la production de cultures arables dans l'Etat de Imo au Nigéria. Etait utilisée, une collection de données primaire à partir d'échantillons aléatoires de 132 cultivateurs d'espèces culturales arables consistant en 57 cultivateurs utilisant le crédit et 75 cultivateurs n'en utilisant pas. Les données étaient analysées à l'aide de la modélisation dite 'stochastic frontier production function' Il est évident que les cultivateurs utilisant le crédit sont plus efficaces, techniquement parlant, que leurs collègues qui n'en utilisent pas. L'age du cultivateur, la taille du foyer, le niveau d'éducation formelle, l'expérience en matière agricole et l'appartenance à une association/coopérative étaient des facteurs statistiquement significatifs influençant l'efficacité technique. Les gammes de ladite efficacité étaient de 0.311 à 0.951 pour cultivateurs utilisant le crédit et de 0.311 à 0.941 pour cultivateurs n'utilisant pas de crédit. L'efficacité technique moyenne pour les 10 cultivateurs à la performance la plus médiocre était 0.157 pour les cultivateurs utilisant le crédit et 0.135 pour cultivateurs n'utilisant pas de crédit. Les valeurs pour les dix meilleures performances de cultivateurs étaient 0.749 pour cultivateurs utilisant le crédit et 0.886 pour les cultivateurs n'utilisant de crédit. Il nécessiterait 64 pourcent en épargne de coûts à un cultivateur moyen utilisant le crédit et 50 pourcent en épargne de coûts à un cultivateur moyen qui n'utiliserait pas de crédit en vue de devenir les cultivateurs à la meilleure performance dans leurs groupes respectifs. Se basant sur ces résultats, des politiques et des programmes appropriées qui pourraient renforcer la participation de l'agriculteur dans les marchés du crédit rural ainsi que pour leurs efficacité dans l'utilisation de ressources sont recommandés.

Mots Clés: Nigéria, utilisation de ressources, systèmes de financement ruraux, modèle conjectural

INTRODUCTION

Over the years, there has been a growing concern regarding the dwindling agricultural production in Nigeria. The poor performance of agriculture has led to high food import bills, lingering food insecurity, escalating social vices and insustainability of the national resource base. Low agricultural productivity resulting in low farm income has weakened the financial position of the farmers and other rural entrepreneurs; a condition that has led to poor funding of their economic activities (Nwaru *et al.*, 2004). Consequently, farming in Nigeria is characterised by low level of private capital investment and changing technology (Mbah, 2001; Nwaru, 2004) resulting in low output and income.

Since the main vehicles for economic development are capital and technology (Odiase-Alegimenlen, 2004), credit became prominent in rural production. This prominence is built on the fact that credit encourages diversified agriculture which stabilises and perhaps increases size of farm operations and resource productivity. Additionally, it facilitates adoption of innovations leading to increased farm production and income, encourages capital formation, improves marketing efficiency and smoothens farmers' consumption (Nwagbo, 1989; Desai and Mellor, 1993; Nwaru, 2004). Moreover, the need for credit tends to increase due to population increases and the rising competition for scarce funds for the expanding agricultural and non-agricultural sectors of the rural economy.

This study examined the relative efficiencies of the credit using and non credit farmers in resource use. Technical efficiency here refers to the ability of the farmers to produce the highest level of output using a given set of resources. It is the ratio of total output to total input. For an efficient farmer, this ratio is unity. Previous studies by Onyenweaku and Fabiyi (1991), Onyenweaku (1994), Ohajianya and Onyenweaku (2001; 2002) and Nwaru (2003), pointed to low resource productivity and efficiency in Nigeria's agriculture. Other studies by Ewuola (1985), Olomola (1988), Nwagbo (1989), Mejeha and Obunadike (1998) and Okorie (1998) examined the role of credit in enhancing resource productivity and efficiency in agriculture. However, none of these provided numerical estimates of technical efficiency as empirical basis for farm resource use planning, this study therefore addressed this gap.

METHODOLOGY

This study was conducted in Imo State. The State was stratified into three pests/blocks according to the agricultural zones of the State; namely Owerri, Okigwe and Orlu. From each zone, two blocks were selected by simple random sampling. Circles were delineated in each chosen block and a list constitutes the sampling frame from which a circle was chosen per block by simple random sampling. In all, a total of six circles were chosen. With the assistance of the village heads and the extension agents of the Imo State Agricultural Development Programme in charge of the chosen circles, the listing of credit using and non-credit using arable crop farmers in the chosen circles was done.

These lists formed the frames from which samples of 60 credit using arable crop farmers consisting of 10 farmers per circle, 78 non credit using arable crop farmers consisting of 13 farmers per circle were chosen randomly. Using a pre-tested interview schedule, actual data collection by the cost route method was done for 12 consecutive months (November 2001 - December 2002) to accommodate the entire production cycle of certain crops like cassava. At the end of the data collection exercise, only 57 interview schedule from the credit using farmers and 75 from the non-credit using farmers were used for further analysis because the others failed to yield consistent data.

Data were analysed by the stochastic frontier production function developed independently by

Aigner *et al.* (1977) and Meeusen and Van den Broeck (1977). The Stochastic production frontier analysis begins with a production function with a multiplicative disturbance term of the form:

$$Y = f(x_i;\beta)\, e^{\varepsilon} \qquad (1)$$

where, Y is the output, x_i is a vector of input quantities β is a vector of parameters to be estimated, e is the natural logarithm, ε is a stochastic disturbance term consisting of two independent elements U_i and V_i. That is

$$\varepsilon = V_i - U_i \qquad (2)$$

V_i is a random variable outside the control of the farm and reflecting noise and other stochastic shocks such as weather, luck, industrial action, measurement errors, etc. It is assumed to be independently and identically distributed as $N\sim(0, \sigma_v^2)$. U_i is a one sided component ($U_i \geq 0$) reflecting technical inefficiency, relative to the production frontier $f(x_i ; \beta)$. U_i is assumed to be the non-negative truncation of $N\sim(0,\sigma_u^2)$ distribution. Thus, $U_i = 0$ for a farm output which lies on the frontier and $U_I > 0$ for one whose output is below. Combining Equations (1) and (2),

$$Y_i = f(x_i ; \beta)\, e^{(vi-ui)} \qquad (3)$$

Measures of technical efficiency for each farmer can be defined as

$$TE = \exp[E\{U_i/\varepsilon\} \qquad (4)$$

Where, TE is technical efficiency, ε and other terms are as previously defined.

$$\text{Therefore, } TE = \exp[E\{U_i/\varepsilon\} = f(z_h ; \delta) \qquad (5)$$

Where, z_h is a vector of farmer specific factors capable of preventing the hth farmer from operating at optimal efficiency and δ is a vector of parameters to be estimated.

The empirical stochastic frontier production function applied in this study was of the form (equations 3 to 5):

$$InY = \beta_0 + \beta_1 InX_1 + \beta_2 InX_2 + \beta_3 InX_3 + \beta_4 InX_4 + \beta_5 InX_5 + \beta_6 InX_6 + V_i - U_i \qquad (6)$$

and

$$TE = \delta_0 + \delta_1 z_1 + \delta_2 z_2 + \delta_3 z_3 + \delta_4 z_4 + \delta_5 z_5 + \beta_6 z_6 \qquad (7)$$

Where, in equations (6) and (7), In is Logarithm to base e; Y is naira value of arable crop output for the ith farmer (₦); X_1 is Land area (ha) under arable crop cultivation, $\delta Y/\delta X_1 > 0$; X_2 is Hired Labour (Mandays), $\delta Y/\delta X_2 > 0$; X_3 is Household labour (Mandays), $\delta Y/\delta X_3 > 0$. A man-hour is the labour input by an adult male working for an hour. Eight man-hours are a manday. According to Upton (1973), a child's and a woman's labour is converted to a man's labour by the ratios 1/3 and 2/3 respectively; X_4 is Value of planting materials like seeds, seedlings, cuttings, etc (₦) and given that unit prices are constant, $\delta Y/\delta X_4 > 0$. X_5 is Fertilizer (kg), $\delta Y/\delta X_5 > 0$; X_6 is Capital (₦), made up depreciation on fixed assets, interest on loans, etc, $\delta Y/\delta X_6 < 0$; V_i, U_i is as defined in equation 2. TE is technical efficiency; Z_1 is age of the ith farmer (in years), $\delta TE/\delta Z_1 < 0$; Z_2 is household size of the ith farmer, $\delta TE/\delta Z_2 > 0$; Z_3 is years of formal education of the ith farmer, $\delta TE/\delta Z_3 > 0$; Z_4 is farming experience of the ith farmer measured by the number of years having been a crop farmer, $\delta TE/\delta Z_4 > 0$. Z_5 is number of farmer associations/cooperatives to which the ith farmer belongs, $\delta TE/\delta Z_5 > 0$; Z_6 is dummy variable to capture the sex of the ith farmer (1 = female; 0 = male); $\delta TE/\delta Z_6 < 0$. β_0, β_i, δ_0, δ_i, δ_v^2, δ_u^2 are the unknown parameters estimated for the credit and non credit using farmers by the methods of Maximum likelihood (MLE) and ordinary least squares (OLS) using the computer program FRONTIER 4.1 (Coelli, 1994). These estimates were compared to show the model which best fit the data.

RESULTS AND DISCUSSION

Farmers bio and other foundation data. A typical credit using farmer was 49 years old with 11 years of education, 16 years of farming experience and household size of eight (Table 1). Farmers generally belonged to three farmer associations/cooperatives, employed about 84 person - days of hired labour and 81 person - days of family labour per annum, spent Naira

(₦)14,545.36 on planting materials and ₦2,102.57 on capital inputs and produced an output of ₦59,595.499 per year. Non-credit using farmers were 55 years, with eight years of education, 23 years of farming experience and household size of seven. Each farmer belonged to one or more farmer associations/cooperatives, employed about 68 persondays of hired labour and 74 persondays of family labour per annum, spent ₦17,845.13 on planting materials and ₦1,600.84 on capital inputs and produced an output of ₦81,748.93 per annum.

Estimated production functions. The estimated stochastic frontier production functions by the Maximum Likelihood Estimation (MLE) and the associated ordinary least squares (OLS) for the credit using and non-credit using farmers was summarised in Table 2. In each case, the maximum likelihood estimates proved better than the ordinary least squares estimates because the intercept term was larger, denoting an outward shift of the production function. As such, there were used for further analysis.

Each of the intercept terms for the credit using and non-credit using farmers was positive and statistically significant. Each of these indicates the revenue accruable to the farmers at zero level of use for all the inputs. Normally, expenses on fixed factors of production such as interest on capital tied to land, farm machinery and tools, buildings, farm roads and other permanent structures would keep running whether or not the variable factors of production are used. Zero level of use for the variable inputs should entail zero output and income while these costs are incurred. However, for the smallholder farmer with a little capital base and most times without elaborate fixed assets, except land, matchet and hoes, these costs are irrelevant. Under some local and unorganised terms, the farmer might earn some income from what could have been termed as idle assets when other farmers use them for some payments. For instance, the farmer's plots of land could be rented out for a cropping season or two during which he is not employing them in production. This offers some explanations to the positive intercepts.

Land is a very important resource in both subsistence and large scale farming in Nigeria. Arable land rather than land per se is the greatest constraint in arable crop production (Iheanacho, 2001). The estimated coefficient for land is statistically significant and positive for credit using farmers and non credit using farmers. This implies that the employment of more land resources would lead to greater output of arable crops. This conforms to *a priori* expectations. For instance, Ohajianya and Onyenweaku (2001) reported a similar result and interpreted this to mean that profit increases with increases in the levels of land inputs. Unfortunately, it has severally been observed that given the severe scarcity, unsustainability and insecurity of land and its fast deterioration (Iheanacho, 2001; Nwaru and

TABLE 1. Average statistics of the sample farmers

Farmers groups	Credit using	Non credit using
Farmland (ha)	3.054	2.379
Hired labour (persondays)	84.219	67.984
Family labour (persondays)	81.041	73.985
Material inputs (Naira)*	14545.36	17845.13
Fertiliser (kg)	228.268	160.827
Capital (Naira)*	2102.574	1600.837
Age (years)	48.743	54.560
Household size	7.566	6.733
Education (years)	10.707	8.208
Farming experience (years)	15.923	23.493
Farmer associations/ cooperatives	3.061	1.661
Output (Naira)*	59595.499	81748.926

Source: Computed from survey data, 2002

*Naira (₦) is the Nigerian national currency with about 130 units to the American dollar

Nnadozie, 2001), increases in crop output should be expected more from the input of superior technology than from land area expansion. For instance, the World Resource Institute (1992) estimated that the deforestation rate in Nigeria was 2.7 percent per annum while the per capita arable land decreased from 0.6 hectares in 1965 to 0.29 hectares in 1990 and was expected to fall to 0.19 hectares in the year 2000. Therefore, there is need for appropriate policies as well as the political will to carry such policies through in the match towards sustainable structures for land mobilization, consolidation and redistribution in Nigeria. Such optimum policies and sustainable structures, when married with superior technology would lead to increased output.

Labour and entrepreneurship are the two most important resources next to land in traditional agriculture because it is in them that the decision making power in the production process resides (Upton, 1987; Nwaru and Ekumakama, 1999). The coefficients for hired labour are statistically significant in all the estimated models. Family labour was not statistically significant for the credit using farmers. However, for the non credit using farmers, it was significant. In all the estimated models, both the hired labour and family labour have positive coefficients. This conforms to *a priori* expectations because farm operations in Nigeria have remained labour intensive. That credit using farmers relied less on family labour in farm production could be part of the shifts in the structures of rural production, which Nwaru (2003) pointed out. It could be deduced that credit enabled the credit using farmers to hire more labour while their non credit using counterparts relied more on family labour. The implication is that *ceteris paribus*, the input of credit would lead to significant shifts in production in which farmers can afford more purchased inputs.

Planting materials consisting of seeds, seedlings, cuttings and agrochemicals except fertiliser were

TABLE 2. Estimated stochastic frontier production functions

Variables	Parameters	Credit using		Non credit using	
		MLE	OLS	MLE	OLS
Intercept	β_0	0.799 (3.791)***	0.621 (3.014)***	0.920 (2.464)***	0.910 (1.206)
Land	β_1	0.116 (2.901)***	0.072 (2.312)***	0.190 (2.956)***	0.052 (2.594)**
Hired Labour	β_2	0.072 (3.277)**	0.121 (2.355)**	0.061 (1.809)*	0.170 (1.134)
Family Labour	β_3	0.066 (1.068)	0.061 (1.050)	0.082 (3.287)***	0.082 (3.021)***
Material inputs	β_4	0.150 (2.559) **	0.034 (1.304)	0.070 0.272	0.382 (3.229)***
(2.111)**					
Fertiliser	β_5	0.382 (1.807)*	0.150 (1.296)	0.092 (1.439)	0.082 (0.904)
Capital	β_6	-0.150 (-2.448)**	0.092 (1.948)*	-0.093 (-2.990)***	0.272 (2.022)**
Log –likelihood	(μ)	-99.319	-830.518	-122.418	-1348.910
	δ_v^2	0.8422	-	0.7994	-
	δ_u^2	0.1547	-	0.2004	-
	X^2	49.117	-	44.218	-
	R^2	-	0.7106	-	0.7419
	R^{-2}	-	0.6723	-	0.6891
F-ratio			11.523***		12.672***

Source: computed from survey data, 2002

***, ** and * imply statistically significant at 1, 5 and 10 percent respectively highly significant and positive for the credit using and non credit using farmers. For the credit using farmers, the input of fertiliser is statistically significant and positively signed in conformity with *a priori* expectations. As more fertiliser is used, output of arable crops increases. This further shows that credit use helps the farmer to participate more actively in the farm input market. Fertilizer is a major and common soil augmenting input in the sense that it improves productivity by increasing crop yields per hectare.

Capital input is highly significant and negative in all the estimated models. Depreciation on fixed assets, interest and rent constitute this input. The coefficients show results that conform to *a priori* expectations. As charges on depreciated assets and interest among others increase, the revenue from food crop production decreases. Advocates of concessionary interest rates, in the Nigerian rural economy, hinge their arguments on this; that farm producers should be given some interest leverage on borrowed monies as this would enable them to earn more per unit of output and to continue in business.

Sources of technical efficiency. The sources of efficiency in arable crop production are examined by using the estimated δ coefficients for the farmer groups as presented in Table 3. The efficiency effects were specified as those relating to age of the farmer, household size, education, farming experience, number of farmer associations/cooperatives to which the farmer belonged, sex of the farmer and credit use.

The estimated coefficient of age is statistically significant and maintained the right *a priori* negative relationship with technical efficiency in all the estimated models. The older a farmer becomes, the more his efficiency drops. This is similar to the findings by Battese and Coelli (1993); Ojo and Ajibefun (2000); Okike, *et al.* (2001) and Onu, Amaza and Okunmadewa (2000). It has been observed that the innovativeness of a farmer, his mental capacity to cope with the daily challenges and demands of farm production activities and his ability to do manual work, all of which bear directly on his production efficiency, tend to decrease the older he becomes.

The coefficient for the size of the farmer's household is statistically significant and negative in all the estimated functions. This implies that the larger the household size, the more inefficient the farmer becomes. This is contrary to *a priori* expectations but agrees with the result from Onyenweaku and Nwaru (2005) who explained that large households might utilize family labour beyond the point where marginal value product is equal to the wage rate. This implication gives an uncomfortable signal given the rising population in the rural economy, which may persist for

TABLE 3. Estimated determinants of technical efficiency for the credit using and non credit using arable crop farmers in Imo State

Variable	Parameter	Credit using	Non credit using
Intercept	δ_0	0.677 (3.351)***	0.710 (3.526)***
Age	δ_1	-0.063 (-3.139)***	-0.072 (-3.093)***
Household size	δ_2	-0.052 (-3.041)***	-0.053 (-2.913)***
Education	δ_3	0.041 (3.336)***	0.191 (2.973)***
Farming experience	δ_4	0.069 (2.302)**	0.092 (1.965)*
Farmers' associations/cooperatives	δ_5	0.190 (3.161)***	0.153 (2.934)***
Sex	δ_6	-0.062 (-1.224)	-0.074 (-1.193)

Source: computed from survey data, 2002. ( ) are t-ratios computed
***, ** and * imply statistically significant at 1, 5 and 10 percent respectively

sometime to come, due too a number of factors. For instance, Nwaru and Ekumankama (1999) observed that the need for local insurance wherein parents count on their children for upkeep and caring in their old age has contributed much to rising household size and to population increase in the rural economy. Moreover, land and labour have been identified as the most critical resources in rural economies. Traditionally, rural households count more on their family members than hired workers as sources of farm labour, which is another reason for rising household size in the rural economy. Economic structures for addressing this would include policies and programmes that ensure social security whereby the aged are taken care of. Such structures should also boost the impetus of the much desired shift of agriculture from its present status of being subsistence oriented to being commercial oriented.

Education is statistically significant and positively related to technical efficiency. This is according to *a priori* expectations and agrees with the results from Battese and Coelli (1993); Ojo and Ajibefun (2000); Onu, Amaza and Okunmadewa (2000). The more educated the farmers are, the less technically inefficient they become. Education helps to unlock the natural talents and inherent enterprising qualities of the farmers. According to Obasi (1991), the level of education of a farmer not only increases his productivity but also enhances his ability to understand and evaluate new production techniques. Ojo and Ajibefun (2000) and Nwaru and Ekumankama (1999) posited that education and training produce a labour force that is more skilled and adaptable to the needs of a changing economy because, *ceteris paribus*, educated farmers are more amenable to risk taking and change than non educated ones.

Experience may be defined as the knowledge and skill gained by contact with facts and events (Nwaru, 2004). By its nature, it is a product of the past and therefore, limited to and controlled by previous exposures. Olomola (1988), Obasi (1991) and Nwaru (1993) observed that farmers would count more on their farming experience for improved productivity rather than their educational attainment. This is because the number of years a farmer has spent in the farming business may give an indication of the practical knowledge he has acquired on how to cope with the inherent farm production, processing and marketing problems leading to higher levels of efficiency. Farming experience as a variable in the efficiency model is statistically significant and positive in each of the estimated models. This conforms to *a priori* expectations. Ojo and Ajibefun (2000) reported a significant negative relationship between practical training and technical inefficiency. However, this result disagrees with those from Onu, Amaza and Okunmadewa (2000) who explained that experience correlates with age, which would always associate with reduced energy and optimism necessary in farming.

Membership of farmer associations/ cooperatives is expected to increase the farmer's interactions with his fellow farmers and other entrepreneurs in his locality. It is hoped that such interactions would help them to receive and synthesise new information on economic activities in his locality and even beyond. For instance, Okike *et al.* (2001) observed that the reduction of inefficiency effects through farmers belonging to cooperatives is linked to cooperatives being a source of good quality inputs, information and organised marketing of products, especially dairy products. The coefficients for farmer associations/ cooperatives for the credit using farmers and non credit using farmers are statistically significant and positively signed according *a priori* expectations. Therefore, if properly mobilised and channeled through appropriate policy initiatives, farmer associations/cooperatives have great potentials for enhancing resource productivity and efficiency in the rural economy.

Technical efficiency estimates of the farmers. The technical efficiency estimates of the arable crop farmers were derived, summarised and presented in Table 4. The range of technical efficiencies vary widely, being 0.351 to 0.981 with a mean of 0.497 for the credit using farmers and 0.311 to 0.911 with a mean of 0.438 for the non credit using farmers. The mean technical efficiencies for the 10 worst performing farmers were derived as 0.366 and 0.314 for the credit using farmers and non credit using farmers, respectively. On the other hand, the mean technical

TABLE 4. Distribution of the farmers according to their technical efficiency estimates

Technical efficiency range	Credit using		Non credit using	
	Frequency	Percentage	Frequency	Percentage
0.262 – 0.381	19	33.33	10	13.33
0.382 – 0.501	13	22.82	25	33.33
0.502 – 0.621	14	24.56	22	29.33
0.622 – 0.741	5	8.77	8	10.67
0.742 – 0.861	3	5.26	7	9.33
0.862 – 0.981	3	5.26	3	4.01
Total	57	100.00	75	100.00
Minimum value	0.351		0.311	
Maximum value	0.981		0.911	
Mean value	0.497		0.438	
	(0.167)		(0.144)	
Mean of worst 10	0.366		0.314	
	(0.032)		(0.040)	
Mean of best 10	0.876		0.811	
	(0.064)		(0.047)	

Source: Computed from survey data, 2002. (.) = Standard deviation

efficiency indices for the 10 best performing farmers were derived to be 0.876 and 0.811, respectively for the credit using farmers and non credit using farmers.

A t-test of difference between means shows that the mean technical efficiency of the credit using farmers is significantly higher than those of non credit using farmers. It further shows that the mean technical efficiency of the 10 best performing credit using farmers is significantly higher than those of the 10 best performing non credit using farmers. However, the mean technical efficiency of the 10 worst performing credit using farmers is not significantly higher than those of the 10 worst performing non credit using farmers. This implies that the credit using farmers are more technically efficient than their non credit using counterparts. This result is consistent with those from Onyenweaku and Nwaru (2005) in Eastern Nigeria, Bravo-Ureta and Evenson (1994) in Eastern Paraguay and differs with that from Okike, *et al.* (2001) in Northern Nigeria.

These indicate that the credit using farmers are more efficient than the non credit using ones. The more credit the farmer uses, the more efficient he becomes in arable crop farming. This result is consistent with a priori expectations. Authors like Desai and Mellor (1993) and Nwagbo (1989) had stated that farm level credit when properly extended ecourages diversified agriculture which stabilises and perhaps increases resource productivity, agricultural production, value added, net farm incomes and therefore facilitate adoption of innovations in farming, encourage capital formation and marketing efficiency. However, Okike *et al.* (2001) reported a contrary result, that receiving credit contributed to farmers' economic inefficiency. They explained that this could be the result of disbursement of credit in cash rather than in kind and loan misapplication engendered by resource poverty.

The foregoing analyses imply that it will take an average credit user farmer and non credit user farmer (1 - 0.497/0.981)100 equals 47 percent cost savings and (1 - 0.438/0.911)100 equals 52 percent cost savings, respectively to become the most efficient farmer in their groups. Similarly, the 10 worst performing credit user farmers would need 63 percent cost saving while their non credit user counterparts would need 66 percent cost saving to become the most efficient farmers in their respective groups. The corresponding percentages for the 10 best performing farmers would be 11 and 14, respectively.

CONCLUSION

Results of data analysis show that the credit using farmers are more efficient than the non credit using ones. The ranges of technical efficiency were 0.351 to 0.981 with a mean of 0.497 for the credit using farmers and 0.311 to 0.911 with a mean of 0.438 for their non-credit using counterparts. The mean technical efficiency for the 10 worst performing farmers is 0.366 for the credit using and 0.314 for the non credit using farmers. Those for the 10 best performing farmers were 0.876 for the credit using and 0.811 for the non-credit using farmers. These results further showed that it would take an average credit using farmer 47 percent cost savings and an average non-credit using farmer 52 percent cost savings to become the best performing farmers in their respective groups. These indicate that there is room for the credit using arable crop farmers and their non credit using counterparts to improve their technical efficiency.

Therefore, through appropriate policies, existing agricultural credit programmes should be refocused and pursued with more vigour. Such policies should be more youth friendly and targeted more at the experienced farmers. They should enhance farmer education, strengthen their participation in agricultural input and output markets and in farmer associations/cooperatives and reduce their household size or improve their use of family labour.

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