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Production Efficiency of Credit and Non- Credit Users of Poultry Egg Farmers in Ogun State, Nigeria:A Data Envelopment Analysis (DEA) Approach

Adewuyi S.A[1],Folawole O.O[1,]Biola Phillip[2], E.O Fakoya[3]
[1]*Department of Agricultural Economics and Farm ManagementFederal University of Agriculture, Abeokuta, Ogun State Nigeria.*
[2]*Department of Agricultural Extension and Rural DevelopmentFederal University of Agriculture, Abeokuta, Ogun State Nigeria.*
[3]*Department of EconomicsFederal University of Agriculture, Abeokuta, Ogun State Nigeria.*

Abstract: *This study analyzed the production efficiency of credit users and non- credit users among poultry egg farmers in Ogun state, Nigeria. The study made use of primary data via questionnaire administration. A multi – stage sampling technique was used to randomly select 120 farmers. Technical, allocative and economic efficiencies were assessed using Data Envelopment Analysis. Factors affecting Production Efficiencies of poultry farmers were determined by Tobit regression method. The result revealed the mean technical efficiency of 62.67%, allocative efficiency of 71.05% and the overall economic efficiency of 42.16%. This implied that poultry farmers could still increase their output by 37.33% or increase revenue by 28.95% showing that maximum output level can be achieved. The mean economic efficiency score of credit users was 0.42 while that of non-credit users was 0.39, this further showed that poultry farmers that used credit were more economically efficient than their counterparts who did not. Tobit regression analysis revealed that an increase in age ($p<.05$), educational status ($p<0.01$), number of birds stocked ($p<0.01$), credit amount ($p<0.05$) will increase the likelihood of being technically and allocatively efficient while credit amount ($p<0.05$) increased the likelihood of being economically efficient. However, access to extension agents ($p<0.1$) by farmers, tends to make farmers economically inefficient. Age, farming experience, educational level, flock size, interest rate were factors affecting the production efficiency of credit and non- credit users of poultry egg farmers. Based on the results, appropriate policy on provision of credit should be made available for poultry egg farmers in order to increase their production efficiency.*

Keywords: *Agricultural credit, ,Allocative efficiency, Data envelopment analysis,Economic efficiency,Technical efficiency, tobit.*

I. Introduction

In Nigeria, production of food has not increased at the rate that can meet the increasing population. While food production increases at the 2.5%, food demand increases at 3.5% due to high rate of population growth of 2.83% (CBN, 2004). The apparent disparity between the rate of food production and demand for food in Nigeria has led to increasing resort to food importation and high rates of increase in food prices. The demand and supply gap for animal protein intake is so high. The Food and Agricultural Organization recommends that the minimum intake of protein by an average person should be 65gm per day; of this, 36gm (i.e. 40%) should come from animal sources. Nigeria is presently unable to meet this requirement. The animal protein consumption in Nigeria is less than 8gm per person per day, which is a far -fetched from the Food and Agricultural Organization minimum recommendation (Niang and Jubrin, 2001). The fall in poultry production could be attributed to inadequate infrastructure, inadequate finance among many other problems. Credit is considered the catalyst that activates other factors of production and make under used capacities functional for increased production. It also helps to determine the under utilization or over utilization of factor inputs. The study examines production efficiency of credit and non-credit users, and factors influencing credit use by farmers in the study area.

II. Methodology

The study was conducted in Ogun State, Southwest Nigeria. Ogun State was created on February 3rd, 1976 from the old western region. It lies within latitude 6^0N and 8^0N and longitude 2^0E and 15^0E.The population of males in Ogun State is 1, 847,243 while the female is 1, 880,855 and the overall total of Ogun State is 3, 728,098 according to National population census 2006. The state is approximately 1.9 % (16,762 km) of Nigeria's 923,219km land area; and located in the moderately hot, humid tropical climatic zone of south western Nigeria.It is made up of 20 Local Government Areas spread across the four main agricultural zones of the state-

Egba, Ijebu, Remo, and Yewa/Awori. The poultry industry also provides employment opportunities for the populace, thereby serving as a source of income to the people in Ogun state.

The respondents were drawn using a multi-stage sampling process. At the first stage, purposive sampling technique was used to select two (2) Local Government Areas in each of the four (4) Agricultural Development Project (ADP) zones in the state where there are prevalent poultry farmers. This gave a total of 8 Local Government Areas (ObafemiOwode, Ipokia, Sagamu, Abeokuta South, Odeda, Ijebu North, Remo, Ikene). Stage two involved the use of snow ball sampling technique to select 15 poultry farmers from each of the 8 selected Local Government Areas in the four (4) ADP zones in Ogun state to give a total of 120 respondents. Primary data were collected by means of structured questionnaires from the sampled farm households. Data on socio-economic characteristics such as age, primary occupation, gender, years of schooling and family sized. Primary data were also collected on the farm inputs that is number of birds, drugs, feeds, family and hired labour and outputs data were obtained from the respondents.

1.2. Estimation Technique

The level of technical, allocative, and economic efficiencies estimation for poultry farmers follows Coelli*et al*(1998) using Data Envelopment Analysis (DEA) technique. DEA is a non-parametric approach and it doesn't require any functional for a given data. This method uses input and output data of decision making units to construct a piece-wise linear surface or the best-practice frontier for a given data. The input-Oriented DEA was used to estimate the production efficiency of the farmers.Technical Efficiency (TE) measured the ability of the firms to produce a given output using the smallest set of inputs. It is attained when the best available technology is used to achieve maximum output possible.

The technical efficiency was estimated by how much feasible output is maximized for a given level of input adopted from Yusuf and Malomo (2007), the mathematical linear programming below was used

Max Y

$Y, \lambda_1, ..., \lambda_k$ ..... (1)

s.t

$\sum_{t=1}^{n} yi\, \hat{\lambda}i \geq Y_i$ ..... (2)

$\sum_{t=1}^{n} xi\, \hat{\lambda}i \leq x_i$ ..... (3)

$\lambda_i \geq 0$

Y_i = the production output of each farm

x_i= the nth factor of production

λ_i= the weight assigned to each production unit.

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + U_i$ .....(4)

Y = output (crates of egg)

X_1 = Age in years

X_2 = Gender (1= Male, 0= Female)

X_3 = Occupation (1 if poultry farming, 0= if otherwise,)

X_4 = Extension visit in number

X_5 = Credit amount in naira

X_6= Experience in years

X_7= Education in years

X_8= Labour cost in man per naira

X_9= Stock size in number

ß's = the unidentified parameter to be estimated.

µi = the error term.

Similarly, Chavas*et al.* (2005) also suggests that allocative efficiency perspective which is a measure of firm's ability to allocate input bundle or produce a given level of output in the cost minimizing way.

The overall economic efficiency which is defined as the capacity of a firm to produce a pre-determined quantity of output at minimum cost for a given level of technology (Farrel, 1957) this is computed as the product of the Technical Efficiency (TE) and Allocative Efficiency (AE) which gives the Economic Efficiency (EE).

III. Result And Discussion

2.1. Socio-economic characteristics of Poultry Egg Farmers.

The study showedthat the mean age for credit users was 40 years while that of non-credit users was 43 years. It was observed that those between 41 and 50 years of age had the highest representatives with 43.2% and 43.3% for both credit users and non-credit users among poultry farmers in Ogun State. This was in line with Yusuf and Malomo.(2007) who reported an average age of 44 years for poultry (egg) farmers in the same State. The study revealed that 86.4% of the respondents were male while 13.6% of the respondents were female poultry farmers for credit users, while 85.5% and 13.2 % are female for non-credit users. The implication of the heavy participation of males in poultry production could be attributed to the rigor and stress which characterizes the poultry production business which many females might not be able to cope with. The field survey further showed that majority (95.5% and 85.5%) of the credit users and non-credit users respectively were married and 4.5% and 14.5% of the of the credit users and non-credit users were singles.Majority (95% and 76%) of both credit users and non-credit users had post-secondary education which agrees with Ajibefun and Daramola (2000) who found out that education has a strong relationship with the level of production efficiency of poultry farmers as majority of the respondent had post-secondary education .

Table 1: **Socio - economic characteristics of Poultry Farmers**

	Credit users			Non-credit users		
Variables	**Frequency**	**%age**	**Mean**	**Frequency**	**%age**	**Mean**
Age						
Less than 30	8	18.2		11	14.5	
31 – 40	15	34.1		19	25.0	
41 – 50	19	43.2		33	43.1	
51 – 60	2	4.5		7	9.2	
61 and Above	0	0		6	7.9	
Total	44	100	40	76	100	43
Gender						
Male	38	86.4		66	86.8	
Female	6	13.6		10	13.3	
Total	44	100		76	100	
Marital Status						
Married	42	95.5		65	85.5	
Single	2	4.5		11	14.5	
Total	44	100		76	100	
Educational Status						
Primary	1	2.3		5	6.6	
Secondary	1	2.3		6	7.9	
NCE/Diploma	9	20.5		6	7.9	
Bachelor Degree 27	61.4		49	63.3		
Masters	6	13.4		10	13.2	
Total	44	100		76	100	

Source: Field Survey, 2011

2.1.2. Data Envelopment Analysis

The technical, allocative and economic efficiencies of the credit users and non credit users among the poultry farmers were estimated using Data Envelopment Analysis (DEA) techniques, [following Coelli (1998) and Chavas, *et al.* (2005)].

The results obtained from the estimates of the set of linear equations indicated that Technical efficiency (*TE*) indices range from 10 to 100% for credit user with an average of 65.93%. This means that if an average farmer in the sample was to achieve the *TE* level of its most efficient counterpart, then an average farmer would be able to save 34.07% of its cost(i.e.,1 - [65.93/100]).

A similar calculation for the most technically inefficient farmer reveals cost savings of 90%

(i.e., 1 - [10/100]). However, for non-credit users, the technical efficiency ranges from 12 to 100% with an average of 60.78 %. This means that if an average non-credit user in the sample was to achieve the TE level of its most efficient counterpart, then an average farmer could realize 39.22% cost savings (i.e.,1 – 60.78/100]). A similar calculation for the most technically inefficient farmer reveals cost savings of 88% (i.e., 1 - [12/100]). The result of the technical efficiency further showed that credit users has 38.6% of its farmers in efficiency interval 0.81-1.00.

The mean allocative efficiency of the poultry credit user in the study area was 71.63% with a minimum of 12.0% and a maximum of 100%. This means that if an average farmer would achieve the allocative efficiency level of its most efficient counterpart, then the average farmer could save 28.37 % cost savings (i.e., 1 - [71.63/100]). A similar calculation for the most allocatively inefficient farmer reveals cost savings of 88% (i.e.,1 - [12.0/100]). While the mean allocative efficiency of non-credit users is 70.71% with a minimum of 0.08% and maximum of 100 %. This means that if the average farmer in the sample was to achieve the allocative efficiency level of its most efficient counterpart, then the average farmer could realize a 29.29% cost savings (i.e.,1 - [70.71/100]). A similar calculation for the most allocatively inefficient farmer reveals cost savings of 92.0 % (i.e., 1 - [8.0/100]).The result of the allocative efficiency further showed that credit users has 52.3% of its farmers in efficiency interval 0.81-1.00

The combination of effect of technical and allocative factors showed that the average economic efficiency level. The result revealed that the average economic efficiency of the poultry credit user is only 47.85%, with a minimum of 0.05% and a maximum of 100%. These figures indicated that if an average farmer would reach the economic efficiency level of its most efficient counterpart, then an average farmer could experience a cost savings of 52.15%(i.e., 1 - [47.85/100]). The same computation for the least economically efficient farmer suggests a gain in economic efficiency of 95% (i.e., 1 - [5/100]). The non-credit users among the poultry farmer in the study area, have a mean economic efficiency of 38.87% with a minimum value of 4% and maximum value of 97 %. These figures also suggest that if the average non-credit users were to reach the Economic Efficiency level of its most efficient counterpart, then the average farmer could experience a cost savings of 61.13% (i.e., 1 - [38.87/100]). The same computation for the least economically efficient farmer suggests a gain in economic efficiency of 96% (i.e.,1 - [4/100]) .The result of the economic efficiency further showed that credit users has 18.2% of its farmers in efficiency interval 0.81-1.00 while only 9.2% of the non-credit users were also in this efficiency interval.

The 71.05% mean allocative efficiency found in this study was greater than 44% mean allocative efficiency reported by Bravo-Ureta and Antonio (1997) for a sample of peasant farmers in Dominican Republic. In addition, the average economic efficiency level of 42.16% reported in this study is higher than 31% average economic efficiency found in Bravo-Ureta and Pinheiro (1994) and 29% reported by Hussain (1989).

Table 2: Data Envelopment Analysis for Production Efficiency for poultry egg farmers in Ogun State

	Credit Users		**Non credit Users**	
	Freq	**%**	**Freq**	**%**
Technical efficiency				
≤0.2	0	0	8	10.5
0.21-0.40	11	25	17	22.4
0.41-0.60	10	22.7	15	19.7
0.61-0.80	6	13.6	11	14.5
0.81-1.0	17	38.6	25	32.9
Mean	0.6593		0.6078	
Minimum	10		0.10	
Maximum	1.0		1.00	
Allocative efficiency				
≤0.2	2	4.5	4	5.3
0.21-0.40	3	6.8	13	17.1
0.41-0.60	8	18.2	9	11.8
0.61-0.80	8	18.2	11	14.5
0.81-1.0	23	52.3	39	51.3
Mean	0.7163		0.7071	
Minimum	0.12		0.08	
Maximum	1.00		1.00	
Economic efficiency				
≤0.2	7	15.9	18	23.7
0.21-0.40	15	34.1	32	42.1
0.41-0.60	7	15.9	13	17.1

0.61-0.80	7	15.9	6	7.9
0.81-1.0	8	18.2	7	9.2
Mean	0.4785		0.3887	
Minimum	0.1		0.14	
Maximum	1.00		1.00	

Source : Field Survey, 2011

2.2. Tobitregerssion analysis

Table 3 revealed factors affecting production efficiency of poultry farmers using Tobit regerssion analysis.

The result showed that occupation, educational level of the farmer and labour cost of the farmer were significant ($p<0.01$) while age was also significant ($p<0.05$). They all had a positive relationship with the technical efficiency of the farmer. This implies that most farmers were still active and technically efficient in owing to the fact that their educational level enhanced their ability in making use of information about production inputs.This agreed with the findings This agreed with the findings Onu *et al* (2000) who found that the more educated farmers are, the less technically inefficient they become.The level of education attained by a farmer not only increases his farm efficiency and productivity but also enhances his ability to understand and evaluate new production technologies (Obasi, 1991). However, experience of farmer was found to have a negative significant ($p<1.0$) relationship with technical efficiency, the more years poultry farmer gather as experience could also make them to latter be technically inefficient.

Extension contact was positively significant ($p<0.1$). This implies that the more extension agent visit farmers, allocative efficiency of poultry farmers also increases, flock size ($p<0.01$) was also positively significant, this implies that as flock size increases, the allocative efficiency of poultry farmer increases. Age and experience of poultry farmers were negatively significant at ($p<0.10$), this implies that the older a farmer becomes, the more his efficiency drops, this is similar to the findings of Ojo and Ajibefun (2000) farmers with more experience are likely to be more conservative and are therefore less willing to adopt new practices, thus making them to be allocatively inefficient. Coellic and Batase (1998) also reported negative production elasticity with respect to farming experience for farmers in his village India. However, Education, and labour cost were negatively significant at ($p<0.10$) and ($p<0.05$) which tend to make them allocatively inefficient. This is contrary to the findings of Oleke and Isinika, (2011) who reported that, educational status, sex of the farm operator and use of credit positively influences the production efficiency of commercial egg producers.

Age ($p<0.01$), Education ($p<0.01$), and credit amount ($p<0.05$) were positively significant respectively. This connotes that as age and education increase in years as well as the amount of credit used increase the economic efficiency of the poultry farmers increased. In addition labour cost, occupation, and flock size were positively significant at ($p<0.05$). This means that as more people choose poultry farming as occupation and more extension visit to the farmers with increase in their labour cost, their economic efficiency increases.

Table 3: Factors affecting production efficiency of poultry farmers in the study area

	Technical Efficiency	Allocative Efficiency	Economic Efficiency
Age	0.026759**	-0.0426741*	0.030161***
	(2.5001)	(-1.72594)	(2.8646)
Gender	0.30810	-0.05690	0.35758
	(1.2922)	(-0.24305)	(1.5116)
Occupation	0.71193***	0.15389	0.48464**
	(2.9364)	(0.66933)	(2.0848)
Extension visit	0.06897	0.12742*	0.16482**
	(0.95072)	(1.7954)	(2.3113)
Credit amount	003864*	0.000406	0.056932**
	(1.6056)	(0.0172)	(2.3689)
Experience	- 0.0259*	-0.0768*	-0.022978
	(-1.724)	(-1.68185)	(-1.5357)
Education	0.0868***	-.04809*	0.066862***
	(3.225)	(-1.8619)	(2.5713)
Labour cost	0.0001139***	-0.008377**	0.0016084***
	(3.2590)	(-2.4415)	(4.5713)
Flock size	0.001288*	0.007170***	0.0019328**
	(1.7705)	(2.6917)	(2.3756)
Constant	-2.3855	5.1783	-2.9894
Likelihood function	33.164717	23.712	75.602814
Mean square error	-0.022	0.03719	0.15438
Experience	- 0.0259*	-0.0768*	-0.022978
	(-1.724)	(-1.68185)	(-1.5357)

Figures in parenthesis are t-ratios

****: significant at 10%, **: significant at 5%, ***significant at1%.***

Source: Field survey, 2011.

IV. Conclusion and Recommendation

The study found that the cogent factors that affect the production efficiency of the respondents were educational level attained, age, gender, years of poultry farming experience, credit amount, and the number of birds stocked among other factors.

As a result of the information provided above, this study can therefore ascertain that the production efficiency of poultry egg farmers would be higher when necessary inputs that would prove their production efficiently are put in place.

V. Recommendations

Based on findings of this study, the following recommendations were advanced towards alleviating the problems being encountered by poultry farmers and increasing their production efficiency:

1. Stakeholders should organize agricultural programmes that cut across different age categories in order to allow evenly participation in poultry production.
2. Policy should be adjusted to improve the provision of agriculturalcredit to poultry egg farmers in the State.
3. Farmers should aim at increasing their flock size as increase in flock size helps increasing efficiency.

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