Journal of Agriculture and Agricultural Technology 6(1), 2015

TECHNICAL EFFICIENCY OF BROILER PRODUCTION IN EDO STATE, NIGERIA

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ABSTRACT

The technical efficiency, determinants of production and sources of inefficiency in broiler production in Edo State was investigated using stochastic frontier production function which incorporates a model for inefficiency effects. Data were generated using questionnaire from a sample of 100 broiler producers from four Local Government Areas where broiler production is predominant using the multi- stage random sampling techniques. The results show that three production factors were significant namely: foundation stock was found to be have positive effect while labour and medication were found to be have negative effect on the production output. Of the broiler farmer specific socio economic variables, level of education, location of farm, age and gender found to be the significant factor accounting for the variation in efficiency among broiler producers. The study recommends policies that will encourage local production, such as strengthening and encouraging the existing extension services in the state and provision of incentives that would encourage more broiler production.

Key words: Broiler production, Technical efficiency, Stochastic frontier, producers.

INTRODUCTION

Poultry is generally called domestic fowls which include chickens, turkeys, geese and ducks, raised primarily for the eggs and meat production which serve as food (The America heritage, 2009). Domestic birds include guinea fowl, fowl ducks, turkey (The America heritage, 2009). Poultry meat and fat possess low level of fat with favourable mix of fatty acid which provides nutritional beneficial food containing high quality protein (FAO, 2014). Poultry products serve as good source of protein and income to poultry producers. Broiler meats have up to two to three times as much polyunsaturated fat as of red meat in weight (Feinberg School, 2011). Poultry meat contains proteins of high grade, minerals and vitamins to supplement the human nourishment. Improved breed of broilers are now present with features of fast growth and high feed conversion rate (National Bank for Agriculture and Rural Development, 2014). Broiler production can serve as a main source of income for family and opportunity to employment all year round (NABARD, 2014). Remains of poultry like manure serves as high fertilizer value which can be used for increasing crop yields (NABARD, 2014).

Poultry production specifically the broiler production venture has great possibilities of improving protein supply in Nigeria due to short production period, rapid growth rate and prolificacy of the birds. Broiler enterprise offer short-period business opportunities which assist in increasing availability of meat and improving the living standard of people. Some of the problems affecting poultry productivity level in Nigeria are low rate production and inefficient utilization of inputs meaning not allocating it accurately (Onyenweaku and Effiong, 2006). Others are high cost of poultry production, low overall revenues, and high bills (Ajibefun, Ademola, and Obioma, 2000). Increase in livestock production in Nigeria is as a result of the average increase in producers rather than high usage of resources (Ezeh, Anyiro, & Chukwu, 2012), which indicates that production at present and change in supply is inadequate (Olaofe, 2004) and there is need to provide useful information that will help broiler farmers and intending farmers for sustainable production in Nigeria. Generally, farming has to use available inputs efficiently for maximum outputs. Inefficient use of available resources can seriously jeopardise and hamper food production, security and availability (Udoh and Akintola, 2008). For ideal production and guaranteeing sustainability, there is requirement for proficient use and administration of assets in poultry enterprise (Udoh and Etim, 2009).

The efficient system of creating a good is the utilization of the limited availability of resources to produce a certain amount of the product. The use of available resources to produce maximum output is a great criteria in maximum production in broiler production. Technical efficiency suggests the capacity to deliver greatest yield from a given arrangement of inputs, given the accessible innovation or technology.

The running of poultry business in Nigeria is left in the hands of few individuals party' due to the complex problems usually encountered such as finance and climatic condition among others (Alabi and Aruna, 2006). infrastructure, lack of integration, poor economic of scale, low level of technical

expertise. Efforts to promote the poultry industry include the restriction on importation of poultry products in 2003, reducing the tariff cost on day old chicks and parent stock that are imported and the president's initiative in 2002 on poultry production. These has resulted in favourable results in face of speedy growth of fast food business and increased animal protein intake. Apart from characteristics of farmer, average cost of production could be reduced by increasing the scale of production. Low average cost shows an improvement in efficiency of production and can give consumers opportunity to buy lower prices even in the event of high market competition.

The knowledge on efficiency and its determinants will help farmers to know whether they are operating optimally along their production functional frontier, this will in turn help in improving food production and welfare of the farmers. This study examined the technical factors that determine production efficiency and the sources of efficiency of broiler producers in Edo State.

Theoretical framework

Efficiency is concerned with the relative performance of the process of transforming given input into output. Technical efficiency is the ability of a firm to achieve maximum possible output with available resources (Farrell, 1957). It measures the ratio of output and the best practice to be utilized in using lesser amount of input in producing maximum output.

Following Ajibefun (2002), stochastic frontier production function can be shown with a producing unit using n inputs (X_1, X_2, ----- X_n) to produce output y. The stochastic frontier production function presumes the presence of technical inefficiency of production and is defined as:

$Y_i = f(x_i, \beta) \exp (v_i - u_i)$ i =1,2, ------, N

Where v = random error associated with random factors not under the control of the producing unit. The technical efficiency of an individual producing unit is defined in terms of the ratio of the observed output of the corresponding frontier output, given the available technology.

$TE = Y_i / Y_i^*$

$= f(x_i; \beta) \exp (v_i - u_i) / f(x_i; \beta) \exp (v_i)$

$= \exp (u_i)$

Y_i is the observed output and Y^* is the frontier output.

X_i is a vector of inputs in production while βs are parameters to be estimated, V_i is as defined earlier.

For the parametric frontier model, the Cobb-Douglas frontier model was assumed to describe the production function of the farmers on which data were obtained. The model in which the determinants of efficiency are incorporated was estimated simultaneously with the Cobb-Douglas stochastic frontier model. The model is represented as:

$\text{Ln } Y = f(x_i; \beta) \exp (v_i - u_i)$

Y, x_i, β, v_i and u_i are as defined earlier.

U_i which defines the inefficiency term is represented by:

$\mu = f(z_s)$

Where z_s are vectors of the determinants of technical efficiency.

METHODOLOGY

The study was conducted in Edo State. It is located in the south southern part of Nigeria which lies between Longitude $05^0 4^/E$ and $06^0 45^/E$ and Latitude $05^0 44^/N$ and $7^0 34^/N$. Edo State capital is Benin City. Edo State has an area mass of around 19,794km^2 and populace of about of 4,150,686 as evaluated in 2015 (UNFPA, 2015). A tropical atmosphere portrayed by two (2) seasons; the wet season which happens in the middle of April and October with a break in August and the dry season last from November to January. The normal precipitation ranges from 150cm in the great north of the state to around 250cm in the south (Edo people forum, 2010). The atmosphere is muggy tropical in the South and sub-moist in the North.

Sampling procedure: A multi-stage sampling method was utilized to select 100 broiler producers. First, four Local Government Areas were purposively chosen according to highest rate of poultry participation. The Local Government Areas were Ovia-North East, Orhionmwan, Oredo and Uhunmwonde. From total sample frame of 108, sample size of 100 was selected, out of sample frame of 27 in Ovia-North East, a total sample size of 25 was selected; 23 out of 25 was selected in Orhionmwan; 23 out of 25 was selected in Uhunmwonde and 29 out of 31 was selected in Oredo. The second stage involved choosing five (5) towns from each of the four (4) Local Government Areas making it a total of twenty (20) towns. The aggregate number of producers chosen in each LGA were chosen base on the quantity of registered broiler producers in the study region. Data were collected from broiler producers using structured questionnaire and oral interview. Data were collected on the socio economic characteristics of the producers, the inputs, output and the price of the broiler producers.

Analytical

The stochastic frontier production function used by Onu *et al.*, (2000) and Parikh and Shah (1994), which in turn derive from the composed error model of Aigner, Lovell and Schmidt (1977), was used in the analysis of data. The empirical stochastic frontier production model that was used to analyse the data is specified as follows:

$$In\ Y_i = \beta_0 + \beta_1\ In\ X_1i + \beta_2\ In\ X_2i + \beta_3\ In\ X_3i + \beta_4\ In\ X_4i + \beta_5\ In\ X_5i + \beta_6 + V_i - B_i \ldots.(6)$$

Where subscripts i_j refers to the jth observation of the ith farmer.

ln = Logarithm to base e,

Where

Y= Birds (matured)

X_1 = Labour Mandays (Family labour/3 months) and Non-family labour (3 months)

X_2 = Feed and feed supplements (kg)

X_3 = Foundation stock (Number of day old chicks)

X_4 = Medication (litre)

X_5 = Fixed inputs (number)

It is assumed that the inefficiency effects are independently distributed and U_{ji} arises by truncation (at zero) of the normal distribution with the mean U_{ij} is specified as:

$$U_i = б_0 + б_1 D_1 + б_1\ In\ Z_{1i} + б_2\ In\ Z_{2i} + б_3\ In\ Z_{3i} + б_4\ In\ Z_{4i} + б_5\ In\ Z_{5i} + б_6\ In\ Z_{6i} \ldots.(7)$$

Where U_i = technical efficiency of the i-th farmer

Z_1 = Credit access (₦)

Z_2 = Age of farmers (Years)

Z_3 = Level of education of the farmers (Years)

Z_4 = Membership of farmers association/cooperatives (Dummy: 1= If a farmer belongs to a association/ cooperative, 0= if a farmer do not belong to a /association /cooperative)

Z_5 = contact with extension agents (Dummy: 1= if a farmer do have contact with extension agants, 0= if a farmer do not have contact with an extension agent)

Z_6 = Gender of the farmer (Male = 1, Female = 0)

Z_7 = Location of Farm (1 = urban, 0 = rural)

Z_8 = Farming Experience (years)

Z_9 = Household size

While $б_0, б_1, б_2 \ldots\ldots\ldots б_9$ are the parameters to be estimated.

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

RESULTS AND DISCUSSION

Socio-economic characteristics of the Respondents

Majority of the broiler producers were male, married, had average age of 44 years, household size of 6 and attained secondary education. Average number of birds raised was 173. Mean years of farming experience was 11 years and more of family labour was used. The mean income from broiler production was ₦ 177226.12.

Stochastic Frontier Estimation

The frontier function was estimated using Maximum Likelihood Estimation approach (MLE) through the FRONTIER 4.1 programme developed and licensed by Coelli (1994). The results are given in table 1.

Table 1 show the maximum likelihood parameter estimates of Stochastic frontier production function of broiler producers in the study area. Results in the table show that coefficient of total variance (δ^2) is 31230.86 while the variance ratio (γ) is 0.960. This indicates a good fit and the correctness of the specified distributional assumption of the composite error term.

One production factors (Foundation stock) is significant at 1% level, two production factor (Labour and Medication) were significant at 5% level. The estimated coefficient of foundation cost is positive (1.462) and implies that every one percent increase in foundation stock would lead to 1.462% increase in the value of broiler produced. This is consonance with Effiong (2005) and Nwachukwu and Onyenweaku (2007) that the larger the stock size, the less inefficient a farmer becomes.

The estimated coefficient of labour is negative (-0.691) and it implies that every one percent increase in labour would lead to -0.691% decrease in the value of broiler produced. The estimated coefficient of medication is negative (-1.844) and it implies that every one percent increase in medication would lead to -1.844% decrease in the value of broiler produced.

The result of analysis shows that gender and location of farm are statistically significant at 5% level while age and level of education are statistically significant at 10% level. This implies that increase in level of education and location of farm will increase their technical efficiency in the study area. This result agrees with Adedeji (2013), Udoh and Etim (2009) and contrary to Ashagidigbi *et al.*(2011). Increase in the age and gender will lead to decrease in the technical efficiency in the study area. This result agrees with the findings of Ashagidigbi *et al.*(2011).

Table 1: Maximum Likelihood of the Determinant of Technical Efficiency of Broiler production in Edo State, 2015.

Variables	Parameter	Coefficient	t-ratio
Constant	$\beta 0$	53.304	7.427
Labour(family and hired) (X1)	$\beta 1$	-0.691	-4.135***
Feed (X2)	$\beta 2$	-0.071	-0.467
Foundation stock (X3)	$\beta 3$	1.462	44.271***
Medication cost(X4)	$\beta 4$	-0.844	-2.930**
Fixed input (X5)	$\beta 5$	-0.0248	-0.159
Constant	Z_0	0.215	0.214
Credit access	Z_1	0.978	0.911
Age	Z_2	-0.930	-1.989*
Level of education	Z_3	1.828	1.582*
Member of farm association	Z_4	0.689	0.659
Contact with extension agent	Z_5	0.444	0.435
Gender of the farmer	Z_6	-16.34	-2.744**
Location of farm	Z_7	9.572	2.330**
Farming experience	Z_8	0.238	0.236
Household size	Z_9	-0.159	-0.158
Diagnosis statistics			
Total variance	δ_2	31230.86	3116.838
Variance ratio	γ	0.960	70.000
L R Test		92.216	
Log likelihood function		-458.663	

*** = connotes statistically significant at (1%), ** = connotes statistically significant at (5%)
* = connotes statistically significant at (10%)

Source: Output of FRONTIER 4.1

Table 2: Distribution of respondents according to the Technical efficiency of Broiler production

TE Range	Frequency	Percentage %
0.00 – 0.20	5	5
0.21 – 0.40	3	3
0.41 – 0.60	2	2
0.61 – 0.80	3	3
0.81 – 1.00	87	87
Total	100	100
Mean Technical Efficiency	0.88	
Maximum Technical Efficiency	1.00	
Minimum Technical Efficiency	0.11	

Source: Derived from output of computer programme, FRONTIER (Version 4.1)

The frequency distribution of technical efficiency of broiler producers is shown in table 2. About 90% of Broiler producers in the study area have efficiency indices above average (0.50), the Frontier broiler farmers therefore are more or less output maximizers while the non-frontier broiler farmers represent only 10%. The average technical efficiency score is 0.88 on average farmer can expand their output by 14% ((1/0.88) – 1) * 100) if the farmers were to attain technical efficiency of one. This implies that the farmers can increase their input by 14% by using the existing inputs better.

CONCLUSION AND POLICY RECOMMENDATION

The study has shown that broiler production in the study were technically efficient but there exist opportunities for improving efficiency by the farmers. Level of education and location of farm have positive and significant impact or influence on the technical efficiency which indicates that increasing the variable will lead to increase in technical efficiency. Policies to encourage local

production of poultry should be implemented by all the agencies concerned, Agricultural agencies as a form of incentives to broiler farmers should subsidize the input item such as day old chick, vaccines, feed, labour so as to reduce the cost of production.

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