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RESEARCH ARTICLE

COMPARATIVE ANALYSIS OF ECONOMIC EFFICIENCY OF BROILER AND EGG PRODUCTION ENTERPRISES IN NIGER STATE, NIGERIA

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ABSTRACT

The study examines the profitability and efficiency of broiler and egg production enterprises in Niger State, Nigeria during the 2011 production season. Farm level data were collected from 120 broiler and 120 layer farmers in the State using a well structured questionnaire. Multi-stage random sampling technique was used to elicit primary data from 240 respondents. The stochastic frontier profit function was used to examine the economic efficiencies of broiler and layer farms. Both broiler and layer farmers are not fully economically efficient. The mean economic efficiencies of broiler and egg enterprises are 0.52 and 0.75 respectively. This implies that there is a wide scope for increasing farm profit by reallocating the existing resources more optimally. Access to credit was found to increase economic efficiency of broiler enterprise (-0.1893) but decrease economic efficiency in egg enterprise (0.4922). The result also shows that the coefficient of membership of cooperative (-0.4320) increases economic efficiency in egg production enterprise while household size (0.0661) reduces economic efficiency. Therefore the study recommends that credit should be made available at terms and times convenient to farmers to enhance their level of efficiency. Farmers should also form cooperative societies to enable them have access to productive inputs to aid large scale operation. Extension services should be improved and intensified to impact economic knowledge on farmers. This should include creating awareness for the women farmers to know the profit potentials of broiler farming so that they could be encouraged to undertake the enterprises.

INTRODUCTION

Poultry is a collective term for all *Avian* species nutritionally and economically useful to man (Okoli, 2006). The most important poultry species remains the domestic fowl commonly called chickens, not only because of its universal availability but also because it provides important highly relished human foods. The other domestic *avian* species classed under poultry include turkey, duck, guinea fowl, goose and pigeon. According to Chukwuji *et al.* (2006), poultry production is attractive, because, birds are able to adapt easily, have high economic value, rapid generation time and high rate of productivity that can result in production of meat within eight weeks and first egg within 18 weeks of first chick being hatched. He further stressed that poultry is an important source of animal protein, income, employment, industrial raw materials, manure, financial security etc. Poultry production has indeed become a leader in the livestock industry both in advanced management and technology. Effiong (2004) posited that it is important to emphasize that farm production which is an organization of resources to produce output involves different operations with varying technical and managerial requirements. Livestock production could be significantly boosted through improved efficiency of farms by utilizing resources as well as introducing improved technology. Efficiency is concerned with the relative performance of the processes used in transforming given inputs into outputs (Ohajianya and Onyenweaku, 2001). Production efficiency means attainment of production goal without waste (Ajibefun and Daramola, 2003). In essence, the efficient utilization of resources in the production process implies optimal productivity of resources. Economic theory identifies three types of production efficiency namely, allocative, technical and economic efficiencies. Farmers in Nigeria need to improve the efficiency in poultry production so that output could be raised to meet the growing demand, (Ojo, 2003). An increase in efficiency would lead to an improvement in the welfare of farmers and consequently, a reduction in their poverty level and food insecurity (Effiong, 2004). Researchers and other stakeholders in the livestock sub-sector concerned about increasing animal protein through efficient resource use and utilization should seek ways or solutions compatible or that will agree with the socio-cultural and economic make up of the people. The poultry industry has become a diverse industry

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with a variety of business interests such as egg production, broiler production, hatchery and poultry equipment business (Amos, 2006). The demand and supply gap for animal protein intake is high (Olagunju, 2007). The Food and Agricultural Organization (FAO) recommends that the minimum intake of protein by an average person should be 65gm per day, out of which 26g, (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 cry from the FAO minimum recommendation (Niang, and Jubrin 2001). Further lending credence to this, Gona (2009) affirmed that the internal supply of livestock products is in such insufficient quantities that importations are made officially and unofficially annually (Gona, 2009). In spite of these importations however, the total supply of livestock products still fall short of the overall demand. In some cases, the domestic production and importations are together still not enough to meet more than 60% of the actual domestic demand (Mbanasor and Nwosu, 2000). However, the sub-sector is undergoing massive transformation fueled by high demand for meat, which is likely to double in the near future (Gona, 2009). The major forces behind this, is the combination of population growth, urbanization and income growth.

Poultry meat and egg offer considerable potential for bridging the nutritional gap in view of the fact that high yielding exotic poultry are easily adaptable to our environment and the technology of production is relatively simple with returns on investment appreciably high. Animal scientists, economists and policy makers are of the opinion that the development of the livestock industry is one of the options for bridging the generally known deficiency gap in Nigerians' diets (Mbanasor and Nwosu 1998). Against the back drop that there is dearth of information on the efficiency in resource use for the emterprises in the study area, this study sought to compare the economic efficiency of broiler and layer production enterprises in the study area from the broad perspective. The specific objectives were to examine the determinants of economic efficiency in broiler and layer production as well as compare the economic efficiencies of the two enterprises in the study area.

Hypotheses

The following hypotheses were formulated for further proof:

- Broiler and layer farmers are fully economically efficient in their production activities.
- There is no significant difference in the economic efficiencies of the two groups of farmers.

Theoretical Framework on Stochastic Frontier Production and Profit Functions

The stochastic production frontier models proposed by Aigner *et al*. (1977) were used in this study. Considering a farmer using inputs X_1, X_2 ,..., X_n to produce output Y, efficient transformation of inputs into output is characterized by the production function f(X) which shows the maximum output obtainable from various input vectors. This approach is favoured, because, it accounts for the presence of measurement error in the specification and estimation of the frontier production function, in that, the former consists of two error terms.

The stochastic frontier production function is defined as:

$$Y_i = f(x_i, \beta) \exp(V_i - U_i),\ i = 1,2\ldots n \qquad \ldots\ldots\ldots\ldots(1)$$

Where;

Y_i = production of the i^{th} farm

X_i = vector of input quantities of the i^{th} farm
β = vector of unknown parameters of the i^{th} farm
V_i = random errors associated with random factors not under the control of farmers e.g weather and diseases
U_i = inefficiency effects (one-sided error with $U \geq 0$) i.e. $U_{i's}$ are non- negative associated with technical inefficiency in production.
$V_i - U_i$ = composite error term

The model simultaneously estimates the individual technical efficiency of respondents as well as determinants of technical efficiency. The estimation of stochastic frontier production makes it possible to find out whether the deviation in technical efficiencies from the frontier output is due to firm specific factors or due to external random factors. It provides estimates for the technical efficiency by specifying composite error formulations to the conventional production functions (Coelli, 1995; Battesse and Coelli, 1995). In this context, technical efficiency of an individual farmer is defined as the ratio of the observed output to the corresponding frontier output, conditional on the levels of inputs used by the farmer. The technical efficiency of farmer (i) in the context of the stochastic production function in equation (1) is given as:

$$TE = Yi/Yi^* \qquad \ldots\ldots\ldots\ldots\ (2)$$

$$= f(X_i; \beta) \exp(V_i - U_i)/f(X_i; \beta) \exp(V_i) \qquad \ldots\ldots\ldots\ldots(3)$$

Where: Yi = Observed value of output, Yi* = Frontier output (or potential output and other variables are as previously defined.

Note that the value of technical efficiency lies between zero and one. The most efficient farm will have value of one whereas the less efficient farm will have their efficiencies lying between zero and one. The parameters of the stochastic frontier production function model were estimated by the method of maximum likelihood using the computer program Frontier version 4.1(Coelli, 1994). A profit function relates maximum profits to the prices of product(s) and input(s) as to other exogenous variables such as fixed inputs or agro-climatic and social variables. The parameters of profit function contain all the information about the underlying production functions. It is more convenient to start model building from the profit function side. More so, some of the independent variables may be so highly correlated as to cause multicolinearity when a production function approach is used but of least significant when profit function approach is employed. It is quite difficult to derive the input demand and product supply functions from the fitted production function. On the contrary, the use of Shepherd's lemma, helps in obtaining such estimations with relative ease when a profit function approach is used, because, it is virtually difficult to mix up endogenous and exogenous variables compared to say the cost function approach. But under certain conditions, a profit or cost function corresponds uniquely to a given production function. Fraser and Graham (2005) emphasized that the duality theory contributes immensely in providing a richer specification of production relationships than the traditionally popular production functions. (e.g. the Cobb-Douglas and Constant Elasticity of Substitution (CES) functions).

Derivation of a Profit Function from a Production Function

Let there be a production function where m variable inputs, $X_1, X_2, \ldots, Xm$ and n fixed inputs. $Z_1, Z_2 \ldots Z_n$ are related to output Y. ie.

$$Y = f(X_1, X_2 \ldots Xm; Z_1, Z_2, \ldots Z_n) \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

In the short run, the opportunity cost of fixed inputs is zero. The producer needs only to maximize the returns to variable inputs called variable costs. In essence, the resulting returns or variable profits (π') to fixed inputs in respect of the production function in equation (4) can be written thus:

$$\pi' = P_y.f(X_1, X_2 \ldots X^*m; Z_1, Z_2 \ldots Zn) - \sum_{i=1}^{m} P_i X_i^* \quad \ldots\ldots\ldots(5)$$

Where:

P_y = output price, P_i = per unit price of the i^{th} variable input and i = 1,2,….m.

For maximization of profit (π') in the short run, we take the first partial derivative with respect to the variable inputs and equate them to zero each in turn. Thus, the partial derivative with respect to X_i, i=1, 2,...,m from equation(5) is given by:

$$\frac{\partial \pi'}{\partial X_i} = P_y fi = P_i \quad \ldots\ldots\ldots\ldots\ldots (6)$$

Where; fi denotes the first partial derivative with respect to the i^{th} input. Since from equation (5), $f(X_1, X_2, \ldots, Xm)$ is equal to Y, equation (6) can thus be written as:

$$Py \,.\, \partial y/\partial xi = Pi \text{ or } \partial y/\partial Xi = P^i/py,\ i=1,2,\ldots,m. \quad \ldots\ldots\ldots (7)$$

There would thus be "m" simultaneous equations in "m" unknowns which can be solved to obtain the optimum input quantities.

X_i^*, where i = 1,2, …………m given by:

$$X_i^* = X_i^*(Py, P_1, P_2, \ldots\ldots, Pm; Z_1, Z_2 \ldots\ldots, Zn) \quad \ldots\ldots(8)$$

Equation (8) thus gives the demand function for the i^{th} variable input. Substituting the demand function given by equation (8) in equation (7);

$$\pi'^* = Py.f(X_1^*, X_2^*, \ldots, X^*m; Z1, Z_2, \ldots, Z_n) - \sum_{i=1}^{m} P_1 X_1^* \quad \ldots(9)$$

Where:

$X_1^*(i=1,2,\ldots,m)$ = is the optimum quantity of the i^{th} variable input and π'^*= corresponds to the amount of maximum variable profits.

In essence, π'^* in equation (9) is expressed as a function of the prices of output and variable inputs and the fixed input quantities which is the profit function.

Thus:

$$\pi'^* = \pi'^*(Py, P_1, P_2 \ldots Pm; Z_1, Z_1 \ldots Zn) \quad \ldots\ldots\ldots (10)$$

In this study, a modified form of this function called the normalized profit function which has proved handier from the theoretical and econometric point of view as it reduces the number of explanatory variables to one and provides a wider choice of the functional form was adopted.

Normalized Profit Function

The normalized profit function is related to relative input prices unlike the profit function which is related to the actual prices of inputs and price of the output, thus, equation (4) is transformed into:

$$\pi/P_y = \pi' = f(X_1, X_2 \ldots, Xm; Z_1, Z_2 \ldots Z_n) - 1/P_y \sum_{i=1}^{m} P_i X_i \quad \ldots (11)$$

If r_i is substituted for P_i/P_y,i=1,2,…,m, then (eqn. 11) can be written as:

$$\pi/Py = \pi' = f(X_1, X_2 \ldots Xm; Z_1, Z_2 \ldots Zn) - \sum_{i=1}^{m} r_i X_i \quad \ldots\ldots\ldots(12)$$

Note that profit (π') in equation (11) and (12) is the normalized profit which is related to input prices unlike the profit function which is related to the actual prices of inputs and the price of the output. We can as well obtain the variable factor demand equations from equation (11) where relative prices are used. Such demand equations when substituted in equation (11) results in the normalized profit function as follows;

$$\pi^* = \pi^*(r_1, r_2, \ldots rm, Z_1, Z_2, \ldots, Zn) \quad \ldots\ldots\ldots\ldots (13)$$

MATERIALS AND METHODS

Study Area

The study was conducted in Niger state. The state is located between latitudes 8°11′N and 11° 20′ N and longitudes 4° 30′E and 7° 20′E. It is bordered on the north-east by Kaduna state and on the South-east by the Federal Capital Territory, Abuja. It is also bordered on the North, West, South West and South by Zamfara, Kebbi, Kogi and Kwara States respectively. It shares a foreign border with the Republic of Benin in the North West. The state covers an estimated land mass of 86,000 Square Kilometers (about 10% of Nigeria's total land mass) of which 85% is arable land, (Aiyedun, 1989). The population of the state according to the 2006 National Census was 3,950,249, persons (National Population Commission (NPC), 2006). The state experiences distinct dry and wet seasons, with the annual rainfall varying from 1100mm in the northern parts lasting for about 120 days. In the southern parts, annual rainfall is about 1600mm lasting for about 150 days. The maximum temperature (usually not more than 44°C) is recorded between March and June, while the minimum is between November and January during the dry harmattan season, Niger State Agricultural Development Project (NSADP), (1998). The state possesses fertile land as a cherished asset. Majority of the state populace (85%) are farmers while others constituting about 15% of the total population are involved in vocations such as white collar jobs, business, craft and arts.

Sampling Technique

The study was based on primary data elicited from respondents using structured questionnaire administered to broiler and egg producers. The multistage random sampling technique was used in the selection of respondents. The three agricultural zones of the state which reflect the demarcation structure were covered. In the first stage, two Local Government Areas (LGAs) were purposively selected based on the preponderance of poultry production activities from each of the zones. The second stage involves the choosing 2 poultry producing villages, giving a total of 12 villages. In the third stage, twenty (20) poultry producers (10 broiler and 10 layer producers) were randomly selected from each of the 12 villages. This gave a total of 120 broiler and 120 egg producers respectively. Overall, primary data were elicited from a total of two hundred and forty (240) poultry farmers for a detailed study. Well trained enumerators as well as agricultural extension agents residing in each of the villages in the study area assisted the researcher in data collection.

Methods of Data Analysis

The stochastic frontier normalized profit function was used in the analysis of data. It was used to empirically determine the economic efficiency in resource utilization of the broiler and layer enterprises respectively.

Empirical Model for Economic Efficiency in Broiler Enterprise

Following Effiong, (2004), the stochastic frontier normalized profit function model used is explicitly specified as:

$$In\pi^*B = In\beta_o^* + \beta_1^* Inq_1 + \beta_2^* Inq_2 + \beta_3^* Inq_3 + \beta_4^* Inq_4 + \beta_5^* Inq_5 + \beta_6^* Inq_6 + \beta_7^* Inq_7 + \beta_8^* Inq_8 + V_i - U_i \text{ .... } (14)$$

Where,

π^*_B = Normalized profit (in ₦ per broiler enterprise)
q_1 = Normalized price of family labour, (₦/manday)
q_2 = Normalized price of hired labour, (₦/manday)
q_3 = Normalized price of feed and feed supplements in (₦)
q_4 = Normalized price of veterinary and medical services (₦)
q_5 = Normalized price of capital inputs (₦)
q_6 = Normalized price of foundation stock (day old chicks purchase) (₦)
q_7 = Farm size (No. of birds)
q_8 = Annual depreciation on durable capital items (₦)

V_i = Normal random errors which are assumed to be independent and identically distributed having N $\{0,\delta^2\}$.
U_i = Non-negative random variables associated with the technical inefficiency of the entrepreneur.

It is assumed that the technical efficiency effects are independently distributed and arise by truncation at (zero) of the normal distribution with mean U_i and variance δ^2, where U_i (for this and the subsequent models) is specified as:

$$U_i = \delta_o + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 Z_{6i} + \delta_7 Z_{7i} + \delta_8 Z_{8i} \text{ …}(15)$$

Where;

U_i =Technical inefficiency of the i^{th} farmer
Z_1 = Age of farmer (years)
Z_2 = Level of education (No. of years spent in school)
Z_3 = Farming experience (years)
Z_4 = Household size (No.)
Z_5 = Extension contact (No.)
Z_6 = Credit status (Dummy variable, 1 for access, zero otherwise)
Z_7 = Membership of cooperative (1 for membership, zero otherwise)
Z_8 = Sex (binary variable, Male = 1, female = 2)

The above model was incorporated in the frontier model in determining the economic inefficiency of broiler and egg production enterprises respectively. This was done with the belief that the variables have direct influence on the level of efficiency (Battesse *et al.* 1993 and Kalirajan and Shand, 1994).

Empirical Model for Economic Efficiency in Egg Production Enterprise

The empirical model for the layer enterprise is specified as:

$$In\pi^*E = In\beta_o^* + \beta_1^* Inq1 + \beta_2^* Inq2 + \beta_3^* Inq3 + \beta_4^* Inq4 + \beta_5^* Inq5 + \beta_6^* Inq6 + \beta_7^* Inq7 + \beta_8^* Inq8 + Vi - Ui \text{ …….. } (16)$$

Where,

$In\pi^*_E$ = Normalized profit of egg production enterprise. All other variables are as previously defined. The use of a single equation is justified by the assumption that farmers maximized expected profits as it is often assumed in similar studies (Idiong, 2005).

Tests of Hypotheses

A generalized likelihood ratio (LR) test was carried out to test the hypothesis that broiler and egg farmers are fully economically efficient. The test statistic is defined as follows:

$$LR(\lambda) = -2\,[L(H_o) - L(H_1)] \qquad \text{……….} (17)$$

Where $L(H_o)$ is the value of the log-likelihood function of the average function as specified by the null hypothesis and $L(H_1)$ is the value of the log likelihood function of the frontier function. The test statistic LR (λ) has a χ^2 distribution which has a degree of freedom equal to q+1 where q is equal to the number of parameters involved in H_o and H_1 respectively (Dey *et al*. 2000). The null hypothesis is rejected when the test statistic (λ) is greater than the critical X^2 value at the 5 percent level. The critical values of the full efficiency were obtained from the table cited in Dey *et al.* (2000) and Idiong (2005). To examine if significant difference exist in the efficiency indices of broiler and egg production in the area, a Z-test was carried out. The formula is as stated below:

$$Z_{cal} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_2^2}{n_2}}} \quad \text{…….. (18)}$$

Where,

$\bar{x}_1$ = the mean economic efficiency indices of broiler production in the study area.
$\bar{x}_2$= the mean economic efficiency indices of layer production in the study area.
δ_1^2 = standard deviation of economic efficiency indices of broiler producing farmers.
δ_2^2= standard deviation of economic efficiency indices of egg producing farmers.
n_1 = the number of broiler farmers
n_2 = the number of egg farmers.

RESULTS AND DISCUSSION

Summary Statistics of Production Factors

A typical respondent sampled was male, married and had completed primary level of education, had four members in his/her household with eight years experience in the business. The summary statistics of input utilized and outputs realized are presented in Table 1.

Table1. Summary Statistics of Output and Inputs in Broiler and Egg Production enterprises

	Broiler			Egg		
Variable	mean	Min	Max	Mean	min	Max
Output	343.59	42.90	2852.00	2637.17	344.00	14318.00
Hired Lab	45.28	0.00	216.00	89.13	0.00	341.00
Family Lab	68.08	0.00	260.00	162.27	0.00	379.00
Feeds	83.57	40.00	112.00	88.23	72.00	100.00
Vet Serv	4379.75	0.00	31000.00	5208.92	1400.00	27800.00
Birds	45582.08	4800.00	255000.00	55741.67	12500.00	270000.00
Transport	3244.75	0.00	18700.00	2995.50	0.00	16700.00
Capital	8843.75	0.00	62350.00	11954.86	310.00	78450.00

Source: survey data, 2011.

Results showed that a typical broiler farmer produced an output of 343.59kg per production cycle. A typical farmer also utilized hired labour of 45.28 mandays; family labour 68.08 mandays, feeds ₦83.57/kg, incurred expenses on veterinary services in the sum of ₦4,379.75, cost of foundation stock ₦45,582.08, cost of transportation ₦3244.75 and capital input cost of ₦8,843.75. For the egg enterprise, a representative farmer produced an average of 2,637.17 crates of egg utilizing 89.13 mandays of hired labour, 162.7 Mandays of family labour, 88.23kg of feeds, expended ₦5,208.92 on veterinary service and medication, ₦55,741.67 on purchase of foundation stock, ₦2,995.50 on transportation and ₦11,954.86 on capital inputs per production cycle. The results showed that for each of the inputs, the average used in production is more for the layer enterprise as compared to the broiler enterprise. This is due to the long production cycle in layer enterprise.

Empirical results of the economic efficiency for the production factors

Table 2 shows the results of stochastic frontier normalized profit function for the economic efficiency of broiler and egg production enterprises respectively. The estimates of sigma-squared (σ^2) for broiler and layer functions are 4.6060 and 4.3723 respectively. They are significant at the 0.01 probability levels indicating that they are significantly different from zero. It assures us of the goodness-of-fit as well as the correctness of the specified distributional assumptions of the composite error term. The value of the gamma (γ) for broiler and layer is as high as 0.9999 and 0.9866 respectively and showed that the unexplained variation in output of broiler and layer birds is the major sources of random errors. It also indicates that about 90 percent of the variation in output of broiler and layer is caused by inefficiency of the producers. This result confirms the presence of the one-sided error-component in the model and hence makes the use of Ordinary Least Square (OLS) inadequate in estimating the production function.

The result indicates that in broiler enterprise, the MLE estimate of normalized price of family labour is -0.0223 and statistically insignificant. While that of egg farmers is 0.1206 and significant at 1% level. This implies that a 1% increase in the use of family labour will result in a 0.1206% increase in the level of profit. The MLE estimate of the normalized price of hired labour of broiler enterprise is 0.0264 and is significant at the 0.01 probability level. In egg enterprise, the value is 0.1158 and is also significant at the 0.01 probability level. This implies that if labour employment is increase by 1% profit will increase by 0.0264% in broiler and by 0.1158% in layer enterprises holding other variables constant. The coefficient of normalized price of feeds in egg enterprise is 0.1207 and significant at 5% level. This implies that if feed is increased by 1%, output will increase by 0.1207% holding other variables constant. The MLE estimate for normalized price of capital inputs in broiler is 0.2394 and statistically significant at the 5% level. This shows that increased capital investment by 1% could lead to an increase in the level of profit by 0.2394% holding other variables constant. For the egg enterprise, the value of the coefficient is 0.2265 and is significant at the 1% level. It implies that if the use of capital inputs is increased by 1%, profit will increase by 0.2265% holding other variables constant. The normalized price of foundation stock is 0.3127 and statistically significant at the 5% level. This implies that a 1% increase in stock of birds will lead to 0.3127% increase in

Table 2. Maximum Likelihood Estimates of parameters of the stochastic frontier production function for the measurement of economic efficiency

		Broiler	Egg
Variables	Parameters	Coefficient	Coefficient
Constant	β_0	-0.5268(-0.6878)	-1.2255(-2.3825)
Normalized price of family labour	β_1	-0.0223(-0.3546)	0.1206(3.0205)***
Normalized price of hired labour	β_2	0.0264(4.3655)***	0.1158(2.7377)***
Normalized price of feeds	β_3	-0.0702(-0.6936)	0.1207(2.1115)**
Normalized price of medication	β_4	-0.1885(-1.5448)	0.0343(0.6841)
Normalized price of capital inputs	β_5	0.2394(2.4180)**	0.2265(2.6301)***
Normalized price of stock	β_6	0.3127(2.0837)**	0.2222(3.8060)***
Farm size	β_7	0.0860(0.5975)	0.5360(6.1293)***
Annual depreciation	β_8	00.1728(2.3310)**	-0.1549(-1.8209)*
Diagnostic statistics			
Log-likelihood function		-182.3379	-34.9286
Sigma squared (σ^2)		4.6060(21.3082)**	1.1254(4.3723)***
Gamma (γ)		0.9999(2819)***	0.9866(122.9109)***
L-R test		12.3898	74.1825

Source: Survey analysis, 2011/ computed from Frontier 4.1 version
Note: ***, **, and * implies statistical significance at the 0.01, 0.05 and 0.10 probability levels respectively.
Values in parenthesis are the t-ratio.

profit holding other variables constant. In the case of layer enterprise, the estimate for the stock of birds was 0.2222 and significant at 1% level implying that profit will increase by 0.2222% if the stock of birds is increased by 1% holding other variables constant. The coefficient of farm size is positive in both enterprises but significant only for the layer enterprise. A coefficient of 0.5360 and significant at the 1% level implies that if farm size is increased by 1%, profit will increase by 0.5360 holding other variables constant. In broiler, the coefficient of annual depreciation on durable capital items is 0.1728 and significant at the 5% level. This implies that a 1% increase in the purchase and use durable capital items will result in 0.1728% increase in profits in broiler enterprise in the study area holding other variables constant. For layer enterprise, the coefficient of -0.1549 and significant at 10% level implies that a 1% increase in the use of durable capital items will lead to a decrease of in profit by 0.1549% for the egg enterprise holding other variables constant. Tijani *et al.* (2006) in the study of profit efficiency among poultry egg farmers in Nigeria reported the significance of labour and farm size on output. They however found that labour reduced profit.

Determinants of economic inefficiency

The result of the determinants of economic efficiency is presented in Table 3. The results indicated that in broiler enterprise, level of education (Z_2) is positive and statistically significant at the 5% level. This implies that as the number of years spent in school increases, economic inefficiency in broiler business reduces.

Credit status (Z_6) was found to be negative and significant at the 0.10 probability level in broiler enterprise but positive and significant at the 0.01 probability level for the layer enterprise. This indicates that access to credit, reduced economic inefficiency in broiler, but increased economic inefficiency in egg production enterprises respectively. Age of farmer (Z_1) was found to be negative and significant in egg production enterprise. This implies that as the age of farmer increases economic inefficiency in egg production increases. Household size (Z_4) was found to be positive in both broiler and egg production enterprises but significant only in egg production enterprise at the 1% level. This signifies that the higher the household size, the lower the economic inefficiency of the layer production enterprise. Membership of cooperative society (Z_7) is negative in both broiler and egg production enterprises but insignificant in broiler. The coefficient is significant in layer production enterprise at the 1% level. This implies that membership of cooperative organization increases the economic inefficiency of the egg farmer in the study area.

Distribution of Economic Efficiency

The distribution of respondents according to their economic efficiency in production is shown in Table 4. The results indicated that the economic efficiency range of broiler farmers is between 0.01-0.99. The table showed the mean economic efficiency of broiler to be at 52%, the minimum economic efficiency of 0.01 and the maximum of 0.99 were obtained. The means for the best 10 and worst 10 broiler farmers are 0.05 and 0.93 respectively. This means if a typical farmer in

Table 3. Determinants of economic inefficiency for broiler and egg enterprises

		Broiler		Egg	
Variables	Parameters	Coefficient	t-ratio	Coefficient	t-ratio
Constant	δ_0	0.7105	2.0563**	0.2576	1.4617
Age of farmer	δ_1	0.0213	0.1160	-0.0369	-7.5488***
Level of education	δ_2	0.0416	1.9746**	0.0007	0.1031
Farming experience	δ_3	0.0136	2.2115**	-0.0089	-1.2813
Household size	δ_4	0.0101	0.7786	0.0661	9.1893***
Extension contact	δ_5	-0.0747	-0.8703	0.0247	1.0388
Credit status	δ_6	-0.1893	-1.8197*	0.4922	6.1584***
Membership of coop	δ_7	-0.5354	-0.9654	-0.4320	-5.0640***
Gender	δ_8	0.0176	0.9979	-0.1040	1.1829

Source: Survey analysis, 2011/ computed from Frontier 4.1 version
Note: ***, **, and * implies statistical significance at the 0.01, 0.05 and 0.10 probability levels respectively.

the sample is to achieve economic efficiency he/she would require a 48% cost saving [i.e., 1-(0.52/0.99)*100]. The worst economically inefficient farmer needs a cost saving of 95% [i.e., 1-(0.05/0.99)*100]. This means that a typical broiler farmer can increase economic efficiency by 48%. The mean economic efficiency of egg production enterprise is 75%. This average value implies that the average egg farmer could increase economic efficiency by 25% by improving their technical and allocative efficiency. The economic efficiency of egg farmers ranged from 0.01-0.96. Egg farmers have the minimum economic efficiency of 0.04 and the maximum of 0.96. The means for the best 10 and worst 10 broiler farmers are 0.24 and 0.94 respectively. This means for an average farmer in the sample to achieve the economic efficiency of its efficient counterpart, the typical farmer could realize about 25% cost saving [i.e., 1-(0.75/0.96)*100]. The worst economically inefficient farmer needs a cost saving of 79% [i.e., 1-(0.24/0.96)*100]. This means that egg producers can increase their efficiency of production by 14% if productive inputs are optimally utilized. If this increase is achieved by these farmers, they will be operating on the production frontiers. Thus, there is still need for improvement on the productivity of farmers and income through increased efficiency in the use of existing resources.

The best economically efficient farmers operated almost on the frontier, as depicted by the maximum economic efficiencies of 0.99 and 0.96 for broiler and layer enterprises respectively. However, there exist a gap between economic efficiency levels of best ten and worst ten farmers. To bridge this gap, the average best farmer needs to save 48% and 25% costs to attain to the frontier for broiler and layer enterprises respectively. This is in contrast with the findings of Tijani *et al*. (2006) who found the mean economic efficiency of egg farmers to be 84.34% and affirmed that about 15.66% of the profit is lost due to economic inefficiency.

Table 4. Frequency distribution of the range of economic efficiency

Range	Broilers		Egg	
	Number	Percentage	Number	Percentage
0.01-0.20	59	49.17	4	3.33
0.21-0.40	22	18.33	7	5.83
0.41-0.60	15	12.50	14	11.67
0.61-0.80	11	9.17	41	34.17
0.81-1.00	13	10.83	54	45.00
Total	120	100.00	120	100.00
Mean	0.52		0.75	
Minimum	0.01		0.04	
Maximum	0.99		0.96	
Mean of worst 10	0.05		0.24	
Mean of best 10	0.93		0.94	

Source: Survey analysis, 2011

Tests of hypotheses

Results in Table 5 shows, the generalized likelihood ratio test indicating the rejection of the hypothesis of full economic efficiency of broiler and layer producers since the calculated chi-square value is less than the critical value at 0.05 probability levels in each of the two scenarios. Therefore, we reject the hypothesis that broiler and layer producers are fully economically efficient and by implication, are not therefore, fully economically efficient in the use of productive resources. To test for differences in economic efficiency, results in Table 5 also shows the Z-cal value of 17.086 which is greater than the Z-critical value of 1.950 at the 0.05 probability level and 118 degrees of freedom. We hereby reject the hypothesis that the mean economic efficiency of broiler and layer farmers is the same. The two groups of farmers are not therefore operating at the same levels of economic efficiency.

Table 5. Tests of hypotheses

Category of producer		L-R test(λ)	Critical $\chi^2_{0.05}$	Decision
Hypothesis one(H_1)				
Broiler		12.3898	11.91	Reject
Layer		74.1825	11.91	Reject
Hypothesis two(H_2)				
Paired samples category	z_{cal}	Critical $z_{0.05,118\,df}$	Decision	
Economic efficiency	17.086	1.950	Reject	

Source: Derived from Table 4.14 and 4.16. Critical χ^2 values were obtained from Kodde and Palm (1986) cited in Dey *et al*. (2000)
Note: H_3 is computed from field survey data, 2011

Conclusion and Recommendations

Based on the findings of this research, it is concluded that poultry farming in Niger state is of the small scale type considering the number of birds raised by broiler and egg farmers. Efforts geared towards increasing the farm size should be intensified. Low participation of women is an indication of limited access of women to inputs needed in poultry production and/or their lack of awareness on the profit potentials of poultry production. High literacy level among the respondents is an indication that poultry farmers' attitude to the adoption of technologies and skill acquisition will be positive. Poultry farmers are not economically efficient in their use of productive resources. The varied economic efficiency of broiler and egg farmer is due to the presence of inefficiency effects. The mean efficiency of layer farmers showed that they are fairly economically, while broiler farmers are less efficient. However, an important conclusion stemming from the analysis is that overall economic efficiency of poultry farms could be improved substantially. The mean economic efficiencies were shown to be higher in egg production enterprise than in broiler enterprise. Economic efficiency is negatively influenced by level of education and positively influenced by credit status of broiler farmers. For egg farmers, age of farmers and membership of cooperative contributes positively to economic efficiency while credit status reduced economic inefficiency.

This study recommends that to expand broiler farmers' scale of operation, farmers in Niger State should form cooperative societies so as to enable them have access to productive inputs that will enable them expand their resource base and consequently their scale of operation. Extension education was found to have significantly affected their levels of economic inefficiency. Extension services should therefore be improved upon and intensified to impart technical and economic knowledge to the farmers. Given the low levels of participation by the women folk, there is need to create awareness for the women farmers to know the profit potentials of broiler production so that they could be encouraged to undertake the enterprises. Years of experience was found to reduce inefficiency and invariably increase profit. This is because, it enables the farmer set realistic targets and broadens the planning horizon thereby exposing them to better production techniques which farm advisory services, training and workshops can provide. Farmers should be encouraged to promote indigenous knowledge systems in poultry production in the state.

REFERENCES

Aigner D.C., A. Lovell and P. Schmidt, (1977). Formulation and Estimation of Stochastic Frontier Production Function Models. *Journal of Econometrics,* 6:21-37

Aiyedun, K.D. (1989). Contempoary Materials Culture in Niger State, With Special Reference to Gbako and Lavun Local Government Areas: An ethno- archeological Study. Paper Presented at the 18th Annual Conference of the Archeological Association of Nigeria, Minna, Niger, June 25- July 2

Ajibefun, I.A., and A.G., Daramola (2003). Efficiency of Micro-Enterprises in Nigerian Economy; *African Economic Research Consortium* (AERC) Nairobi, Kenya. No 134.

Amos, T.T. (2006). An Analysis of Backyard Poultry Production in Ondo State, Nigeria. *International Journal of Poultry Science*, 5(3) 247-250.

Battesse, G.E. and T.J. Coelli (1995). A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data. *Empirical Economic*, 20: 325-335.

Battesse, G.E., S.J. Malik, and S. Broca (1993). Production Function for Wheat Farmers in Selected Districts of Pakistan. An Application of a Stochastic Frontier Production Function with Time Varying Inefficiency Effects. The Pak Development Review. 32, 233-268.

Chukwuji, C.O, O.E. Inoni, O.D. Ogisi and W.J. Oyaide (2006). A Quantitative Determination of Allocative Efficiency in Broiler Production in Delta State, Nigeria. *Agricultural Conspectus Scientificus* Vol. 71 (1): 21-26.

Coelli T.J. (1995). Recent Developments in Frontier Modeling and Efficiency Measurement. *Australian Journal of Agricultural Economics*. 34 (3): 219-245.

Coelli, T.J. (1994). A Guide to Frontier Version 4.1: A Computer Program for Stochastic Frontier Production and Cost Functions Estimations, Mimeo, Department of Econometrics, University of New England, Armidale.

Dey, M.M., F.J. Paraguas, G.B. Bimbao and P.B. Regaspi (2000) “Technical Efficiency of Tilapia Grow Out Pond Operations in Philipines” *Aquaculture Economics and Management*, 4(1&2)p_p 33-47

Effiong, E.O. (2004). Efficiency in Selected Livestock Enterprises in Akwa-Ibom State, Nigeria. Unpublished PhD Thesis, Michael Okpara University of Agriculture, Umudike, Nigeria.

Fraser, I. And M. Graham (2005). Efficiency Measurement Of Austrialian Dairy Farms. National and Regional Performance, Agribusiness Association of Australia, *Australasian Agribusiness Review,* Vol. 13 pp 1-15

Gona, A. (2009). Production Efficiency Among Selected Livestock Fattening Enterprises in Kebbi State, Nigeria: A Stochastic Frontier Production Function Approach. Unpublished PhD Thesis, Usmanu Danfodio University, Sokoto

Idiong, I.C. (2005). Evaluation of Technical, Allocative, and Economic Efficiencies in Rice Production in Cross River State, Nigeria. Unpublished PhD Thesis presented to the Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Kalirajan, K.P. and R.T. Shand (1994). *Economics in Disequilibrium*: An Approach From the Frontier, Macmillan India Limited, New Delhi.

Mbanassor, J.A. and A.C. Nwosu (2000). Economic Revival and Sustenance in Nigeria: The Analysis of Livestock Industry. Proceedings of Silver Anniversary Conference of NASP/WASAP Inaugural Conference, March 21-26, Nigeria Paper No. 223, p 442

National Population Commission (NPC) (2006). National Population Figures

Niang, I. and S.Jubrin (2001). Quarterly Newsletter of the Nigerian Agriculture, Questions and Answers Service. 1(3).

Niger State Agricultural Development Project (NSADP), (1998). Visitor’s Guid.

Ohajianya, D.O and C.E Onyenweaku (2001). Gender and Relative Efficiency in Rice Production System in Ebonyi State, Nigeria: A Profit Function Analysis. *Journal of Sustainable Agriculture and Environment* 3 (2); 384-392.

Ojo, S.O. (2003). Productivity and Technical Efficiency of Poultry Egg Production in Nigeria. *International Journal of Poultry Science* 2(6): 459-464.

Okoli, I.C. (2006) Technical Notes, On Animal Management and Health Issues. Tapas Institute

Olagunju F.I. (2007). Cost and Returns on Egg Production in South Western Nigeria. *Research Journal of Applied Sciences* 2(2): 160-164.

Tijani, A.A., T. Alimi, and A.T. Adesiyan (2006). Profit Efficiency among Nigerian Poultry Egg Farmers: A Case Study of Aiyedofo Farm Settlement Nigeria. *Research Journal of Agricultural Biological Sciences,* 2(6): 256-261.

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