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PROFIT EFFICIENCY IN BROILER PRODUCTION IN AKWA IBOM STATE, NIGERIA.

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ABSTRACT

The study estimated the profit efficiency and its determinants in broiler production in Akwa Ibom State of Nigeria using the stochastic frontier profit function approach. A multi- stage random sampling method was used to collect data from sixty(60) broiler farms in the study area for the production year 2004.The stochastic frontier profit function was used to analyze profit efficiency results for broiler production as well as the factors influencing efficiency levels in the study area. The analysis of data revealed that labour cost (wage rate), price of feeds/feed supplements, price of drugs /medication, capital inputs and farm size were the major factors determining profit level. Furthermore, level of education, farming experience, extension contact and gender variables were shown as major factors influencing their efficiency levels. The mean economic efficiency (MEE) is 81.0% implying that profit efficiency could be increased by 19.0% through better use of available resources.

KEYWORDS: Profit efficiency, broiler, stochastic frontier,Akwa Ibom State.

INTRODUCTION

The most pressing problem of economics is resource allocation. Sidhu et al (1998) stressed that input utilization refers to the allocation of resources such as land, labour, capital and management in its variable forms. It embraces deriving a maximum return such as profit, food calories or national income from given resource stock. Effiong (2005) emphasized that it is necessary to identify the knowledge with respect to the relationship between resources and products because it is an aid to identify problems associated with production and resource use. When these resources are judiciously utilized, farm level credit is very useful in improving resource use and efficiency. Shapiro (1994) stressed that efficiency is an aspect concerned with the utilization of resources to produce a given output rather than simply the rate at which input produces output. Farm business whether modern or traditional involves the usage of resources in producing output. The input – output process of farm production is relevant in at least four major problem areas. These include the area of income distribution, resource allocation, the relation between stocks and flows and measurement of efficiency.

Successive governments had embarked on policies and programmes aimed at boosting sustainable livestock production in Nigeria. These policies mostly centred on production of cattle, pigs, poultry and small ruminants. Most Nigerian populace are involved in livestock production either on part time or full time but unfortunately, the sector remains undeveloped as a result of low technology and lack of implementation of agricultural policies by government and its agents. Ekpenyong,(2001) Obioha (1999) reported that the distribution of agricultural production turnover in Nigeria is 88.0% for crop production and 12.0% for livestock production. Common observation indicates that rising costs of livestock feed and animal health drugs are major constraints to growth and efficiency in the broiler enterprise. Farmers in Nigeria need to improve the efficiency in livestock production so that output could be raised to meet the growing demand. In essence, 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.

This study is designed to measure profit efficiency and its determinants in broiler production in Akwa Ibom State, Nigeria using the stochastic frontier profit function approach.

Theoretical framework: Economic theory identifies three important production efficiency (Farrel, 1984)
These include allocative, technical and economic. Allocative efficiency reflects the ability of the farm to use the inputs in optimal proportions given their respective prices and the production technology. Technical efficiency is the measure of the farms success in producing maximum output from a given set of inputs. i.e ability to operate on the production frontier. (Farrel,1984)

A lot of effort has been made by eminent scholars to define economic efficiency and to measure it in an empirical sense. Farrell (1984) simply define economic efficiency as the simple product of the technical efficiency and the allocative efficiency. It is possible for a farm to have either technical or allocative efficiency without having economic efficiency. Technical and allocative efficiency are necessary conditions and when they occur together are sufficient conditions for achieving economic efficiency. In essence, perfect technical and allocative efficiency implies that the farm is maximizing profit or minimizing cost for a given level of output, (operating on the expansion path).

Globally, there is a wide body of empirical research on the profit efficiency of farmers in the developed and developing countries, (Battese and Coelli,1995). Profit efficiency however depends on market forces which in turn are influenced by the sectoral and marketing policies of the country. Ali et al (1992) however measured profit efficiency in which certain restrictions were imposed. Efficiency could be measured from a production function or a profit function approach. The profit function approach is much more helpful when individual or sole enterprises is considered as applied in the study.

Profit efficiency in this study which in a profit function framework is the ability of a farm to attain the highest possible profit, given the prices and levels of fixed factors of the farm. Empirical literatures suggest several alternative approaches to measuring profit efficiency grouped into non-parametric frontiers and parametric frontiers. Non-parametric frontiers do not impose a functional form on the production frontiers and do not make assumptions about the error term and the most popular is the Data Envelopment Analysis (DEA) while parametric frontiers impose a functional form in the production function and make assumptions about the error term. The most common functional forms include the Cobb-Douglas, Constant Elasticity of Substitution (CES) and Trans-log

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production function. Stochastic frontier profit function may be specified as follows:

$\Pi j = f(Pij, Zki) \exp(Vj - Uj)$ ------------------------------ (1)

Where Πj is the normalized profit of the jth farm defined as gross revenue less variable costs divided by the farm specific broiler price, f represents an appropriate function (e.g.Cobb-Douglas, Trans-log etc),

Pij is the price of the ith variable input faced by the jth farm divided by the price of broiler , Zkj is the level of the kth fixed factor on the jth farm; Vj is a random variable which is assumed to be N-(0, σv^2), and independent of the Uj which are non-negative random variables which are assumed to account for profit inefficiency in production and are often assumed to be N-(0, σu^2). i.e half normal distribution or have exponential distribution.

If Uj = 0, the farm lies on the profit frontier obtaining maximum profit given the prices it faces and levels of fixed factors. If Uj > 0, the farm is inefficient and looses profit because of inefficiency. The stochastic frontier model was independently proposed by Aigner, et al (1977) and Meeusen and Van den Broeck (1977).

Profit Efficiency = $\Pi/\Pi^* = f(Pij,Zkj) \exp(Vj - Uj)/ f(Pij,Zkj) \exp. Vj = \exp.(-Uj)$ ---------------------------(2)

Where:

Π is the observed profit and Π* is the frontier profit. Profit efficiency of an individual farmer is defined in terms of the ratio of the observed profit to the corresponding frontier profit given the prices and the levels of fixed factors of production of that farmer as in equation 2.Battese et al (1995)

The parameters of the stochastic frontier models are estimated using the maximum likelihood techniques, (Aigner, 1977)

MATERIALS AND METHODS

(a) The Data : The study was conducted in Akwa Ibom State, Nigeria. located in the south-south zone of the country. It comprises of thirty one (31) Local Government Areas for administrative convenience and delineated into six (6) agricultural zones. The ecological distribution favours the production of livestock such as goat, sheep, pork, fish rabbit, poultry etc. Agriculture is the major occupation of the people. A multi-stage random sampling method was used to collect data. The National population census of 1991 put the population of the state at 2,359,736 people. The sample frame of broiler farmers in the state was collected from the Ministry of Agriculture and Natural Resources, Uyo. In each agricultural zone, ten (10) broiler farms were randomly selected giving a total sample size of sixty (60) broiler farms in the state. Primary data were collected by means of structured questionnaire on the socio-economic features of the farmer and other quantitative variables of interest in terms of inputs, output and their respective prices for the year 2004 production period.

(a) **The Empirical Model**: The Cobb- Douglas stochastic frontier profit functional form was fitted for the broiler farms in the state and specified as follows:-

$$\ln \Pi j = \ln \alpha o + \sum_{i=1}^{4} \alpha i \ln Pij + \sum_{k=1}^{2} \alpha k \ln Zkj + Vj - Uj \text{ -------------(3)}$$

Where i refers to variable inputs, k refers to fixed inputs and j refers to farms respectively.

Πj is normalized profit in naira per broiler enterprise defined as gross revenue less total variable costs divided by the price of broiler;

P1j is wage rate in naira (labour cost) normalized by the price of broiler;

P2j is price of feed /feed supplements (naira), normalized by the price of broiler; P3j is the price of drugs/medication normalized by the price of broiler, P4j is the price of day old chicks normalized by the price of broiler; Z1j is farm size measured by the total number of birds housed, Z2j is capital inputs in naira including depreciation charges on machinery, equipment, implement, tools, cost of machine hire, interest charges on loan. Vj and Uj are the error terms as defined earlier while αo, αj and αk are regression parameters to be estimated

(b) Determinants of Profit Efficiency:

The model specified in (equation 4) was formulated and estimated jointly with the stochastic frontier profit model in a single stage maximum likelihood estimation procedure using the computer software frontier version 4.1 (Battese and Coelli,1995) to determine factors contributing to the observed profit efficiency.

$PEj = bo + b1x1j + b2x2j + b3x3j + b4x4j + b5x5j + b6x6j + b7x7j + b8x8j + b9x9j$ ---------------------------------- (4)

Where;

PE is profit efficiency, x1j is farmers age in years, x2j is farmers level of education measured by number of years of schooling, x3j is farming experience measured in years, x4j is membership of cooperative society, a dummy variable which takes the value of unity for members and zero otherwise, x5j is farm size measured by the total number of birds housed, x6j is access to credit, a dummy variable with value of unity for credit access and zero otherwise, x7j is number of extension visits/contacts made by the farmer in the production year, x8j is farmer's gender, a dummy variable with value of unity for male broiler farmers and zero otherwise; x9j is farmers household size measured as the number of people who are held together in the same house and compose a family while bo, b1, b2---b9 are the regression parameters to be estimated.

RESULTS AND DISCUSSION

TABLE 1. Estimated stochastic frontier profit function for broiler farm in Akwa Ibom State, Nigeria, 2004.

Production factors	Parameters	Estimated coefficients	t-ratios
Constant term	αo*	-2.367	-2.262**
Wage rate (P1)	α1*	-0.191	-2.014**
Price of feeds (P2)	α2*	-0.526	-3.815**
Price of drugs (P3)	α3*	-0.160	-4.371***
Price of day old chicks(P4)	α4*	-0.099	-0.674
Capital inputs (Z1)	β1*	0.210	2.474**
Farm size (Z2)	β2*	1.243	10.290**
Diagnostic statistics			
Log-likelihood function		-9.150	

Sigma squared (σ^2)	0.317	2.490**
LR Test	12.857	11.795***
Gamma (γ)	0.881	
Sample size (n)	60	

** = significant at 5% *** = significant at 1%

Source: computer print out of Frontier Version 4.1/ Field survey,2004.

(b) **Estimated Stochastic Frontier Profit Function:**

The estimates of the stochastic frontier profit function for broiler enterprise in Akwa Ibom State, Nigeria are presented in Table 1. It shows that all the coefficients have the expected theoretical signs and all the input prices have the theoretical expected negative signs indicating that the estimated normalized profit function is convex in input prices which hitherto implies that profit decreases with increases in input prices.

The parameter estimate of hired labour (wage rate) is –0.191 and statistically significant at 0.05 probability level. The sign of the coefficient however confirms the cost implication of hired labour to profit level of broiler farms especially in labour intensive situation. Dillion et al (1998) reported that cost of labour constitute the second largest after feed. It is therefore relevant that efficiency of labour should be as high as possible if profit is to be maximized in the enterprise.

Feed cost variable is negative and statistically significant at 0.05 probability level and conformed to a-priori expectations. Dawson (1995) stressed that feed cost is the most important single cost item associated with broiler production due to increased cost of maize, groundnut cake, soya bean meal, fish meal and scarcity of wheat and corn offals. Khan and Marki (1999) was of the view that the availability of feeds at economic prices is by far the most important condition for profitable broiler production because it constitutes more than 75 percent of the total expenditure. Ekpenyong (2001) observed that the cost of feed as a percentage of total variable cost (TVC) was 67.8% in the broiler enterprise. He noted with interest that the upward increase in feed costs lead to reduced profit margin in the broiler industry which is in line with this study. The estimated coefficient (-0.160) for price of drugs / medication is statistically significant at 0.01 probability level. Obioha (1999) found out that the cost of drugs and medication accounted for 5 - 10 percent of the total variable cost. With continuous increase in the cost of drugs, the implication is that it becomes more difficult to check the increasing mortality in broiler farming due to high and fast increasing cost of medications and veterinary services.

The estimated coefficient of capital inputs is positive and statistically significant at 0.05 probability level. These fixed cost items are the costs incurred in the use of such fixed assets such as buildings and equipment. Abaelu (1999) stressed that fixed cost affects the profit of most crops and livestock enterprises especially in the short- run planning period.

The estimated coefficient for farm size is 1.244 and positively signed and statistically significant and follows a - priori expectations. Fixed cost item depends on the size of the farm operation and not on the output level in which the enterprise is operating. Bhagwat (1998) stressed that the more broilers housed together, the more economic the operation becomes which is in line with the findings of this study. With respect to farm size, the scale of operation has a positive relationship with profits.

The estimated variance (σ^2) is statistically significant at 5% indicating goodness of fit and the correctness of the specified distribution assumptions of the composite error terms. Gamma (γ) is estimated at 0.881 and is statistically significant at 1% level. Its value implies that only 88.1% of the total variation in farm profit is due to profit inefficiency.

The frequency distribution of profit efficiency in broiler production is shown in Table 2. Individual profit efficiency indices range between 0.26 (26%) and 0.95 (95%) with a mean value of 0.8 (80%). The mean profit efficiency is relatively high indicating that the average farmer has a little above 80 percent of potential profit from a given mix of production inputs. The mean level of profit efficiency obtained in this study compares favourably with the 84% and 80% obtained by Huang et al (1986) for small and large farms in India. The high level of profit efficiency obtained in this study is consistent with the low variance of the farm effects, which implies that the stochastic frontier profit function and the average profit function are expected to be quite similar, (Battese et al 1995).

Table 2: Frequency distribution of profit efficiency in broiler production in Akwa Ibom State, Nigeria.2004.

Profit efficiency range	Frequency	Relative frequency
0.10 - 0.20	1	1.67
0.21 - 0.40	1	1.67
0.41 - 0.60	3	5.00
0.61 - 0.80	25	41.66
0.81 - 0.90	21	35.00
0.91 - 1.00	9	15.00
Total	60	100.00

Maximum value = 0.95 (95%)
Minimum value = 0.26 (26%)
Mean profit efficiency = 0.80 (80%)
Source: Field survey,2004.

(c) **Determinants of profit efficiency**: The estimated determinants of profit efficiency in broiler production are presented in Table 3.

The positive impact of level of education of broiler farmers follows a- priori expectations. This result agrees with those of Ali et al (1996), Bravo-Ureta and Pinheiro (1997). Battese and Coelli (1995) stressed that the more educated the farmer was the less inefficient he becomes. Educated farmers are more receptive to improved farming techniques and amenable to risk taking.

The coefficient of farming experience is positive and statistically significant indicating its importance in the broiler enterprise. Farmers with more years of experience achieve higher levels of profit efficiency suggesting that they are aware of current farm techniques in broiler production and/or are better at managing their limited resources at that point in time. This result agrees with that of Onu, et al (2000).

The coefficient of extension contact variable is positive and statistically significant at the 0.05 probability level. This shows that broiler farmers who have more extension visits and teachings were more economically efficient in broiler production in the state. This result agrees with those of Bravo-Ureta and Pinheiro (1997). Interactions through extension contacts/visits give the farmers opportunities to learn improved technologies and to acquire and apply needed inputs and services.

The coefficient of gender variable is negatively signed and statistically significant at 0.05 probability level implying that gender influences the level of profit efficiency. Bagi (1992) however pointed out that gender variable had positive effect on efficiency measurements which is contrary to the result of this study. This result agrees with those of Adesina and Djato (1997) and Ohajianya and Onyenweaku (2000) in their study on gender and relative efficiency in rice production systems in Ebonyi state, Nigeria however concluded that no differences in economic efficiencies of male and female rice farmers were found.

Table 3. Estimated Determinants of Profit Efficiency in Broiler Production in Akwa Ibom State, Nigeria,2004..

Variables	Parameters	Estimated coefficients	t-ratios
Age (X1)	b1	-0.824	-0.956
Level of Education(X2)	b2	0.274	5.901***
Farming experience (X3)	b3	0.630	2.708**
Membership of cooperative society (X4)	b4	0.414	1.119
Farm size (X5)	b5	0.022	0.065
Access to credit (X6)	b6	-0.094	-0.540
Extension contact (X7)	b7	0.632	2.394**
Gender (X8)	b8	-0.752	-2.118**
Household size (X9)	b9	3.563	1.387

** Significant at 5% *** Significant at 1%

Source: Computed from computer software, Frontier 4.1,2004.

SUMMARY AND CONCLUSION

The result of the analysis confirmed that labour costs, prices of feeds/feed supplements, prices of drugs and medication, capital inputs and farm size had significant effects on profit levels of the broiler farms and conformed to a-priori theoretical signs. The results confirmed that an increase in the use of any of the variable inputs would reduce profit levels while increased use of fixed inputs would lead to expansion thus enhancing profit level.

Important factors directly related to profit efficiency in broiler production are education, farming experience, extension contacts and gender variables. The mean profit efficiency level achieved was 80.0%. At a glance this level was not low but indicated that additional profit gain and/or production cost reduction may be obtained through more efficient utilization of productive resources. This would move the broiler farmers to their profit frontier. These result call for policies and programmes to improve farmers access to education and agricultural extension services and encouraging experienced farmers to remain in farming business.

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