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Profit Efficiency in Poultry Production in Peri-Urban Lagos, Nigeria

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Abstract

The study was conducted to determine the profit efficiency of poultry production in four peri-urban Local Government Areas in Lagos state. A total of ninety-six poultry farms involved in the survey were selected using a two-stage sampling technique. An average farmer in the sample was 40 years old; 85% were males and 84% had tertiary education. Most poultry farm in the sample had flock size that range between 500 and 2500. Prices of all the variable inputs significantly influence the profit of poultry farms while that of fixed inputs have no significant effect. The result indicates that the poultry farmers are not fully profit efficient. The mean efficiency estimated was 72 percent indicating that there was a 23 percent allowance to improve efficiency. Furthermore, the result shows that gender, family farm, finance, number of broilers and fulltime employment are the determinants of profit (technical and allocative) efficiency.

Key Words: Poultry, Production, Profit, Efficiency, Nigeria

Introduction

The most important thing that can happen to any country is agriculture (Paddy, 2001) opined that "The happiness of a nation is like a tree, farming is its roots, and commerce and industry are its branches and leaves. If the root is removed, the branches will die and the leaves fall off". That's how important agriculture is to any nation (Paddy, 2001). According to Agbor Ndoma (2008), agriculture remains the single largest contributor to the Gross Domestic Product (GDP), employment and industrialization. The fundamental value of Agriculture in the development and growth of the Nigerian economy is indicated in its contribution to food security, industrialization and the linkage effects with employment, income, market opportunities for industrial output and reduction in poverty. However, the sector is yet to attract the right kind of attention and quantum of investments that will enable it to realize its full economic potentials and development capacities. Agricultural growth and development is important to increase food supplies and improve the nutritional status of the people of Africa. This is particularly true for Africa where food production per person actually fell over the last 20years.

The provision of food and fibre for the growing national population is another

key role for agriculture. It is estimated that for the whole world and for the developing countries of Africa, Asia, and Latin America, the growth of agricultural production over the last decade has exceeded that of the population, so that agricultural production per head has increased. In Nigeria, agriculture provides a means of livelihood for over 70% of the population, raw materials for agro-allied industries and is a potent source of the much-needed foreign exchange (Chukwuji *et al*., 2006).

Poultry production is one of the major subsectors in Nigerian agricultural industry. Poultry apart from supplying protein is also a good source of lipids and vitamins of high zoological value to man (Bamiro, *et. al*, 2006). Animal protein is essential in human nutrition because of its biological significance. In realization of the importance of animal protein, the various governments of Nigeria have been pursuing programs at national, state and community levels to boost the mass production of livestock products, to ensure the attainment of Food and Agriculture Organization (FAO), recommendation of 3.5g per caput of animal protein per day (Ojo, 2003).

One of the developmental challenges facing most developing countries is their inability to adequately feed their ever-increasing population with the right proportion of calories and protein (Apantaku, 2006). In Nigeria, the production of food has not increased at the rate that can meet the ever-increasing population. CBN (2001) stated that the rate of increased food production of 2.5% per annum does not measure up with the annual population growth of 2.8%. The apparent disparity between the rate of food production and demand for food in Nigeria has led to a food demand supply gap thus leading to a wide gap between domestic food and total food requirement, an increasing resort to food importation, high rates of increase in food prices, and as a result, widespread hunger and malnutrition are evident in the country (Ojo, 2003).

The problems associated with poultry production in Nigeria are low egg production, diseases and pests, low and poor performing breeds, poor weight gain or feed conversion, feeding and management problems and lack of capital (Apantaku, 2006). According to Oludimu *et al.* (2002), poultry industry in Nigeria is plagued by host of risks and uncertainties and these include natural risks, poultry diseases, pests, all these result in high mortality rates in poultry production; social risks; economic risks (price fluctuation;), loss or unexpected depreciation of investment: uncertain or unstable supply of feed as well as variation in the quality of feed.

The profit function approach combines the concepts of technical and allocative efficiencies in the profit relationship, and any errors in the production decision are assumed to be translated into lower profit or revenue for the producer (Ojo, 2003). Profit efficiency, therefore, is defined as the ability of a farm to achieve the highest possible profit given the prices and levels of fixed factors of that farm, and profit inefficiency, in this context, is defined as loss of profit for not operating on the frontier (Alli and Flin, 1989).

Alli and Flin (1989) estimated the farm-specific profit inefficiency among Basmati rice producers from a variable-coefficient profit frontier and stated that the mean level of inefficiency at farm resources and price levels was 28%, with a wide range (5%–87%). Tsue *et al*. (2012), in their study

on profit efficiency among catfidh farmers in Benue State, Nigeria, stated that the mean level of profit efficiency indicated the existence of a scope to increase profit by improving technical and allocative efficiencies. The variables of years of schooling of farmers, off-catfish-farm income and training decreased profit efficiency while age of farmers, years of catfish farming experience and duration of culture increased efficiency in profit making. They concluded that profit inefficiency in catfish production can be reduced significantly over time as the farmers get more experienced. According to Oladeebo and Oluwaranti (2012), profit efficiency is positively influenced by household size and farm size, and further stated that there is scope for increasing profit efficiency in cassava production by directing policy focus on these profit efficiency factors.

Measurement of Efficiency

The measurement of efficiency remains an important area of research both in developing and developed countries. The measurement of efficiency goes a long way to determine profitability and agricultural growth linked to profit (Tijani *et al*, 2006). Determining the efficiency status of farmers is very important for policy purpose. In an economy where technologies are lacking, efficiency studies show the possibility of raising productivity by improving efficiency without increasing the resource base or developing new technology (Yusuf and Malomo, 2007).

One way of approaching the problem of increasing production is to examine how efficient the farmers are using their resources; if resources used are inefficient, production can be increased by making adjustment in the use of factors of production in optimal direction. In case it is efficient, the only way for increasing production would be the adoption of modern inputs and improve technology of production (Singh, 1975; Oladeebo and Oluwaranti, 2012).

Measuring Efficiency Using Frontier Profit Function

Production inefficiency is usually analyzed by its two components – technical and allocative efficiency. In a production context, technical efficiency relates to the degree to which a farmer produces the minimum feasible output from a given bundle of inputs (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level output (an output oriented measure). Allocative efficiency, on the other hand, relates to the degree to which a farmer utilizes inputs in optimal proportions, given the observed input prices (Ali *et al*., 1994). Recent developments combine both measures into one system, which enables more efficient estimates to be obtained by simultaneous estimation of the system (Ali *et. al*, 1994).

The popular approach to measure efficiency, the technical efficiency component, is the use of frontier production. The profit function approach combines the concepts of technical and allocative efficiency in the profit relationship and any errors in the production decision are assumed to be translated into lower profits or revenue for the producer (Ali *et. al*, 1994).

The stochastic profit function is defined as

$$\pi_i = f\left(P_{ij}, Z_{ik}\right).\exp\left(\xi_i\right) \quad \text{……...…} \quad (1)$$

where π_i is normalize profit of the *i*th farm defined as gross revenue less variable cost, divided by farm-specific output price; $P_{ij,}$ is the price of *jth* variable input faced by the *ith* farm divided by output price; Z_{ik} is level of the *kth* fixed factor on the *ith* farm; ξ_i is an error term; and $i = 1,\ldots\ldots$, n, is the number of farms in the sample.

The error term ξ_i is assumed to behave in a manner consistent with the frontier concept (Ali and Flinn, 1989; Oladeebo and Oluwaranti, 2012), that is

$$\xi_i = v_i - u_I \ldots\ldots\ldots\ldots (2)$$

where $v_i s$ are assumed to be independently and identically distributed $N\left(0,\sigma^2{}_v\right)$ two sided random errors, independent of the u_i s; and the $u_i s$ are non-negative random variables, associated with inefficiency in production, which are assumed to be independently distributed as truncations at zero of the normal distribution with mean, $\mu_i = \delta_0 + \Sigma_d \delta_d W_{di}$ and variance σ_u^2 ($|N(\mu,\sigma^2_u|$), where W_{di} is the *d*th explanatory variable associated with inefficiencies on farm *i* and δ_0 and δ_d are the unknown parameters.

The production/profit efficiency of farm *i* in the context of the stochastic frontier profit function is defined as

$$PE_i, = E\,[\exp(-u_i)\,|\,\xi_i] = E\,[\exp(-\delta_0 - \sum_{d=I}^{D} \delta_d W_{di})\,|\,\xi_i] \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where PE_i lies between 0 and 1, and it is inversely related to the level of profit inefficiency.

E is the expectation operator, this is achieved by obtaining the expressions for the conditional expectation u_i upon the observed value of ξ_i. The method of maximum likelihood is used to estimate the unknown parameters, with the stochastic frontier and the inefficiency effects functions estimated simultaneously. The likelihood function is expressed in term of the variance parameters, $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2 / \sigma^2$ (Battesse and Coelli, 1995).

Methodology

This study was carried out at peri-urban of Lagos State, the commercial nerve centre of Nigeria. The study made use of primary data collected from poultry farmers through structured questionnaires administered to the target samples of 100 poultry farms. However, data from 96 farmers were used for analysis due to inconsistencies in the information from four respondents. A two-stage sampling technique was used in selecting the study sample. At the first stage, a purposive sampling technique was employed for the selection of four Local Government Areas that were peri-urban in nature, while the second stage involved a random selection of poultry farms in the selected areas. Descriptive statistics, gross margin and translog profit frontier were employed for the data analysis.

Model specification

The functional form of the translog profit frontier was employed and the model is presented thus:

$$\ln \pi' = \alpha_0 + \sum_{j=1}^{5} \alpha_j \ln P'_j + \tfrac{1}{2} \sum_{j=1}^{5} \sum_{k=1}^{5} \tau_{jk} \ln P'_j \ln P'_k + \sum_{j=1}^{5} \sum_{l=1}^{4} \phi_{jl} \ln P'_j \ln Z_l + \sum_{l=1}^{4} \beta_l \ln Z_l + \tfrac{1}{2} \sum_{l=1}^{4} \sum_{t=1}^{4} \varphi_{lt} \ln Z_l \ln Z_t + v - u \ldots\ldots\ldots (1a)$$

l=1 l=1 t=1

$$u=\delta_0 + \sum_{d=1}^{6}\delta_d W_d + ώ \ldots\ldots\ldots\ldots\ldots (1b)$$

Where π = restricted profit (TR-TVC) (normalized profit of the jth farm and it is computed as gross revenue less variable cost divided by the farm specific output price, P)

$P_{'j}$ = price of the jth input (₦)

P_1 = price of feed (₦) (Pij=price of jth variable input faced by the ith farm divided by output price)

P_2 = normalized wages (₦)

P_3 = normalized price of water (₦)

P_4 = normalized veterinary cost (₦)

Z_1 = quantity of egg sold (trays)

Z_2 = stock of birds sold (₦)

Z_3 = worth of by-product (₦)

W_d = variables representing socio-economic variables

d = ages, sex, education, farming experience, flock size, hired/family labour marital status, part-time/full time farming

UV = two sided random error

U = one sided half- normal error

Where $e_i = v_i - u_i$

e_i = Composite error term

v_i = Non-negative error term

u_i = Technical inefficiency effect which are assumed to be independent

Results and Discussion

Socio-economic Characteristics of Poultry Farmers

The socio-economic characteristics of the poultry farmers are presented in Table 1**.** The result shows that a large percentage (about 68%) of the poultry farmers in the study area are between 31 and 50 years age and the enterprise is gender biased as male poultry farmers account for 85% of the sampled farmers characterized with high level of education which is expected to culminate to high level economic performance. About 89% of the poultry farmers have poultry farming experience that spans between 1 and 15 years. This is also expected to manifest in high level of productivity as they bring their experience to bear on the job. Most (45%) of the sampled poultry farmers are part-time farmers having poultry farms that are classified on the basis ownership structure as sole proprietorship (58%) closely followed by family based poultry farms. The minimum and maximum flock size is 500 and 5000 respectively.

The Structure of Poultry Production

The maximum likelihood estimate (MLE) of translog stochastic frontier profit function defined by equation (1a), given the specifications for the inefficiency effects defined by (1b) were obtained using FRONTIER 4.1 (Coelli, 1996). The results of the profit function are presented in the upper part of Table 2. The lower section of Table 2 reports the result of testing the hypothesis that the efficiency effects jointly estimated with the profit frontier function are not simply random errors. The estimated value of γ is close to 1 and is significantly different from zero, thereby, establishing the fact that a high level of inefficiencies exists in poultry farms in peri-urban Lagos. Moreover, the corresponding variance- ratio parameter γ* implies that 57.81% of the differences between observed and the maximum frontier profits for poultry farms is due to the existing differences in inefficiency levels among farmers.

These parameter γ is not equal to the ratio of the variance of the efficiency effects to the total residual variance because the variance of u_i is equal to $[(\pi-2)/\pi]\ \sigma^2$ not σ^2.

The relative contribution of the inefficiency effects to the total variance term (γ^*) is equal to $\gamma^* = \gamma / [\gamma + (1 - \gamma)\pi / (\pi - 2)]$.

Further, a set of hypothesis on different inefficiency specifications using Likelihood Ratio (LR) test statistic was tested. The null hypothesis that $\gamma = 0$ is rejected at 5% level of significance confirming that inefficiencies exist and are indeed stochastic (LR Statistic 212.13> χ^2,11.95 = 19.7).The log of likelihood function estimate is 40.47, this represent the value that maximize the joint densities in the estimated model. Hence, a significant part of the variability in profits among poultry farms is explained by the existing differences in the level of technical and allocative efficiencies.

The results in Table 2 further show that all the explanatory variables with the exception of fixed inputs significantly and positively influence the profitability in poultry enterprise. The fixed inputs have significant but negative influence on profitability. The coefficients of output and other explanatory variables are significant at 1 percent probability level. Profitability increases sharply with increase in the price of the output. In the same vein, increase in the price of feed, labour and wages lead to increase in accrued profits in poultry production. On the other hand, increase in the price of fixed inputs reduces the accrued profits.

Determinants of Profit Efficiency

The determinants of profit efficiency are presented in the lower part of Table 2. Age, gender, family farm, finance, number of broilers and fulltime employment are the determinants of profit (technical and allocative) efficiency. All these variables were significant at 1% probability level. In the same vein, each variable had positive and significant effect on the profit efficiency. This implies that each of these socio-economic characteristics (farm specific variables) had inefficiency increasing effect. The efficiency reducing effect of age is in consonance with the finding of Bolaji (1980) and Aihonsu, (2002), but contrary to the finding of Bamiro *et al*. (2006). This is theoretically plausible because it is in tune with the law of diminishing returns. The inefficiency increasing effect of full-time (part-time = 1, fulltime = 0) is in accordance with a-priori expectation, because the farmers have to allocate their time and resources amongst several enterprises. This agrees with the finding of Rahman, (2003) that those who do less off farm work tend to be more efficient. The inefficiency increasing effect of other variables is contrary to expectation. For instance, it is expected that the greater the amount of funds available for production, the higher the level of efficiency. However, the observed scenario could have arisen due to non-judicious use of available funds. The positive co-efficient of gender (female=1, male= 0) indicates that male poultry farmers were more efficient than their female counterparts.

Table 1: Socio-economic Characteristics of Poultry Farmers in Lagos State

Characteristics	Frequency	Percentage
Age (Years)		
31-40	25	26.0
41-50	40	41.7
51-60	24	25.0
Above 60	7	7.3
Level of Education		
No formal education	4	4.2
Primary school	2	2.1
Secondary school	9	9.4
NCE/OND	22	19.8
University	40	41.7
Years of Experience		
1-5	27	28.1
6-10	45	46.9
11-15	14	14.6
16-20	5	5.2
Above 20	5	5.2
Major Occupation		
Farming	41	42.7
Business	10	10.4
Civil servants/paid workers	44	45.8
Artisans	1	1.0
Source of Financing		
Personal savings	84	87.5
Relatives	3	3.1
Cooperatives	7	7.3
Banks	2	2.1
Ownership structure		
Sole proprietor	56	58.3
Family based business	24	25.0
Partnership	1	1.0
Cooperative	3	3.1
Limited liability company	12	12.5
Flock Size		
<500	33	34.4
501-1000	22	22.9
1501-2000	6	6.3
Above 2000	35	36.5

Table 2: Estimates of Tranlog Profit Frontier by Ordinary Least Square and Maximum Likelihood

Variables	**Parameter**	**MLE Coefficient**	**MLE t-ratio**	**OLS Coefficient**	**OLS t-ratio**
PROFIT FUNCTION					
Constant	α_0	-48.0953	-16.0091*	64.3727	12.3986*
lnP'f	αf	59.9538	24.0420*	48.6240	10.4800*
lnP'l	αl	15.9813	9.9121*	22.1283	11.5465*
lnP'T	α_t	149300	12.1130*	14.3908	11.8984*
lnP'Z	αz	-0.6490	-1.3694	0.6490	1.3694
lnP'f x lnP'l	τfl	-5.5922	-5.9587*	5.5922	5.9586*
lnP'f x lnP'T	τft	-11.9774	14.6349*	11.9774	14.6349*
lnP'l x lnP'T	τlt	-0.2287	-2.0468**	0.2286	20.4675*
lnP'f x lnP'f	τff	-18.8733	-8.1167*	18.8733	8.1167*
lnP'l x lnP'l	τll	-1.4801	-12.0375*	1.8019	12.8004*
lnP'Tx lnP'T	τtt	-0.1320	3.1812*	0.2054	2.9306*
lnP'f x lnP'Z	τfz	0.8248	2.6084*	0.5186	1.4455
lnP'l x lnP'Z	τlz	0.6134	15.4225*	0.2222	2.8965*
lnP'T x lnP'Z	τtz	0.2178	5.2845*	0.0013	0.0153
Variance Parameters					
Sigma squared σ^2	σ^2	0.2144	9.2253*	0.1316	
Gamma γ	γ	0.9871	137.9625*	-	
Inefficiency effects					
Constant	δ_0	1.5573	2.1251**	-	
Gender	δ_1	2.0890	9.5556*	-	
Age	δ_2	0.0659	4.3057*	-	
Farming experience	δ_3	0.0022	0.1396	-	
Family farm	δ_4	1.5339	7.4383*	-	
Other owners	δ_5	0.1526	0.7234	-	
Education	δ_6	0.0168	0.8644	-	
Finance	δ_7	0.000004	4.6719*	-	
Broiler	δ_8	1.1118	5.7956*	-	
Cockrel	δ_9	0.2532	1.4520	-	
Other livestock	δ_{10}	5.6455	0.4251	-	
Fultime employmnt	δ_{11}	0.5576	3.9106*	-	
Log likelihood function	Llf	40.47			
Likelihood ratio	Lr	212.13		65.5970	
Number of observations		96			

Note: *significant at 1 percent level, ** significant at 5 percent
F = feed, L = labour, T = others, Z = fixed inputs

Profit or Production Efficiency

The distribution of profit efficiency of poultry farmers is presented in Table 3. The results indicate a profit efficiency range from 0.11 to 0.97. The mean estimate is 0.72. The efficiency distribution shows that 64.60 percent of the poultry farmers attained between 60 and 100; while 16.7 percent of the poultry farmers had below 40 percent level of efficiency. The results further imply that the average poultry farm producing poultry eggs and birds could increase profits by 28 % by improving their technical and allocative efficiency. This result is in consonance with the findings of Rahman (2003), who reported mean profit efficiency level of 0.69 (range 13 to 95%). It also agrees with the findings of Oladeebo and Oluwarnati (2012) who stated that profit efficiency ranged between 20% and 91%, and the mean profit efficiency level of cassava farmers was 79% which suggested that an estimated 21% loss in profit was due to a combination of both technical and allocative inefficiencies in cassava production. The finding also tallies with the result obtained by Tsue *et al*. (2012) in their study on profit efficiency among catfish farmers in Benue State, Nigeria. Their findings showed that profit efficiency ranged from 23 percent to 99 percent with a mean efficiency of 84 percent.

Table 3: Frequency Distribution of Profit Efficiency

Efficiency class	No. of farmers	Percentage
<0.2	6	6.3
0.2-0.39	10	10.4
0.4-0.59	18	18.7
0.6-0.79	24	25.0
0.8-1.00	38	39.6
Total	**96**	**100**

Source: computed from field data, (2008)
Mean = 0.72, Maximum = 0.97, Minimum = 0.11

Conclusion

This study estimated the profit efficiency of poultry farmers in peri-urban Local Government Areas of Lagos State, Nigeria. Data obtained were analyzed by the use of descriptive statistics and stochastic Cobb-Douglas profit frontier model. Majority (about 96 percent) of the poultry farmers were educated in formal institutions of learning while a substantial percentage of them (about 72 percent) had more than five years of poultry farming experience. Majority (about 65 percent) had flock size that was greater than 500. The mean level of profit efficiency was 0.72; an indication that there remains a considerable scope (28 percent) to increase profit by increasing allocative and technical efficiency. The socio-economic characteristics and farm specific variables employed to explain the inefficiencies indicate that each of them had inefficiency increasing effect. Therefore, inefficiency can be reduced by the involvement of younger folks, reduce the participation of family members in the day-today running of the poultry enterprise. Also, judicious spending of the available funds and right combination of broilers with layers and cockerel will further enhance profit efficiency in poultry production.

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