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FACTOR PRODUCTIVITY AND EFFICIENCY IN POULTRY FARMING: EVIDENCE FROM BROILER PRODUCTION IN IMO STATE

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ABSTRACT

The study focused on factor productivity and efficiency in broiler production in Imo State. Technical efficiency is synonymous with productivity in resource performance assessment. The main objective of the research was to compare resource use productivity in broiler production looking at the two distinct activities of brooding and selling after four weeks and rearing the brooded to maturity before selling. In order to achieve this, a random sample of 180 broiler farmers of 90 brooders and 90 who rear was taken from the three agricultural zones of the state. A set of structured questionnaire was administered on the farmers. Data obtained were analyzed using simple statistical tools and Additive Multiplicative Dummy Variable Model and t-test statistic. Results showed that farmers who reared their birds to maturity before selling were more technically efficient in the use of production resources; they had higher productivity than their counterparts that just brooded and sold. It is therefore recommended that farmers should brood and rear their broilers to maturity for higher productivity and efficiency.

***Keywords**: Factor Efficiency, Broiler, Production*
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INTRODUCTION

Productivity of factor or resources is generally defined in terms of efficiency with which the factors are converted to output within a given production process. Using more resources than necessary in production often indirectly causes other problems. Efficiency is relative performance of methods used in production process. Productivity is synonymous with technical efficiency in the measurement of input and output. In this case, productivity measures the ratio of output to inputs of the factor while technical efficiency is the use of "best practice" in production processes so that not more than the necessary quantities of input are used in the production of "best" output (Carlson,1972;Timmer,1980). In other words, efficiency or productivity is the art of doing the same or better services with fewer resources. That means no compromise or loss of performance.

There are four methods of measuring productivity and efficiency. They are Least Squared Econometric Production Models (LSEPM), Total Factor Productivity Indices (TEPI), Data Envelopment Analysis (DEA), and Stochastic Frontier Production Function (SFPF) analysis. Seiford and Thrall (1990) generally categorized the approaches to estimating technical efficiency into parametric and non-parametric methods. Stochastic estimations incorporate a measure of random error. This involves the estimation of a stochastic production frontier, where output of a firm is a function of a set of inputs, inefficiency and random error. One disadvantage with the use of the technique is that they impose an explicit functional form and distribution assumption on the data. The linear programming technique of data envelopment analysis (DEA) does not impose any assumptions about functional form; hence it is not likely to be prone to miss-specification. In addition the DEA as a non-parametric approach does not take into consideration random error and therefore is not subjected to the problems of assuming an underlying distribution about the error term. However, since DEA cannot take account of such statistical noise, the efficiency of estimates may be biased if the production process is largely characterized by stochastic factors.

Different researchers prefer any of the four approaches of measuring productivity based on convenience and circumstance. According to Antle and Capalbo (1984), productivity can be measured by aggregate input index to an aggregate output index. More recent approaches focused on total factor productivity as opposed to single factor productivity. In this approach, the guiding principles are matching inputs and outputs taken from the same population and related to the same period, independence and measurement of output and input and consideration of quality variations in output. There are two approaches to total factor productivity measurement: the index number or growth accounting approach and the econometric approach. (Antle and Capalbo, 1984). The growth accounting approach involves compiling detailed accounts of inputs and outputs and using these indices to compute total factor productivity index. The econometric approach involves econometric estimation of the production technology function.

Productivity of resources can be influenced by certain factors; which can be grouped into physical factors which include, land area, climate and soil; technological factors, that is, available technological-know-how and inputs; and human factor which has to do with the way society makes use of the other factors (Beets, 1990). Productivity therefore could be improved by expanding area planted, raising the yield per unit area of individual crop enterprise, that can be enhanced by technology and by growing more crops per year.

However, in crop production use of improved crop husbandry such as better weeding, use of improved planting materials, recommended plant configuration, good soil management, appropriate timing of cultural operations, optimal use of available labour and use of external inputs like fertilizers, machines, pesticides and herbicides are some of the assured ways of raising farm productivity.

Appropriate technology is important factor affecting productivity. Technologies introduced to farmers must be appropriate for use under the conditions in which the farmers operate. In addition, the technology has to be disseminated. Public provided infrastructure can influence agricultural productivity, (Antle, 1983). Such infrastructural facilities include good roads, irrigation services, agricultural research, communication facilities, education and health facilities.

Some socio-demographic and economic factors influence agricultural productivity. Socio-cultural behaviour, entrepreneurship, farm size, farmers age, level of education, experience, attitudes and outlook are among the human factors affecting productivity of resources in farms (Betelle, 1990; Todaro, 1980; Omolola, 1988).

The main aim of this work was to analyze resource use efficiencies in broiler production in Imo State. In broiler production it can be observed that there are two distinct activities namely, brood and sale and rearing the brooded to maturity or market age. Some broiler producers only brood day old birds to four weeks and sell them while others engage in rearing the brooded or day old to market age. Literature is lacking in resource productivity and technical efficiency of resource use in broiler production especially in the two district enterprises of broiler sub-sector in the study area. Efforts were therefore made to compare resource use efficiency and resource productivity among them with the hope of filling the gap in knowledge in resource productivity and efficiency in the poultry sub-sector.

METHODOLOGY

The Study Area

The study area is Imo State of Nigeria. Imo State is situated in the Southeastern geographical zone of Nigeria. It lies between longitudes 6°35´ and 7°28´E and latitudes 5°10´ and 5°37´N, covering an area of 3,289.49km^2. It is bounded on the East by Abia State, on the West by Delta State, on the North by Anambra State and on the West by Rivers State. The state falls within the tropical rainforest zone with an average annual rainfall of up to 2550mm, and temperature and relative humidity of 27°C and 75% respectively (Kenkwo and Egeonu,2000; Metrological Unit, Ministry of Land and Survey, 2006). It has estimated population of 3.927563million with a growth rate of 2.8% per annual (Imo State Planning and Economic Commission, 2004 and FGN 2006). For ease of administration of agricultural programmes, the state was divided into three agricultural zones namely Owerri, Orlu and Okigwe agricultural zones. Farming is the major occupation of the people of which livestock production forms a significant portion.

Sampling Technique

To achieve this, multi-stage sampling procedure was employed. This involved the division of the state into three zones or cluster following the zoning arrangement of Imo State Agricultural Development Projects (ISADP), namely Orlu, Okigwe and Owerri zones. From each zone, three L.G.As were randomly selected and from each L.G.A ten broiler producers (made up of five brooding farmers and five rearing farmers) were randomly selected. This has a sample size of ninety farmer-respondents. Then a set of structured questionnaire was administered on the respondents to obtain necessary information.

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Analytical Framework
Productivity of resources can be equated to technical efficiency of resource use. In this study, productivity or technical efficiency of resource use was analysed with the aid of the concept of Additive Multiplicative Dummy Variable Model Approach following the works (Baggi, 1981; Benwo, 1986; Onyenwuaku, 1994; Nwaru, 2003; Nwaru and Nnadozie, 2006). This is a model used to discover technical efficiency differences and similarities of group of farms in a production system. The model uses pooled data for comparison.

The main aim of the model is to establish whether any group of farms under consideration is characterized by neutral production function, non-neutral or factor-biased production function or some production function. Neutral production function means that the production functions of the two farms under consideration differ only in their intercepts while their slope coefficients are the same. Slope coefficients being the same means that none of them is statistically significant. Factor-biased or non-neutral function situation means that the two farms significantly differ in one or more of their slope coefficients even if their intercepts differ or not.

If there is however no significant difference in both the intercepts and slope coefficients of the two production functions, the farmers are said to face the same production function showing equal technical efficiency. Implicitly, the model is given as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, D, X_1D, X_2D, X_3D, X_4D, X_5D, X_6D) + ei$$

Where X_1 = Labour; X_2 = Feed; X_3 = Farm size; X_4 = Medication; X_5 = Other inputs; and X_6 = Capital.

Explicitly, the log linear Cobb-Douglas functional form is:

$$\text{In } Y = \text{In } A_0 + B_0D + A_1 \text{ In } X_1 + B_1D \text{ In } X_1 + A_2 \text{ In } X_2 + B_2D \text{ In } X_2 + A_3 \text{ In } X_3 + B_3D \text{ In } X_3 + A_4 \text{ In } X_4 + B_4D \text{ In } X_4 + A_5 \text{ In } X_5 + B_5D \text{ In } X_5 + A_1 \text{ In } X_6 + B_6D \text{ In } X_6 + ei$$

In interpreting the result of the estimates of this model, attention is focused on the intercept shift dummy (B_0D) and slope shift dummies (B_iD_i). If the B_0 of the dummy 'D' is positive and significant, it means that the production function for the farm with value of unity in the dummy has larger intercept, showing higher level of technical efficiency and vice-versa. If the coefficient of the slope dummy (bi) is equal to zero but (B_0) is not equal to zero, the two groups are facing neutral production function. But if at least, one of the slope coefficients (bi) is not equal to zero, the two groups face factor biased or non-neutral production function. If coefficient of intercept dummy (B_0) is zero and all the coefficients of slope dummies are zero, the two groups are facing the same production function showing equal technical efficiency in the use of the resources.

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RESULTS AND DISCUSSION

Table 1 below contains the result of fitted numerical data collected to the additive multiplicative dummy variable model. The model was estimated in four functional forms and the linear form was chosen as lead equation following statistical and econometric reasons. It has the best fit, that is higher coefficient of multiple determination (R^2). The coefficient of multiple determination (R^2) in the equation was 0.934 showing that the explanatory variables of the model explained up to 93% of variation in the dependent variable. The feed input, farm size measured in number of birds, farm size shift dummy and other inputs shift dummy were highly significant at 1% level showing their immense influence on the dependent variable. The capital resource and feed shift dummy were significant at 5% level of probability.

The intercept shift dummy was not statistically significant. It was also negatively signed suggesting that the brooding farmers achieved lower output than the rearing farmers. The slope shift dummy for farm size, other inputs and feed were statistically significant at 1% and 5% levels indicating that the two farmer groups were characterized by factor-biased production functions. In other words, they had different production functions. In addition, the slope shift dummies for feed and farm size were negatively signed suggesting lower use intensities for these resources by the brooding farmers. The slope shift dummies for other inputs, medication and capital were positively signed suggesting higher use intensities for the resources by brooding farmers.

Table 1: Estimated Pooled Production Function for Brooding and Rearing, Enterprises

Variable	Linear	Exponential	Semi-log	Double-log
Intercept	33609	10.50717	-1896463	4.10451
	(`.98)	(65.66)***	(-6.54)***	(5.70)***
Labour	63.14551	0.00690	-53356	0.05787
	(0.28)	(3.29)**	(-1.57)	(0.69)
Feed	1.7147	0.00000361	248936	0.42982
	(8.50)***	(1.90)*	(5.28)***	(3.67)**
Bird	325.7307	0.00119	-32141	0.4502
	(4.92)***	(1.90)*	-(0.65)	(3.74)**
Medication	2.39855	-0.00001975	35195	-0.01945
	(0.74)	(-0.65)	(1.26)	(-0.28)
Other inputs	-0.51238	0.00004152	-63782	0.07533
	-(0.20)	(1.72)*	(-2.60)***	(1.24)
Capital	3.89949	0.00003683	24783	0.04954
	(2.49)**	(2.49)	(1.07)	(0.86)
Intercept dummy	-14595	-0.12405	1307439	0.06812
	(-0.52)	(-0.47)	(2.98)**	(0.06)
(labour) D	-233.665	-0.00572	48840	-0.14724
	(-0.41)	(-1.07)	(0.79)	(-0.96)
(feed) D	-1.3598	0.00000480	-24002	-0.28518
	(-2.63)**	(0.99)	(-4.42)***	-(2.04)

(bird) D	-316.5578	-0.0008877	56060	-0.02253
	(-4.42)***	(-1.31)	(6.90)	-(0.15)
(medication) D	2.30218	0.000046	-27322	-0.07300
	(0.51)	(1.11)	(-0.76)	(-0.82)
(input) D	23.9025	0.000123	124369	0.31541
	(4.88)***	(2.67)**	(3.46)**	(3.54)**
(capital) D	5.41215	0.0000473	-15006	0.00303
	(0.67)	(0.62)	(-0.43)	(0.03)
R^2	0.9347	0.65	0.770	0.915
$R\text{-}^2$	0.9290	0.6211	0.750	0.9084
F-ratio	164.02***	21.76***	38.38***	124.57***

Source: Field Survey Data, 2009

NB: Values in parenthesis are t-values
* Significant at 10%
** Significant at 5%
*** Significant at 1%

CONCLUSION AND RECOMMENDATION

Productivity of resource is synonymous with technical efficiency of resource use. The broiler rearing farmers, that is farmers that bought brooded birds and reared them to market age or maturity, had better production technology than those that brooded day old chicks to about four weeks and offered them for sale. They were more technically efficient in the use of resources and therefore had higher productivity in resource use. Profit maximization requires a firm to produce the maximum output given the level of inputs employed.

The implication is that the rearing farmers made better use of resources and optimum output and profit than the brooding and selling farmers. This therefore offers the choice of making profit in rearing birds to maturity by intending investors. It is recommended that brooder farmers should rear their birds to maturity. They should brood and rear to enable them avail themselves of benefits of both resource use efficiency in brooding and high technical efficiency and profit of rearing

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