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Analysis Of Productivity And Risk Factors In Commercial Poultry Production In Osun State, Nigeria

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Abstract

The study examined the resource use efficiency and occurrence of risk factors in poultry production in osun state, nigeria using the production function and bayesian decision model analysis. Data were collected using a set of questionnaire from 200 poultry farmers selected from five local government areas of the state using the multistage sampling technique. Findings showed that in egg production there was efficient allocation and utilization of resources in poultry production in the study area as shown by the returns to scale of 0.253 and elasticities of production of the factors most of which were in stage ii of the production surface. The factors of feed and labour costs showed decreasing function to the factors and were in stage iii of the production surface and thus inefficiently allocated. The identified major risk factors were that of diseased/parasites and feed poisoning with posterior probabilities of occurrence of 0.787 and 0.212 respectively. These risks are preventable risks if there are efficient management practices.

Keys Words: Production, Risk Factors, Poultry Production, Nigeria

Introduction:

A lot of improvements have been recorded in the Nigerian livestock subsector since 1993. Its contribution to the Gross Domestic Product (GDP) in absolute terms rose from N5.17 billion in 1993 to N6.06 billion in 1999 (CBN 1999).

Poultry production is unique and it offers the quickest returns to investment outlay in livestock enterprises. Poultry has the highest feed conversion rates and produces the cheapest, commonest and best sources of animal protein (Orji et al 1981). The contribution of poultry production (meat and eggs) to total livestock output increased from 26% in 1995 to 27% in 1999 with increase in eggs production alone accounting for about 13% during the period.

The improved performance in poultry production was sustained by the availability and use of improved vaccines which curtailed mortality rates in birds, reduction in tariff on imported day old chicks and parent stocks, and the relative ease of compounding efficient feeds using easily available local feedstuffs such as replacing the fishmeal source of protein in broiler starter mash with plant protein concentrate called *Glyricidia Sepium* (Agbede et al 2002). This improvement could further be sustained with a proper analysis of the productivity of inputs involved in the production process and the analysis of the risk factors that militate against optimum production

A knowledge of the chances of occurrence of these risk factors would enable poultry farmers take appropriate measures to minimize the effect of such risks by adopting better management practices.

This study therefore focused on resource use efficiency, identification and qualification of selected risk factors in poultry production and forecast the probabilities of the occurrence of these risk factors. Resource productivity, the ratio of total output to the resources is measured by computing of the following economicmetrics, namely, Average Product (AP), Marginal Product (MP), Value of Marginal Product (MVP), Elasticity of Production and Returns to Scale (RTS) (Olayide and Heady, 1982). A knowledge of these economicmetrics is used as a frame of reference to undertake a quantitative interpretation of the stages of the production function where each stage is important from the view point of economic analysis and efficient resource use. In stage I, the AP and MP are

increasing and the RTS is greater than unity. It is not economical to stop production and employment of more inputs of production at that stage. In stage III the MP is less than zero and total product reduces as the input is increased. Therefore, both stages I and III are uneconomical or irrational zone of production.

Stage II is the stage where elasticity of production is between zero and unity and input allocation and utilization are efficient and total product increases at decreasing marginal rate (Doll and Orazen, 1978).

Methodology:

Study Area:

The study was carried out in Osun State, Nigeria. The state is one of the 36 states in Nigeria. It is located in the south west part. The state has a land area of 8802 squared kilometers and a population of 2.2 million (FOS 1996). The people are predominantly peasant farmers cultivating mainly food crops such as cassava, yam, maize export crops (cocoa, oil palm) because of favourable climatic conditions. They are also involved in small scale production of goats, sheep, pigs, and rabbits while poultry production is undertaking in small, medium and large scales. The people live mostly in organized settlements, towns and cities.

Data Collection and Sampling Techniques

Primary data were collected on farm level data using a set of structured questionnaire from 200 poultry farmers selected using a multi stage sampling technique (purposively and simple random sampling methods) from five Local Government Areas, namely, Osogbo, Ede, Ife Central, Ife East and Oriade.

Information was collected on production activities, such as, value of eggs and birds sold by the farmers, number of birds raised for egg and meat production, labour cost, feed consumed in kilogramme and other operating expenses.

The socio – economic information included, years of schooling, experience of the farmers and location of poultry fanns either in the urban centre or rural area.

Information was also collected on the following risk factors – number of birds lost to diseases and parasites, windstorm, food poisoning, pilfering and pest attack.

Method of data Analysis

Data collected were analysed using descriptive statistics (mean, standard deviation, frequency tables), production function analysis ands the Bayesian Decision Analysis.

Production function analysis

The production function stipulates the technical relationship between resources and output in any production process (Dillion and Hardaker 1993, Ozsabuncuoglu 1997). It is used in determining the extent to which output and productivity can be increased from given resource stock. In its explicit and linear form it is defined as

$$Y_i = \beta_0 + \Sigma\beta_j X_{ji} + \epsilon_i$$

Where

Y_i = outpnt of the i^{th} farmer

X_j = explanatory variables (J = 1, 2, ... k, k = number of variables)

βj = estimated coefficients of parameters of explanatory variables

β_0 = constant term

ϵ_i = error term

For this study

X_1 = number of birds raised for eggs or meat

X_2 = feed consumed (kg)

X_3 = labour cost

X_4 = other operating cost

X_5 = year of schooling of farmers

X_6 = experience in poultry farming

ϵ_i = error term which is assumed to be normally distributed with zero mean and constant variance

Data analysed were assumed to be free from problem of multi collinearity and autocorrelation among independent variables (Johnston 1982). Data were fitted to three functional equations – linear, semilog and Cobb-Douglas equations. The equations were statistically evaluated on the basis of the magnitude of the coefficient of multiple determination (R^2), t – ratio and standard error tests of the estimated coefficients. The Cobb-Douglas equation was the lead equation selected. The estimated parameters β_0 and β_j were used for further economic analysis.

Bayesian Model

The Bayesian decision model is a quantitative technique developed to calculate probabilities of "causes" on observed "effects" (Morris 1970). It is used in the solution of problems involving decision making under uncertainty. It could be used to measure the occurrence of risk factors in management decision-making processes. It involves the use of posterior probabilities, which are obtained by combining the prior probabilities of occurrence of risk factors with their conditional probabilities (Ossenbruggen, 1984). The Bayesian formular as defined by Hoel (1976), Spiegel (1980) and SFMPG (1974) is given as :

$$P(Si/Zj) = P(Si)\, P(Zj/Si)\left[\sum_{k=1}^{n} P(Si)\, P\left(Zj/Si\right)\right]^{-1}$$

Where

P(Si) = the prior probabilities of occurrence of the state of nature (events Si).

P(Zj/Si) = the conditional probabilities of event Zj given event Si have occurred

((Si/Zj) = the conditional probabilities of event Si given Zj have occurred. It is also called the posterior probabilities

P(Zj) = marginal probabilities and are arrived at using the formular

$$P(Zj) = \sum_{k=1}^{n} P(Si)\ P\ (Zj\ /Si)$$

In most applications of the theorem to decision problems, the Zj represent events which precede the occurrence of the observed Si:

For decision making, the posterior probability distribution P(Si/Zj) and the marginal probability distribution PZ$_j$) are required (Morris, 1970). In order to determine these distributions, a prior probability P(Si) must be assigned and a simple likelihood (conditional) distribution P(Zj/Si) must be known (Ossenbruggen, 1984)

Events Zj represent the decision of the poultry farmers as to what type of poultry enterprises to produce while events Si represent the identified risk factors in the poultry business.

For this study, the poultry enterprises involved include

Z_1 = Layer/egg production

Z_2 = Layer + broiler production

Z_3 = Broiler production

Z_4 = Broiler + Cockerels production

Z_5 = Layer + Broiler + Cockerels production

The identified risk factors include,

S_1 = Diseases and Parasites,

S_2 = Pilfering,

S_3 = Windstorm

S_4 = Pest attack and

S_5 = Food Poisoning

Results and Discussion:

Productivity Analysis:

Production performance: The average net return per bird in poultry egg enterprises was N1498.88; per annum and about N250 per bird in Broiler and Cockerels production per a period of three months.

Broiler and Cockerels production is a short gestation enterprise lasting about three months for the production cycle. It could be repeated about three to four times a year depending on level of demand. The profitability analysis shows that poultry production was profitable in the study area.

The average number of birds kept by a farmer was 2746 with a standard deviation of 4058 birds, implying that there were different categories of poultry farms, namely: small, medium and large scale in the study area. This confirmed Omotoso and Ladele (1988) assertion that poultry farms in Nigeria are categorized into small, medium and large scales. About 81% of farms were in the small and medium scale categories.

The average quantity of feed consumed per bird per day was about 0.68 kg and the average labour cost per day per bird was about N0.17. The farmers were well educated with about average of 15 years spent schooling and were quite experienced with average of ten years in poultry farming.

Productivity Analysis:

The estimates of the parameters of the production function are presented in Table 1. The coefficient of determination, R^2, was 0.967 indicating that about 96.7% variation in the value of poultry output in the study area was explained by variation in explanatory variables. It also confirmed a good fit.

The estimated coefficients also represented the elasticities of production (because the lead equation chosen was the Cobb Douglas equation). The elasticities with respect to number of birds (X_1), other operating expenses (X_4), years of schooling (X_5) and experience (X_6) were positive decreasing marginal returns to the inputs. This implies efficient allocation and utilization of these inputs and thus their utilization was in stage II of the production function. The elasticities of feed and labour cost were negative decreasing marginal returns to the input implying inefficiency allocation and utilization. Their continued usage would lead to decrease in total output because the usage was already in stage III of the production function. The coefficients of variables such as, number of birds, feed and labour cost were significant, implying the variables were the most significant inputs in poultry production and they require special attention. The returns to scale (RTS) was 0.253 (Table 2) indicating that poultry production was in stage II and very efficient in the study area and thus resource allocation and utilization were also efficient.

(b) Risk factors Analysis:

The computation of the prior probabilities from the number of birds lost by each poultry enterprise to each of the identified risk factor is presented in Table 3.

Table 1: Estimates of Parameters of Poultry Production in Osun State, Nigeria.

Variables	Parameters	Coefficients	T - ratio
Constant	β_0	*5.4	7.66
Number of birds	β_1	*0.57	4.50
Feed	β_2	-*0.84	6.72
Labour cost	β_3	-*0.047	3.04
Operating expenses	β_4	0.24	1.83
Years of schooling	β_5	0.31	1.92
Farming experience	β_6	0.02	1.14
Coefficent of Multiple Determination	R^2	0.967	
Adjusted R^2	R^2	0.964	
F - value	F - value	124	

* Estimate is significant at 5% level of significance

A total of 3557 birds were lost to all the risk factor out of which 2100 were lost to diseases and parasites alone, followed by a loss of 1100 to feed poisoning. Diseases/ parasites and feed poisoning thus had the largest prior probabilities of occurrence.

The joint and conditional probabilities are presented in Tables 4 and 5. The conditional probabilities are got by dividing the joint probabilities by the prior or marginal probabilities (Agbadudu, 1994).

Table 2: Elasticities and Returns to scale (RTS)

Variables	Elasticities
Number of birds	0.57
Feed	-0.84
Labour cost	-0.047
Operating expenses	0.24
Years of schooling	0.31
Farming experience	0.02
RTS	0.253,

The posterior probabilities, that is, probabilities of occurrence of the identified risk factors given the poultry enterprises are presented in Table 6. The values of the posterior probabilities of diseases/parasites for all the poultry enterprises were largest with that of layer (Zi) and broiler (Z_3) production being the most critical.

The mean value of the posterior probabilities of diseases/parasites was 0.787 and 0.212 for feed poisoning. Therefore diseases/parasites and feed poisoning were the two major risk factors in poultry production in the study area. These risk factors are preventable risks with efficient management practices. Such management practices could include the employment of veterinary services to minimize the incidence due to diseases/parasites and efficient supervision of personnel and resources to control losses due to feed poisoning.

(IV) Conclusion

The study revealed that the productivity and production of poultry industry would increase if feed and labour costs are minimized in addition to efficient management and supervision of resources and personnel to minimise the occurrence of the major preventable risk factors of diseases/ parasites and feed poisoning.

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Table 3: Computation of Prior Probabilities of Occurrence of Risk Factors

Poultry enterprise Produced Zj Number of birds lost to states of nature (Risk factors)Si

	S_1	S_2	S_3	S_4	S_5	Total
Layers only Z_1	400	25	10	50	100	585
Broilers only Z_2	300	20	12	35	200	567
Layers/Broilers Z_3	400	15	10	25	150	600
Broilers/Cockerels Z_4	300	25	15	30	250	620
Layers/Broiler/Cockerels Z_5	700	30	15	40	400	1185
Total birds lost	2100	115	62	180	1100	3557
Prior Probabilities P(Si)	**0.59**	**0.03**	**0.02**	**0.05**	**0.30**	**1.00**

Table 4: Computation of Conditional Probabilities of Occurrence of Risk Factors P(Zj/Si)

Poultry enterprises Zj States of nature

	S_1	S_2	S_3	S_4	S_5	Total
Z_1	0.68	0.04	0.02	0.09	0.17	1.00
Z_2	0.53	0.04	0.02	0.06	0.35	1 00
Z_3	0.67	0.02	0.02	0.04	0.25	1.00
Z_4	0.49	0.04	0.02	0.05	0.40	1.00
Z_5	0.59	0.03	0.01	0.03	0.34	1.00
Conditional Prob.	0.59	0.034	0.02	0.054	0.302	1.00

Table 5: Joint Probabilities of Occurrence of Risk factors

$$P(Zj) = \sum_{i=1}^{5} P(Zj / Si)\, P(Si)$$

Joint Prob.	Value
$P(Z_1)$	0.46
$P(Z_2)$	0.4258
$P(Z_3)$	0.4758
$P(Z_4)$	0.4162
$P(Z_5)$	0.461

Table 6: Computation of Posterior Probabilities of Risk Factors $P(S_i/Z_j) = P(Z_j/S_i)\, P(S_i)/P(Z_j)$

Poultry enterprises	States of nature					
	S_1	S_2	S_3	S_4	S_5	Total
Z_1	0.872	0.003	0.0009	0.009	0.115	1.00
Z_2	0.734	0.0028	0.0009	0.007	0.255	1.00
Z_3	0.831	0.0013	0.0008	0.0042	0.1629	1.00
Z_4	0.693	0.0029	0.001	0.006	0.2972	1.00
Z_5	0.763	0.002	0.004	0.0033	0.231	1.00
Posterior probabilities	**0.779**	**0.0024**	**0.0008**	**0.0061**	**0.2122**	**1.00**

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