The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Asian Journal of Agricultural Extension, Economics & Sociology

17(4): 1-7, 2017; Article no.AJAEES.24376
ISSN: 2320-7027

Empirical Analysis of Egg Production Functions: A Case Study of Ikot Ekpene and Uyo Metropolis of Akwa Ibom State, Nigeria

E. D. Uwah[1], A. J. Arigor[1*], J. A. Igiri[1] and J. U. Ekong[1]

[1]Department of Agricultural Economics, Faculty of Agriculture, University of Calabar, Calabar, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author EDU designed the study, wrote the protocol and supervised the work. Authors AJA carried out all laboratories work and performed the statistical analysis. Author JAI managed the analyses of the study and wrote the first draft of the manuscript. Author JUE managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2017/24376
Editor(s):
(1) Jurislav Babic, Faculty of Food technology, University of Osijek, Croatia.
(2) Piotr Tworek, University of Economics in Katowice, Poland.
(3) Kwong Fai Andrew Lo**,** Agronomy and Soil Science, Chinese Culture University, Taipei, Taiwan.
Reviewers:
(1) Timothy A. Okeowo, Lagos State Polytechnic, Nigeria.
(2) Bergaoui Ridha, National Institute of Agronomy, Tunisia.
(3) Adela Marcu, Banat´s University of Agricultural Sciences and Veterinary Medicine, Romania.
(4) Hasan Vural, Uludağ University, Turkey.
(5) Yin Zhang, Chengdu University, China.
Complete Peer review History: http://www.sciencedomain.org/review-history/19710

Original Research Article

Received 17th January 2016
Accepted 28th June 2016
Published 27th June 2017

ABSTRACT

The study carried out an empirical analysis of egg production functions, a case Study of Ikot Ekpene and Uyo Metropolis of Akwa Ibom State, Nigeria. Specifically, this study was carried out to estimate the egg production functions in the study area, determine the resource use efficiency of egg producers in the study area and to make recommendations based on the findings. Data for this study were obtained from primary source collected from thirty – seven (37) purposively selected poultry farmers using personal observations and interview method while the secondary data were obtained from farm records kept by the farmers. Regression analysis was carried out to show the

**Corresponding author: E-mail: aarigor@yahoo.com;*

relationship between egg lay and several input explanatory variables namely; feed intake, mortality rate, culling rate, labour and floor space. Resource use efficiency analysis was used to determine the rationality of the firms in their use of resources. The result showed that the effect of feed intake and labour on egg lay was significant at 0.01% level, Floor space was also significant at 0.01. Further analysis showed that sum of elasticities for feed, labour and floor (EP) is1.59 indicating an increasing return to scale scenario, implying that a 1% increase in the variables; feed, labour, and floor space will lead to a 1.59% increase in egg lay. Of all the four egg production function estimated in this study, it became clear that the exponential function was found to be the lead equation since four out of the five variables employed in this study were significant where as other forms had less numbers of significant variables. The analysis with respect to resource use showed that feed, labour and floor space were over utilized during the period of egg lay.

Keywords: Egg production; production function; regression analysis; resource efficiency and elasticity.

1. INTRODUCTION

The poultry industry comprises of several aspects which includes raising of table egg and meat, production of day-old chicks, point-of-lay pullets or ready-to-lay birds, poultry feeds, vaccines and drugs. Of all the aspect listed above, the first two are the main branches of poultry production [1]. Poultry has a worldwide acceptability across nations and religions unlike pigs and cattle that is discriminated against by some religion. Products from poultry provides an acceptable form of animal protein to most people throughout the world [2]. Poultry meat and eggs offer considerable potential for meeting human needs for dietary animal supply [3]. The poultry industry has become a diverse industry with a variety of business interest such as egg production, broiler production hatchery and poultry equipment businesses [4]. Egg is affordable and it's sale helps to provide employment and means of livelihood to thousands of people [5]. Commercial Poultry production in Nigeria grew rapidly during the 1963 to 1983 periods but performed poorly thereafter. Despite the growth recorded in the poultry industry, egg demand still outweighs egg supply and import has remained on the high side. About 732 million eggs were imported into Nigeria in 1999, 730 million in 2000. The situation remained so because most of the farmers involved in egg production lack technical knowledge, managerial ability and have failed to seek the counsel of experts which has limited their ability to maximise profit which in turn translate to huge capital loss, hence discouragement and frustration . This down-turn was attributed to high cost of poultry feeds, day-old chicks, drugs and especially stringent fiscal measures adopted by Government during the oil boom period resulting to the shutting down of several poultry farms [6]. [7] observed that the decline was drastic from 1986 due to the ban on the importation of maize which constitutes about fifty percent of the required poultry feed. The per-capita consumption of animal protein is higher in developed countries than the developing countries.

According to [8], "the activity of production may be defined as the process of combining and coordinating materials and factors services (inputs) in the creation of goods and services (output). [9] defined production as the process of transforming inputs into outputs. They also asserted that production function stipulates the technical relationships between inputs and outputs in any production scheme or process. Production function is a purely technical relationship which connects factors and outputs. It describes the laws of proportion that is, the transformation of factor inputs into products (outputs) at any particular time period [10]. The term production function is unique in concept and could be expressed mathematically. The production function portrays an input-output relationship. It describes the rate at which resources are transformed into products [11].

Production function in traditional economic theory assumes the form;

$$Y = f(X_1, X_2 .....X_n) \quad (1)$$

Equation 1 implies that output (Y) is a function of inputs (X_1, X_2 .....X_n)

In explicit form, there are many forms of equations ranging from linear to power (Cobb-Douglas), quadratic, square root, exponential and transcendental functions. The functions are assumed to be continuous and differentiable [9,12]. It's differentiability has allowed the derivation of elasticities, marginal values and

other parameters which are identified and used in determining resource productivity as well as efficiency. Productivity on the other hand is defined as output per unit of input [11]. [9] considered agriculture productivity as the index of the ratio of the value of total farm output to the value of total inputs used in the farm production. It is difficult to see the future clearly enough to allow the making of current dispositions of resources that will be best for the future, nor to measure accurately the productivity of the portion of current resources to be transformed. Therefore, average as well as marginal products are used in measuring productivity. [10] defined average product as the total output from using a set of input divided by the amount of any of the inputs being used. Thus the average product of labour would be given as total product (TP) divided by the total amount of labour used [13] Marginal productivity on the other hand is defined as the increase in total output that results from the employment of an extra unit of variable factors of production.

[1] observed that 250-300 eggs are laid per bird during the first year of lay. [14] observed that the point showing a drastic rate of increase in weekly egg production with advancing age occur during the first quarter of the production (40^{th} -52^{nd})weeks of lay. [15] stated that the optimum level of egg production should be reached at about 25 weeks of egg lay or 46 weeks of bird age. Researches on input and output relationship in commercial egg production showed that feed intake has increasing returns on egg lay. [16] in his study found out that effect of feed intake on egg lay was significant and feed intake had a positive effect on egg lay. Egg production in Nigeria is also troubled by unstable trends in the economy. These problems make it very difficult to expand the scale production and new egg producers find it hard to start a business. Other problems that hinder egg production in Nigeria agricultural sector includes high cost of feed, outbreaks of diseases, and marketing problems [5]. This situation has forced many small scale poultry farms to close down and those still managing to survive are producing at very high cost with serious input limitations.

Commercial egg production is widely adopted and practiced in Akwa Ibom State especially in Ikot Ekpene and Uyo metropolis. There seems to be frequent movement of eggs from these towns to Calabar Municipality in Cross River State, probably due to high demand for eggs in the latter. However, the extent to which egg production in these areas is affected by the various variables relevant in egg production is not known, also the differences in input and output prices in the areas may affect production. It is not known if farmers are to continue with egg production or if the farmers are efficiently utilising their resources. There is need to investigate the functional relationship existing between egg production and the various explanatory variables and also to attempt to proffer answers to the following questions; i. To what extent is egg lay affected by the following explanatory variables (feed, mortality rate, culling rate, labour and floor space).

The specific objectives of this study are to;

i. Estimate the egg production functions in the study area
ii. Determine the resource use efficiency of egg producers in same area
iii. To make recommendations based on the findings of the study.

2. RESEARCH METHODOLOGY

The study made use of both primary and secondary data and the study covered the period of forty eight (48) weeks. The primary data were obtained from thirty seven (37) purposively selected poultry farmers using personal observations and interview method. While the secondary data were obtained from farm records kept by farmers. Data obtained from farm records include floor spacing, number of dead birds (mortality), number of eggs laid daily and number of workers/ attendants. The poultry farmers raised their birds in intensive system of poultry management. Three tier battery cage system were used by 35 farmers while 13 farmers raised their birds in deep litter system. The birds were fed twice a day and eggs (small, large and Jumbo size) were collected twice a day. With the large size eggs comprising of 70%, jumbo size 20% and small size making up for the balance of 10%. The strains of birds raised includes Rhode Island Red (RIR) which is noted for her good egg production. An average of about Three thousand (3,000) birds were kept by each of the purposively selected farms summing it up to 111,000 birds in all. Each of the farms engaged a minimum of 10 staff. Product prices were taken as the average market prices of eggs whereas the input prices were taken as the average market prices of feed, wage rate. In these farms, eggs collection were made twice a day and the eggs were of different sizes; small, medium and

jumbo. The study made use of four functional forms, out of which a lead equation was obtained. The equations include the following;

(i) Linear Production Function which is expressed as;

$$Y = bo + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + \mu t \quad (2)$$

Where

Y = Output (egg lay)
bo = intercept
$b_1 – b_5$ = regression coefficient
μ = error term
$x_1 – x_5$ = explanatory variables

(ii) Exponential production function

$$\ln Y = bo + b_1 x_1 + x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + \mu t \quad (3)$$

(iii) Double Log Production Function

$$\ln Y = \ln bo + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + \ldots\ldots b_5 \ln x_5 + \mu \quad (4)$$

(iv) Semi Log Production Function

$$Y = bo + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + \ldots\ldots\ldots b_5 \ln x_5 + \mu \quad (5)$$

From the equations above, it imply that a total change in egg production is brought about by change in input variables. A priori expectation suggest that feed intake and labour per bird should be positively related to egg lay per bird. On the other hand, average mortality rate, average culling rate and floor space per bird are expected to vary negatively with egg lay. It is therefore expected that xi and x4 will carry positive sign while x2 and x5 will carry negative signs.

The elasticity of production (EP) for the different production forms were estimated using the following;

(i) Linear Function

$$EP = b_1 * X/Y \quad (6)$$

here, MPP = b

Where;

b_1 = Coefficients of the variables

X = mean of the variables

Y = mean of output

(ii) Exponential Function

$$EP = b_1 * X \quad (7)$$

Where

b_1 = Coefficients of the variables
X = mean of the variables

(iii) Double log function

$$EP = b_1 \quad (8)$$

where

b_1 = coefficient of the variables

(iv) Semi Log Function

$$EP = b_1/Y \quad (9)$$

Where

b_1 = Coefficients of the variables
Y = mean of the Output

Efficiency in resource use is achieved when the marginal Value of the Product (MVP) is equal to the price of the input.

The formula is given as;

$$MVP = P_x \text{ or } MVP/Px = 1 \text{ in a ratio form} \quad (10)$$

Where

MVP = Marginal Value Product of input (11)

P_X = Price of input

The MVPs were obtained by multiplying their respective marginal marginal physical products with their prices.

That is, MVP = MPP * Py (12)

3. RESULTS AND DISCUSSION

3.1 Estimate of Egg Production Functions for 48 Weeks

The regression analysis results of the egg production function for 48 weeks are presented

in four production functional forms namely; linear, Exponential, Double log and Semi- Log forms above. Of the four functional forms estimated, the exponential form was chosen as the lead equation and used in the discussion because four of the five variables were significant whereas the other forms had less number of significant variables as presented in the Table 1. The significant variables were feed, culling rate (significant at 5%), labour and floor space which were significant at 1% level. These variables significantly affected the egg lay during the entire 48 weeks of egg lay.

Floor space carried a negative sign implying that less output is achieved with increased floor space. This finding agrees with that of [16]. The elasticity of production for feed, labour and floor space are 0.74, 1.47 and -0.62 respectively indicating that a 1% increase in these variables will bring about a 0.74, 1.47 and -0.62 percent increase in egg lay. The sum of elasticity is given as 1.59 indicating an increase in return to scale which implies that if all the above mentioned variable increase by 1%, egg lay will increase by 1.59%.

3.2 Resource Use Efficiency of Poultry Farmers for 48 weeks

In the entire 48 weeks of egg lay, the resource use efficiency for feed, labour and floor space was 0.70, 0.12 and 0.72 respectively. This implies that through out the whole laying phase, (production cycle), all the three resources; feed, labour and floor space were over utilized. The farmers were not rational in their resource utilization. These finding differs from [16] who found out that farmers were rational in their resource use based on the study of 15 farms of Long man brown birds. The variation may be attributed to the fact that he used only feed resource to determine rationality in his study and also fewer number of farms and a homogenous flock size as against this study where 37 no. farms were considered and various variables such as feed, labour and floor space were taken into consideration.

Table 1. Egg production estimate for 48 weeks of egg lay

	Functional forms			
Variables	**Linear**	**Exponential**	**Double log-exponential**	**Semi log**
C	-37904	9.957	2.265	-599063.4
	(-2.026)*	(40.163)***	(4.711)***	(-0.759)NS
Feed	3.178	1.20E-05	0.934	-11051.78
X_1c	(9.344)***	(2.667)**	(14.524)***	(-0.105)NS
Mortality rate	-433.4444	0.006	-0.001	-1553.553
X_2c	(-0.638)NS	(0.667)NS	(-0.314)NS	(-0.375)NS
Culling rate	619.837	0.031	0.002	-8611.879
X_3c	(0.0605)NS	(2.270)**	(0.398)NS	(-1.337)NS
Labour	42277.12	0.654	0.202	212041.3
X_4c	(3.847)***	(4.493)***	(2.058)**	(1.317)NS
Floor Space	206.101	-0.005	-0.028	223549.2
X_5c	(3.024)***	(-4.353)***	(-0.411)NS	(1.987)*
R^2	0.993	0.853	0.989	0.756
Adj. R^2	0.992	0.829	0.987	0.717
Akaike info	23.982***	1.519NS	-1.050NS	27.573***
F. Statistics	919.061***	35.846***	542.662***	19.218***

Source: Field study

Note : * = *Significant at 10%*
** = *Significant at 5%*
*** = *Significant at 1%*
NS = *Non Significant*
Figure in parenthesis represents t – statistics

Table 2. Estimate of egg production function (48 weeks)

Period of lay (48 weeks)	Variables	APP (Y/X)	MPP	MVP(MPP X PY)	PX(N)	PY(N)	Allocative efficiency
Feed	X_1c	5.1601	2.25	33.75	48.00	15.00	0.70
Labour	X_4c	377.72	554.53	5665.80	48,000.00	15.00	0.12
Floor space	X_5c	920.37	572.01	8550.15	12,000.00	15.00	0.72

4. CONCLUSION AND RECOMMENDATIONS

Findings from the research above points to the fact that egg lay was affected by mortality, thus farmers should pay attention more to health care services of the layers to further reduce the mortality of birds to the barest minimum. The study further reveals that in estimating the egg production function of poultry birds, it is advisable that the researcher employs the exponential production function for effective estimation. The resource use efficiency of feed, labour and floor space given as 0.70, 0.12 and 0.72 respectively implies over utilization of these resources. This result differs from those of [16] who found out that farmers were rational in their resource utilization. It also differs from result of [17] whose finding shows that poultry farmers are relatively technically efficient. Profitability in broiler production can be achieved if farmers feed their birds with recommended amount of feed, employ optimum man-day in the farm and provide a floor space of 0.1 m^2 per bird in the farm. The study concludes that poultry production is profitable in the study area, and that most of the respondents are relatively efficient technically.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Oluyemi JA, Roberts FA. Poultry production in warm wet climates. London: MMacmillan; 1988.
2. Smith OP. Economics of poultry production. A B. Agri. Dissertation submitted to the Department of Agric. Economics and Extension, University of Calabar, Calabar; 2001.
3. Folorunsho OR, Onibi GB. Assessment of the nutritional quality of eviscerated waste from selected Chicken types. Proceedings from 1st Annual Conference on Development in Agriculture and Biological Sciences. 27th April, 2005. School of Agriculture and Agric. Technology, Federal University of Technology Akure, Nigeria; 2005.
4. Amoss TT. Analysis of backyard poultry production in Ondo State, Nigeria. International Journal of Poultry Science. 2006;5(3):247-250.
5. Ojo SO. Productivity and technical efficiency of poultry egg production in Nigeria. International journal of Poultry Science. 2003;2(6):459-464.
6. Dada SA, Atanda LA, Alabi BE. Utilization of *Leucana* leaf meal as a protein supplement in broiler finisher ration. Nigeria Journal of Animal Production. 1988;27(1):41-47.
7. Dedekuma E. Feed millers cry out as cost of borrowing inp go up. Business Concord. 1989;22.
8. Cowling K, Metcif D, Rayner AJ. Resource structure of agriculture: An economic analysis. Oxford: Pergamon Press; 1970.
9. Olayide SO, Heady EO. Introduction to agricultural production economics. Ibadan: Ibadan University Press; 1962.
10. Koutsoyianis A. Modern microeconomics, 2nd edition. London Macmillan; 1979.
11. Doll JP, Orazem F. Production economic theory with applications. Ohio: Columbus Grid; 1978.
12. Sankhayan PL. Introduction to the economics of agricultural production. New Delhi: Prentice Hall; 1988.
13. Nmadu JN. Ogidan IO, Omolehin RA. Profitability and resource use efficiency of poultry egg productionin Abuja, Nigeria. 2014;35(4):134–146.
14. Eyenihi EA. Effect of operating cost on profit and risk analysis of the broiler industry. A Case – study of two farms in Calabar. B.Sc Dissertation of the Department of Agric. Economics and Extension, University of Calabar, Nigeria; 1987.
15. Say RR. Manual of poultry production in the tropics. London: C.A.B. International; 1993.

16. Okorie NM. Input-output relationship in commercial egg production in Calabar, Cross River State, Nigeria. Unpublished M.Sc. Thesis of the Department of Agric. Economics, University of Calabar; 2000.

17. Yusuf SA, Malomo O. Technical wfficiency of poultry production in Ogun State, Nigeria. Using data envelopment analysis. International Journal of Poultry Science. 2007;6(9):622-629.

© 2017 Uwah et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/19710