Comparative Analysis of Allocative Efficiency in Input use by Credit and Non Credit User Small Scale Poulty Farmers in Delta State, Nigeria

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Abstract: This study examined the relative allocative efficiencies in input use by credit user and non credit user small scale poultry farmers in Delta State, Nigeria. Relative elasticities of production and returns to scale of the defined poultry farmers were examined. Primary data were collected from a random sample of 108 small scale poultry farmers consisting of 54 credit users and 54 non credit users. A stochastic frontier production function model was used to analyse the data. Results of the findings indicate that none of the poultry farmer groups allocated any production input optimally. All the variables entered in the model were significant for credit and non credit users except drugs and veterinary services which was not significant for non credit user poultry farmers. On the whole, the credit user poultry farmers over utilized ($K_{ij}<1$) hired labour, family labour and under utilized ($K_{ij}>1$) feed input as well as drugs and veterinary services. The non credit user farmers over utilized ($K_{ij}<1$) three inputs namely hired labour, family labour and capital and under utilized ($K_{ij}>1$) feed input. It is therefore the recommendation of this study that economic policies and programmes such as the Delta state microcredit programme should be strengthened so as to improve access to credit and enhance efficiency in the use of resources by small scale poultry farmers.

Key words: Alloctive efficiency, credit use, poultry farmers, returns to scale

INTRODUCTION

The food and Agriculture Organization of the United Nations (FAO) stipulates a daily requirement of 65 to 75 g of total protein out of which 40% or 36 g should be derived from animal protein. Currently, the estimated per caput animal protein consumption is about 17gm which indicates a shortfall. The shortfall can be corrected through maximum use of available resources to foster the production of livestock. This will in turn lead to an increase in total output of animal and food products such that the generality of the populace would have adequate protein intake. This will improve the nutritional status of children and other groups who are most vulnerable to malnutrition which can lead to permanent damage of the mental faculties and physique.

Poultry offers the greatest scope of increasing the quantity and quality of animal protein. Poultry meat and eggs account for about 30% of total livestock output in Nigeria of which eggs account for over 80% (Evbuomowan, 2005). Commercial poultry is well established in the country with substantial infrastructure (poultry houses, feed mills, hatcheries and processing plants) already on ground. However, most of these items became idle for reasons associated with high cost of strategic inputs and working capital as well as competition from cheap imports. The embargo placed on the importation of poultry products in 2002 by the Federal Government is aimed at encouraging local production. The challenge therefore, is how to produce poultry products at sustainable levels in order to bridge the protein supply gap in the nearest future.

The poultry industry in Nigeria has undergone a significant transformation since the early fifties, from a backyard, peasant and primitive household-oriented husbandry of indiscreet breeds of semi-wild chickens, to the cash-oriented, modern and large scale poultry which dot our country-side and urban centres today. It can be said that poultry keeping has become a business in Nigeria. The estimate of livestock resources as reported by RIM (1993) indicate that there are 103 million indigenous poultry and 15 million commercial (exotic) poultry in the country. It is therefore clear that much needs to be done to accelerate the transformation to commercial poultry husbandry and sustain the interest of present and intending modern poultry farmers in Nigeria.

The early government agricultural programmes emphasized poultry farming and contained substantial subsidies in day-old chicks and feeds. This attracted millions of peasant farmers, civil servants, professionals

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and entrepreneurs into poultry farming at small, medium and large scales. Following changes in governments and government policies, particularly during the structural adjustment programme, the huge subsidies in the agricultural sector were withdrawn, and many poultry farmers closed down in the face of rising costs of stock and raw materials.

This study examined the relative allocative efficiency in resource use by credit user and non credit user small scale poultry farmers. Allocative efficiency is achieved for a given resource where its marginal value product is equal to its unit price (Nwaru *et al.*, 2006). The hub of efficient resource husbandry is the manipulation of available scarce resources and technical know how to achieve the highest possible benefits within given natural and socioeconomic environment. Most studies on efficiency in the past have been on arable crops production in Nigeria. One of such studies by Ike (2008) pointed that there is low resource productivity and efficiency in Nigerian agriculture, hence the need for resource users to come to a dynamic and innovative level wherein they can create, establish and nurse economic activities with greater success through efficiently mobilizing and reallocating available resources. Studies by Mejeha and Obunadike (1998) as well as by Ike (2009) pointed out the roles of credit in enhancing resource productivity and efficiency in agriculture.

This study specifically estimated the production function of credit user and non credit user small scale poultry farmers as well as the relative elasticities of production. It also determined the returns to scale of the defined poultry farmers and estimated the allocative efficiency indices of the different resource inputs applied in the poultry farming business.

METHODOLOGY

Study area/Data collection: The study was conducted in Delta State in 2010. The State lies between Longitudes 5°00′ and 6°45′ East and Latitudes 5°00′ and 6°30′ North. The State has a total land area of 17,440 km², about one-third of this is swampy and water logged, (Delta State Dairy, 2003).

Delta State is bounded in the north by Edo State, in the East by Anambra and Rivers State and in the south by Bayelsa State. The Atlantic Ocean forms the western boundary while the North-West boundary is Ondo State. The State is made up of 25 Local Government Areas and has a population of 4.1 million (NPC, 2006).

Delta State has a tropical climate with distinct dry and rainy seasons. The rainy season is mainly from April to October while the dry season is from November to March. The rainfall ranges from 190.5 to 266 cm monthly. The temperature ranges from 29 to 340°C with an average

of about 30°C (Delta State Ministry of Agriculture Statistic Information, 2000).

Delta State consists of three (3) agro-ecological zones. These are the Delta North; Delta Central and Delta South agro-ecological zones. The three zones were used for the study. Multistage sampling technique was used to draw samples for study. Of the nine LGA's that make up Delta-North agro-ecological zone, three (3) were randomly selected. The same procedure applied for both Delta Central and Delta South agro-ecological zones. This gave a total of nine (9) local government areas. From each of the nine (9) local government areas, three (3) communities were randomly selected per local government areas. This gave a total of 27 communities.

With the assistance of agricultural extension agents of Delta State Agricultural Development Programme in charge of the chosen communities the listing of credit user and non credit user small scale poultry farmers in the area was done. The lists formed the sample frames from where random samples of the credit user and non credit user poultry farmers were chosen. In all, 54 credit user poultry farmers and 54 non credit user poultry farmers consisting of two farmers in each category per community were chosen for a detailed study. Data for the study were collected through the use of structured questionnaire.

Data analysis: The empirical production function applied in this study was of the form:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \epsilon_i \qquad (1)$$

where, ln is logarithm to base e; Y is poultry output for the ith farmer (N); X_1 is hired labour (Mandays); X_2 is household labour (Mandays); X_3 is value of feeds (N); X_4 is value of drugs and veterinary services (N); X_5 is capital (N), made up of depreciation on fixed assets, interest on loans, wages and ϵ_i is the error term assumed to fulfill all the assumptions of the classical linear regression model. $_0$ and $_1$ are the unknown parameters estimated by the method of Maximum likelihood data disaggregated on the basis of credit and non credit use. The estimated coefficients for the inputs formed the basis for the analysis of allocative efficiency.

According to Onyenweaku (1994), allocative efficiency is determined by equating the Marginal Value Product (MVP) of the ith input to its price or marginal factor cost.

That is:
$$MVP_{xi} = P_y f_{i} = P_{xi} \qquad (2)$$

where,
MVPxi (I = 1, 2, ….5) = The marginal value product of the ith input

Table 1: Estimated production functions for the credit user and non credit user poultry farmers

Variable	Parameter	Credit user	Non credit user
intercept	β_0	0.684 (2.369)**	0.821 (2.263)**
Hired labour	β_1	0.093 (1.981)**	0.046 (1.968)**
Family labour	B_2	0.124 (2.056)**	0.091 (2.961)***
Feed	β_3	0.186 (3.268)***	0.306 (4.012)***
Drugs & vet. serv.	β_4	0.462 (2.913)**	0.103 (1.265)
capital	β_5	-0.187 (-2.250)**	-0.154 (-2.351)**
R2		0.7225	0.6921
F-Ratio		4.268**	3.147**

***: Statistically significant at 1%; **: Statistically significant at 5%; *: Imply statistically significant at 10%

$f_i = dY/dX_i$ = Marginal Physical Product (MPP) of the ith input

P_y = Unit output price

P_{xi} (i = 1, 2, ….5) = Unit price or marginal factor cost of the ith input. The allocative efficiency index, kij, for each farmer group is:

$$\frac{MVP_{xi}}{P_{xi}} = \frac{P_y f_i}{P_{xi}} = Kij \qquad (3)$$

where, i is the particular input and j is the poultry farmer group and all other variables are as previously defined. For any input that is measured in monetary terms, P_{xi} becomes irrelevant and Eq. (3) translates to:

$$MVP_{xi} = P_y f_i = Kij \qquad (4)$$

In this study, the gross poultry farm output, Y is measured in monetary terms (Eq. 1); hence the Marginal Product (MP) is in monetary terms. Therefore, P_y becomes irrelevant and Eq. (3) becomes:

$$\frac{MVP_{xi}}{P_{xi}} = \frac{P_y f_i}{P_{xi}} = Kij \qquad (5)$$

and Eq. (4) becomes:

$$MVP_{xi} = f_i = Kij \qquad (6)$$

Absolute or maximum allocative efficiency for a particular group of farmers is confirmed with respect to given input if Kij=1. The input is over-utilized if Kij<1 and under utilized if Kij>1. The two groups of farmers would have achieved equal allocative efficiency if Ki1 = Ki2. The required percentage change (Wij) by which a particular input must be changed in order to achieve absolute allocative efficiency is:

$$Wij = (1-Kij) 100 \qquad (7)$$

If Wij is zero, absolute allocative efficiency has been achieved. A negative Wij implies that an increased employment of the input is required and vice versa.

RESULTS AND DISCUSSION

Estimates of the production functions: The estimated production functions by the Maximum Likelihood Estimation for the credit user and non-credit user small scale poultry framers are as summarized and presented in Table 1. The F-ratio for each of the estimated models is statistically significant at 5%; hence each of them is adequate for use in further analysis. The R2 is 0.7225 for the credit user small scale poultry farmers and 0.6921 for the non credit user small scale poultry farmers indicating that the included predictor variables explained about 72 and 69% of the variation in output for the credit user and non-credit user respectively. Each of the intercept term for the credit user and non credit user poultry farmers is positive and statistically significant. These indicate the revenue accruable to the farmers at zero level of use for all the inputs. Normally, expenses on fixed factors of production such as interest on capital tied to buildings and other permanent structures would keep running whether or not the variable factors of production are used. Zero level of use for the variable inputs should entail zero output and income, while at the same time these costs are incurred.

The intercept for the credit user poultry farmers is larger than that for the non credit user poultry farmers. This is in line with a priori expectations and also agrees with the observations from researchers like Desai and Mellor (1993) and Nwagbo (1989) that farm level credit when properly extended encourages diversified agriculture which stabilizes and perhaps increases resource productivity, agricultural production, value added, net farm incomes and therefore facilitates adoption of innovations in farming, encourages capital formation and marketing efficiency. However, this is against the findings of Nwaru et al. (2006) who reported that receiving credit contributed to farmers' economic inefficiency. They explained that this could be the result of disbursement of credit in cash rather than in kind and loan misapplication engendered by poverty.

Labour is a very critical resource next to land in traditional agriculture because it is in it that the decision making power in the production process resides (Upton, 1996). The coefficients for hired labour are statistically significant in the estimated models. This agrees with the

Table 2: Estimated coefficient and mean values of inputs and output

Farmers groups	Credit users	Non credit users
Coefficient of estimated parameters		
Hired labour	0.093	0.046
Family labour	0.124	0.091
Feed	0.186	0.306
Drugs and vet. Services	0.582	0.076
Capital	- 0.169	- 0.086
Mean values of inputs and output		
Hired labour	74.256	76.592
Family labour	92.681	46.238
Feed	19821.610	172610.321
Drugs and vet. services	7843.864	8697.402
Capital	8234.921	3006.560
Output	76289.136	6713.882

Table 3: Allocative efficiency indices for the poultry farmer groups

Farmers groups	Credit user	Non credit users
Marginal value products (MVP$_{xi}$)		
Hired labour	78.659	62.162
Family labour	81.726	94.280
Feeds	981.031	998.216
Drugs and vet. services	930.650	0.415
Capital (N)	-42.611	-33.364
Unit input price (Pxi)		
Hired labour (N/Manday)	266.67	266.67
Family labour(N/Manday)	266.67	266.67
Feeds (N)	700.00	700.00
Drugs and vet. services (N)	100.05	100.05
Capital (N)	70.59	70.59
Allocative efficiency indices		
Hired labour	0.295	0.233
Family labour	0.306	0.354
Feeds	1.401	1.426
Drugs and vet. services	1.551	**
Capital	-0.604	-0.473
Required changes in allocative efficiency		
Hired labour	70.50	76.70
Family labour	69.4	64.6
Feeds	-40.1	-42.6
Drugs and vet. services	-55.1	**
Capital	39.6	52.7

**: Allocative efficiency indices was not derived because the coefficient was not significantly different from zero

reports from Effiong and Nwaru (2002) and Fasasi and Fasina (2005). That for family labour was also statistically significant. In all the estimated models, both the hired labour and family labour have positive coefficients. This conforms to *a priori* expectations because farm operations in Nigeria have remained labour intensive hence the addition of more mandays of labour would lead to higher output both in food crops and animal production.

The coefficient for feed is highly significant and positive for the credit user and non credit user poultry farmers. The coefficient for value of drugs and veterinary services is statistically significant only in the estimated model for the credit user poultry farmers. The positive signs conform to a priori expectations. As more and more drugs and veterinary services are procured for the birds, output of poultry increases. This further implies that credit use helps the poultry farmer to be more active in the farm input market. The coefficient for capital is highly significant and negative in each of the estimated models.

This result conforms to a *priori* expectations. At the established farm size or installed capacity of the farm, rising expenses on depreciation, interest, rent and wages would impinge on the allocative efficiency and productivity of the farm.

Allocative efficiency indices: Table 2 contains the means of inputs and output and the estimated coefficients of the various inputs. With these and given the double log specification of the production models, the Marginal Value Products (MVP) of the various inputs were derived and reported in Table 3. With the MVP and unit input price (Pxi), the allocaticve efficiency indices as presented in Table 3 were derived. Since drug and veterinary services use by the non credit user poultry farmers is statistically insignificant, its efficiency index was not derived. The results here indicate that none of the defined groups of poultry farmers achieved absolute allocative efficiency because none achieved an allocative efficiency index of unity. They were all allocatively inefficient in the use of all the inputs. This result agrees with the works of Nwaru *et al.* (2006) for swamp rice farmers in Ogun State of Nigeria. Also they did not achieve equal allocative efficiency in the use of any input. However, both farmer groups achieved their best allocative efficiency (with an efficiency index closest to unity in the allocation of feed input, with the credit user poultry farmers being more efficient in allocating this input. They achieved their least efficiency (with an efficiency index farthest from unity) in allocating hired labour, with the credit user poultry farmers performing better.

On the whole, the credit user poultry farmers over utilized (Kij<1) hired labour, family labour and under utilized (Kij>1) feed input as well as drugs and veterinary services. The non credit user farmers over utilized (Kij<1) three inputs namely hired labour, family labour and capital and under utilized (Kij>1) feed input. Situations of over or under-utilization of farm inputs give indication to the directions in which particular farm inputs could be re-allocated in order to strike at maximum allocative efficiency.

The required percentage changes in allocating each input is derived and presented in Table 3. This Table reveals that the credit user poultry farmers need to increase their current level of use of feed by 40.1 percent while the use of drugs and veterinary services should be increased by 55.1%. They should reduce the use of hired labour, family labour and capital by about 70.5, 69.4, and 39.6%, respectively. On the other hand, the non credit user poultry farmers should increase the level of feed input use by about 42.6% while hired labour, family labour and capital should be reduced by about 76.7, 64.6 and 52.7%, respectively to achieve optimum allocative efficiency.

Table 4: Elasticity of production and returns to scale

Input	Credit users	Non-credit users
Hired labour	0.093	0.046
Family labour	0.124	0.091
Feeds	0.186	0.306
Drugs and vet. services	0.582	0.076
Capital	-0.169	-0.086
∑Ep	0.816	0.433

Elasticity of production and returns to scale: The elasticity of production is a concept that measures the degree of responsiveness of output to changes in input. It measures the proportionate change in output as a result of a unit change in input. The estimates for the parameters of the production function are the direct elasticities of production for the various inputs, given the double log specification of the model. The coefficients of elasticity for the various inputs are derived and presented in Table 4. The output of poultry is inelastic with respect to all the inputs ($Ep<1$), indicating that a large change in the resource level(s) will lead to a less than proportionate change in output. This is in line with the report of Nwaru *et al.* (2006) and implies that in the short run, poultry production cannot be increased to meet immediate increase in its demand. For instance, a change in the quantity of feed by 1 unit brings about a change, in the same direction, of 0.186 units in the output for the credit user poultry farmers and 0.106 units in the output for the non credit user poultry farmers.

In the same way, a change of 1 unit in capital employment brings a change, in the opposite direction, of 0.169 units in the output for the credit user poultry farmers and 0.086 units in the output for the non credit user poultry farmers. The summation of the coefficients of elasticity of production for the various inputs implies that both farmer groups are operating at decreasing returns to scale. This result coupled with the fact that output is inelastic with respect to all the inputs, implies that both the credit user and non credit user poultry farmers can improve on their efficiency by an overall increase in their current levels of resource employment, particularly feeds as well as drugs and veterinary services.

CONCLUSION

Results from this study indicate that neither the credit nor non credit user poultry farmers achieved optimum allocative efficiency in the use of any of the inputs. The implication is that input reallocation is needed for efficiency to be improved. Even though credit use have had impacts on allocative efficiency of input use by credit user poultry farmers, much still need to be done in order for the farmers to increase the level of use of feeds as well as drugs and veterinary services which are the major inputs in poultry production.

This point to the fact that policies which encourages the giving of credit to small scale farmers generally in Delta State should be vigorously intensified and sustained. This will enable credit user small scale poultry farmers to appropriately increase their current use level of feed as well as drugs and veterinary services and reduce human labour involvement in poultry production. Non credit user poultry farmers should be given the opportunity to access credit so as to increase the overall level of poultry production in Delta State.

REFERENCES

Delta State Dairy, 2003. Delta State Printing Press, pp: 1.

Delta State Ministry of Agriculture, 2000. Statistical Information. Delta State Printing Press, pp: 1-3.

Desai, B.M. and J.W. Mellor, 1993. Institutional Finance for Agricultural Development: An Analytical Survey of Critical Issues, (Food Policy Review 1), Washington: International Food Policy Research Institute.

Effiong, E.O. and J.C. Nwaru, 2002. Production Function Analysis of Selected Food Crops in Akwa Ibom State, Nigeria. J. Appl. Chem. Agric. Res., 8(2): 92-100.

Evbuomowan, G., 2005. Empirical Analysis of cost and Returns to commercial Table egg production in Lagos State. The Proceedings of Farm Management Association of Nigeria Conference, pp: 18-20.

Fasasi, A.R. and O.O. Fasina, 2005. Resource Use efficiency in Yam production in Ondo State. The Proceedings of Agricultural Society of Nigeria, pp:184-186.

Ike, P.C., 2008. Estimating production technical efficiency in Irvingia seed (Ogbono) species farmers in Nsukka agricultural zone in Enugu state, Nigeria. J. Sustain Trop, Agric. Res., 9(28): 1-7.

Ike, P.C., 2009. Credit availability, utilization and repayment among smallholder women crop farmers in Enugu state, Nigeria. Farman J., 10(1): 1-8.

Mejeha, R.O. and A. Obunadike, 1998. The impact of credits on adopting innovations on fertilizer use, Yam minisett and cassava in anambra State of Nigeria. Nigerian J. Agric. Teacher Educ., 7(1-2): 92-100.

NPC, 2006. National Population Commission Provisional Census figure Abuja NPC.

Nwagbo, E.C., 1989. Impact of institutional credit on agriculture in funtua local government area of Katsina State, Nigeria. Samaru J. Agric. Res. 6:75-86

Nwaru, J.C., C.E. Onyenweaku, and E.C. Nwagbo, 2006. A comparative analysis of allocative efficiency in input use by credit and non credit user food crop farmers in IMO state of Nigeria. J. Sci. Agric. Food Technol. Environ., 6(1): 90-97.

Onyenweaku. C.E., 1994. Economics of Irrigation in Crop Production in Nigeria Issues. In: Berth, S.A., (Ed.), African Rural Development2, Arlington, USA: Winrock International Institute of Agricultural Development/African Rural Social Sciences Research Networks, pp: 129-138.

Upton, M., 1996. The Economics of Tropical Farming Systems. Cambridge University Press, USA., pp: 282-286.