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COMPARATIVE EFFICIENCY ANALYSIS OF BROILER FARMING UNDER AFTAB BAHUMUKHI FARM LIMITED SUPERVISION AND FARMERS' OWN MANAGEMENT

S. Akhter and M. H. A. Rashid[1]
Ex-post graduate student, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

ABSTRACT

This study was conducted to assess the comparative efficiency of Aftab Bahumukhi Farm Limited (ABFL) supervised broiler farms and farmers' own managed broiler farms. Data were collected from randomly selected 90 broiler farmers of which 45 were ABFL supervised farmers and 45 were own managed farmers. Cobb-Douglas stochastic production function and cost frontier function were applied to determine the technical, allocative and economic efficiency of broiler farming. Technical and economic inefficiency effect models were also estimated. The estimated mean technical efficiency of all farms was 94.06 percent. Whereas it was 94.49 percent for ABFL supervised farmers and 93.66 percent for the own managed broiler farm owners. The estimated mean allocative efficiency was 96.76 percent for all farmers, and 96.51 for ABFL supervised farmers and 96.45 percent for own managed broiler farm owners. The mean economic efficiency was estimated at about 91.60 percent for ABFL supervised farmers, 90.34 percent for own managed farmers and 91.00 percent for all farmers. This implies that the cost of broiler production per farm can be reduced by 9 percent keeping the output constant. The findings reveal that ABFL supervised farmers and own managed farmers were not significantly different in terms of efficiency.

Key words : Economic efficiency, Broiler farming, Supervised, Own management

INTRODUCTION

Poultry is the most widely used livestock species. It has remained as back- yard venture since 1960. Poultry industry as an emerging agri-business started practically during eighties in Bangladesh. From the beginning of early 1990s in response to the wide market opportunity, a commercial poultry sector (broiler and layer) has emerged using intensive production techniques and is getting more and more popularity. It is mainly due to the low productivity of local breeds of chicken, poor nutrition (only 14 percent and 23 percent of the requirement for protein and energy respectively) and high mortality (45-84%) (Haque *et al.*, 1999). With the expanding market of the livestock sector, traditional farmers, especially small and marginal

[1] Professor, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

farmers of Bangladesh captured an insignificant share. They faced problems of inadequate input supplies, low technological adoption, poor yield and falling output prices at harvest time. To cope with these problems, some of commercial breeding farms introduced contract growing system of broiler and layer production. ABFL is one of the leading poultry farms in Bangladesh under the Islam Group Ltd. that has introduced contract growing system of broiler production in 1994 and integrated with supply chain to serve urban consumers. After readymade garment sector, poultry sub-sector of livestock sector has turned out to be promising dynamic sector with enormous potential for rapid poverty reduction in Bangladesh. Contribution of livestock sector in annual growth of gross domestic product (GDP) was 5.85 percent in 2006 which was 2.96 in 2001-02 year (Bangladesh Economic Review, 2007). Poultry sector is also most vital due to its contributions to national economy in the spheres of generation of local income, employment creation and improving the nutrition level.

Poultry rearing is no more considered as low prestigious occupation fit for only weaker sections of the society. It has now become a full time job for many people and it is an attractive economic activity as well, especially to women and poor population. In addition, it can be adopted under diversified agro climatic conditions. Broiler farming is more attractive to the farmers because it gives quick return to them. Many new farms are being setup every year although it was seriously affected by the rumor of bird flue in recent past.

A number of studies have been undertaken on different economic aspects of broiler farming at home and abroad. The studies include relative costs, returns and profitability analyses (Ahmed, 2001; Bhuiyan, 2003; Alam, 2004), efficiency of trained farmers (Ershad *et al*. 2004), Profitability analysis of contract broiler farming (Karim, 2000; Vukina and Foster, 1998) efficiency analysis (Sarker *et al*., 1999; Effiong and Onyenweaku 2006) and marketing system (Rahman, 20004). The main effort of most of the researches in Bangladesh was on the production aspect of poultry and such type of studies employed only cost benefit analysis. But efficiency is a very important factor of productivity growth especially in developing agriculture where resources are meager. Thus, the present study is designed to generate valuable information on productivity performance of supervised broiler enterprise and independently managed broiler farms along with identification of factors affecting efficiency.

RESEARCH METHODS

The present study was carried out at 3 upazilas of Kishoreganj district namely : Bajitpur, Kuliarchar and Kishoreganj sadar. Data were collected from the sample broiler farmers of these areas during the months of February to April 2008 through direct interviews. At first a list of 100 contract broiler farmers was prepared with the help of the officials of ABFL. Then a sample size of 45 broilers farms under ABFL supervision was randomly chosen and a sample size of 45 own managed broiler farms was purposively chosen from the study area. The final survey questionnaire included general information on ABFL supervised farms and farmer's own managed farms, information on family size, education, occupation, and land ownership of sample farmers, cost of day old chicks

(DOC), cost of feeds, cost of human labor, vaccine and medicine costs, cost of equipment, housing costs, income from broilers, terms and condition of contract etc. All the collected data were then edited and it was converted into standard international units. Data were analyzed using the Microsoft Excel, SPSS and Frontier 4.1 Package Program (Coelli, 1992).

Empirical model

In the present study, Cobb-Douglas stochastic production frontier function was used with inefficiency variables to determine the technical efficiency effects and effects of most important variables to the returns of broiler farms. And Cobb Douglas stochastic cost function was used to assess the economic efficiency.

A Cobb-Douglas stochastic production function was specified with inefficiency variables as follows:

$$\ln Y_i = \alpha_0 + \alpha_1 \ln X_{1i} + \alpha_2 \ln X_{2i} + \alpha_3 \ln X_{3i} + \alpha_4 \ln X_{4i} + \alpha_5 \ln X_{5i} + \text{Farmtype(dummy)} + V_i - U_i \ldots (1)$$

and

$$u_i = \delta o + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} \ldots (2)$$

where,

ln represents the natural logarithm (i.e. to the base e)

and i refers to the ith farm in the sample

Yi = Gross return from broiler production (Tk.)

X_{1i} = Cost of feed for the ith farm (Tk)

X_{2i} = Cost of DOC for the ith farm (Tk.)

X_{3i} = Labor cost for the ith farm (Tk)

X_{4i} = Medicine cost for the ith farm (Tk)

X_{5i} = Litter cost for the ith farm (Tk)

Farm type (dummy) = 1 for ABFL supervised farms

0 for farmer's own managed farms

$\alpha_1 - \alpha_5$ are parameters to be estimated

Vi represents the random variations in output due to factors outside the control of the farm operator.

The u_i's in equation (2) are non negative random variables, associated with the technical inefficiency of production of the farmers in the population.

where,

Z_{1i} denotes the age of the ith farmer;

Z_{2i} denotes the education of the ith farmer;

Z_{3i} denotes the experiences of the ith farmer;

δ_0, δ_1, δ_2, and δ_3 are unknown parameters to be estimated.

The stochastic frontier cost function

$\ln C_i = \alpha_0 + \alpha_1 \ln Y + \alpha_2 \ln P_1 + \alpha_2 \ln P_2 + \alpha_3 \ln P_2 + \alpha_3 \ln P_2 + \alpha_4 \ln P_3 +$ Farm type (dummy) $+ V_i + U_i$ … … … … … … … … … … (3)

and

$u_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i}$ … … … … … … … … … … (4)

where,

ln represents the natural logarithm (ie, to the base e)
C = Gross costs of broiler production
Y = Quantity of live broiler (kg)
P_1 = Price of feed (Tk/kg)
P_2 = Price of day old chicks (Tk.)
P_3 = Wage rate of labor (Tk.)

Farm type (dummy) = 1 for ABFL supervised farms
0 for farmer's own managed farms

$\alpha_1 \ldots \alpha_4$ are parameters to be estimated

Vi represents the random variations in output due to factors outside the control of the farm operator.

The u_i's in equation (4) are non negative random variables, associated with the economic inefficiency of production of the broiler farmers.

where,

Z_{1i} denotes the age of the ith farmer;
Z_{2i} denotes the education of the ith farmer'
Z_{3i} denotes the experiences of the ith farmer;
δ_0, δ_1, δ_2 and δ_3 are unknown parameters to be estimated

Again, allocative efficiency was determined from the following relationship

$EE = TE \times AE$

$AE = \frac{EE}{TE}$

where,

EE denotes economic efficiency;
TE denotes technical efficiency; and
AE denotes allocative efficiency.

The model for the inefficiency effects can only be estimated if the inefficiency effects are stochastic and have a particular distributional specification. Hence there is interest to test the null hypothesis that the efficiency effects are not present. H_0: $\gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = 0$. This null hypothesis of interest was tested using the generalized likelihood ratio test and t test.

RESULTS AND DISCUSSION

Technical efficiency estimates of broiler farms

Maximum likelihood estimates of stochastic frontier production function for sample broiler farms are shown in Table 1. The empirical results indicate that estimated coefficient of feed cost and cost of DOC were 0.651 and 0.252, respectively and were significant at 1 percent level. These indicate that keeping other variables constant, if feed cost increases by 1 percent, then the gross return from broiler production would increase by 0.651 percent and if DOC cost increases by 1 percent, the gross return from broiler production would increase by 0.252 percent. The estimated coefficient of labor cost and litter cost were insignificant which implies that increase in the use of labor and litter had no significant effect on gross return of broiler production. The estimated coefficient of medicine cost was 0.114 and was significant which indicates that if medicine cost increases by 1 percent, the gross return from broiler production would increase by 0.114 percent. The estimated coefficient of farm type (dummy) was 0.023 and was insignificant. This implies that no significant differences existed between performance of ABFL supervised broiler farms and farmers' own managed broiler farms.

Technical inefficiency effect model

The estimated δ coefficients in Table 1 associated with the explanatory variables in the model for the inefficiency effects are worthy of particular discussion. It is evident that the coefficient of age, education and experiences of the farmers were found negative and significant which mean the cost of broiler production would decrease with the increase in age, education and experience of the broiler farmers. The estimate for the variance parameter, δ associated with the variance of the inefficiency effects appear to be significantly positive. This indicates that inefficiency effect was present in the production of broiler.

Economic efficiency estimates of broiler farms

The maximum likelihood estimates of stochastic frontier cost function for broiler production are presented in Table 2. The estimated coefficients of quantity of live broiler, feed price and DOC price were positive and significant at 1 percent level. Again, coefficient of wage rate was positive and insignificant and an estimated coefficient of farm type (dummy) was positive and insignificant.

Thus, it is evident that the explanatory variables such as quantity of live broiler, feed price, DOC price had impacts on the gross costs of broiler production. No significant impact of wage rate was observed on the gross costs of broiler production. Again, dummy variable, farm type was insignificant stated above indicating that there was no significant differences between ABFL supervised farmers' performance and farmers' own managed broiler farms performance on broiler farming.

Table 1. Maximum likelihood estimates of the stochastic frontier production function for broiler farms

Variable	Parameter	Coefficient	Standard error
Stochastic frontier			
Constant	α_0	0.066	0.985
Feed cost (X_1)	α_1	0.651	0.029
DOC cost (X_2)	α_2	0.252	0.062***
Labor cost (X_3)	α_3	0.334	0.071
Medicine cost (X_4)	α_4	0.114	0.028**
Litter cost (X_5)	α_5	0.078	0.025***
Farm type (Dummy)	1 = ABFL supervised farms 0 = farmer's own managed farms	0.023	0.54
Inefficiency model			
Constant	δ_0	0.253	0.059
Age of farmer (z_1)	δ_1	-0.005	0.0019**
Education(z_2)	δ_2	-0.015	0.0072**
Experience (z_3)	δ_3	-0.0029	0.001**
Variance parameter			
σ^2		0.0043	0.001***
$Y = \sigma^2u/\sigma^2S$		0.080	0.031**

Source : Akhter 2008; *** Significant at 1% level; ** Significant at 5% level

Economic inefficiency effect model

Table 2 shows simultaneous estimation of the stochastic cost frontier and economic inefficiency effect model for broiler production. It can be observed that the coefficients of age and education of the farmers were negative which implies that cost of broiler production decreases with the increase in the age and education of the farmer. The estimated coefficient of experience was found to be positive and insignificant but it is unusual in practice. The estimate for the variance parameter, γ associated with the variance of the inefficiency effects was appeared to be significantly positive. This indicates that inefficiency effect was present in the production of broiler.

Tests of hypotheses

Results of different coefficients tests on stochastic production frontier and stochastic cost frontier have already presented in Table 1 and Table 2. Here results of the hypotheses tests on the technical and economic inefficiency effect models using the generalized likelihood-ratio, LR statistic are presented in Table 3.

From Table 3, we observed that in both cases, stochastic production frontier and cost frontier, the null hypotheses were rejected. It can therefore be concluded that the

inefficiency effects were significantly influenced by age, education and experience of broiler farmers in the study area.

Table 2. Maximum likelihood estimates of the stochastic cost frontier for broiler farms and economic in efficiency effect model

Variable	Parameter	Coefficient	Standard error
Stochastic frontier			
Constant	α_0	5.179	0.843
Quantity of live broiler (X_1)	α_1	0.390	0.0514***
Feed rice (X_2)	α_2	0.966	0.276***
DOC price (X_3)	α_3	0.188	0.056***
Wage rate (X_4)	α_4	0.058	0.044
Farm type (Dummy)	α_5	0.00154	0.0252
Inefficiency model	1 = ABFL supervised farms 0 = farmer's own managed farms		
Constant	δ_0	0.488	0.0114
Age (Z_1)	δ_1	-0.014	0.034
Education (Z_2)	δ_2	-0.052	0.14
Experience (Z_3)	δ_3	0.0053	0.0281
Variance parameter			
σ^2		0.0205	0.0471
$\gamma = \sigma^2u/\sigma^2s$		0.941	0.137***

Source : Akhter 2008, *** Significant at 1%

Efficiency scores for broiler farms

The following Table 4 represents the estimated technical, allocative and economic efficiency scores of the sample broiler farms and a simple frequency distribution of the efficiencies. Table 4 reveals that the technical efficiency of the broiler farms varies from 80 percent to 99 percent. The maximum technical efficiency has been observed to be in the range 95-100 percent.

The mean technical efficiency has been estimated from stochastic production frontier is 94.06 percent. This implies that, on average, the broiler farmers were producing broiler to about 94 percent of the potential frontier production levels, given the levels of their inputs and the technology currently being used and there appears to be 6 percent technical inefficiencies of the farmers in the study area.

Table 4 shows that average allocative efficiency was 96.76 percent which indicates there appears to be 4 percent allocative inefficiency in the sample broiler farms in the study region.

Table 3. Test of hypothesis for coefficients of the explanatory variables for the technical and economic inefficiency effects in the stochastic production and cost frontier

Null hypothesis	Log-likelihood value	Test statistics LR	Critical value	Decision
$H_0 : \gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = 0$				
Model specific:				
Stochastic production frontier	116.88	12**	12	Rejected
Stochastic cost frontier	137.26	9.81*	9	Rejected

Source : Akhter 2008, ** Significant at 5% level, * Significant at 10%

Table 4. Distribution of technical, allocative and economic efficiency estimates of the sample broiler farms

Efficiency (%)	Frequency of farms		
	Technical efficiency	Allocative efficiency	Economic efficiency
0<80	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
80-85	2 (2.22)	0.0 (0.0)	6.0 (6.66)
85-90	7 (7.77)	6 (6.66)	23 (25.55)
90-95	35 (38.88)	19 (21.11)	45 (50.00)
95-100	46 (51.11)	65 (72.22)	16 (17.77)
Total number of farm	90 (100)	90 (100)	90 (100)
Mean efficiency	94.06	96.76	91.00
Minimum efficiency	80.00	87.3	80.30
Maximum efficiency	99.00	99.00	99.00

Source : Akhter 2008, Figures within parentheses indicate percentage

The economic efficiency of broiler farms is observed to be an average of 91.00 percent. This indicates that there appears to be 9 percent economic inefficiencies of sample broiler farms and the cost of production per farm can be reduced by 9 percent in keeping the output constant.

Farm specific average efficiency scores

Table 5 represents the efficiency scores of ABFL supervised broiler farmers and farmers own managed broiler farms. It is evident from Table 5 that average technical efficiencies were 94.49 percent for ABFL supervised farmers and 93.66 percent for own managed broiler farms respectively whereas average allocative efficiency for the respective farms were 96.51 percent and 96.45 percent.

Table 5. Average technical, allocative and economic efficiency estimates of the studied broiler farms

Average efficiency scores (%)	Farm type		All farms
	ABFL supervised	Farmers' own managed	
Technical efficiency	94.49	93.66	94.06
Allocative efficiency	96.51	96.45	96.76
Economic efficiency	91.60	90.34	91.00

Source : Akhter 2008.

The average economic efficiencies estimated from the cost frontier were about 91.60 percent and 90.34 percent for the ABFL supervised farms and own managed broiler farms respectively in the study area. It was stated before by the explanatory variable farm type (dummy) which was insignificant indicating that the ABFL supervised broiler farms and farmers' own managed broiler farm's performance were not significantly different in terms of efficiency achievements.

CONCLUSION

The study revealed that insignificant difference exists between ABFL supervised framers and independent farmers in terms of efficiency achievements which were found in the statistical analyses. There were some degrees of technical and economic inefficiency in the production of broiler. There appears to be 6 percent and 9 percent technical and economic inefficiencies of broiler farming respectively in the study area.

As the poultry sub sector has enormous potential and it was found from the study that the broiler owners achieved remarkable efficiency in their farming, the government should provide adequate financial support and incentives to enhance the sustainable growth of this sector for the national interest.

It was found that performance of own managed broiler farms was almost same as ABFL supervised farms. This may be due to the fact that ABFL has already brought about some changes since March 2004 which entail that the inputs would be supplied for cash and no longer for credit. It was also found from the farm survey that numbers of ABFL contract farmers were reduced (Akhter, 2008). Thus the contracts needs to be reviewed and updated with respect to changing market conditions in a participatory manner involving both the parties for retaining the confidence of the contract growers. There will of course be incentives for the farmers that they will get some discount per day old chick and per kilogram of feed, ABFL has to closely monitor that the contract growers are not discouraged by the new system and that the quality of production does not deteriorate.

Feed cost is increasing too high that it would be difficult for the farmers to purchase adequate amount. Thus more efforts are needed to increase domestic production of maize and soybean; the main ingredients of feed.

From the present study a positive influence of education on efficiency was found. Educated farmers were found to have positive impact on production and were technically and economically more efficient. Thus, it can be recommended from this study that education should be one of the top priorities of the government to develop the necessary human capitals for sustainable development. The government should take various training programs for the less educated farmers.

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