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# PROFIT ELASTICITY OF LIVESTOCK FARMING IN BANGLADESH

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Farmers' input cost with respect to profit elasticities for livestock farming in two districts of Bangladesh were estimated using translog profit function analysis. The objective of study was to analyze livestock farmers' profit response. Research was conducted in Gazipur and Sirajgonj districts in the year of 2012. Result showed that for milk production labor was the most important input cost which effect profit elasticities compared to straw and other inputs. Sirajgonj profit is higher than Gazipur district by about 3.37 percent. Conversely, in case of egg production mixed feed was higher input cost compared to veterinary care cost which effect profit elasticities. Commercial farming profit was higher than that of traditional farming by about 0.95 percent.

**Key words:** Profit, Elasticity, Inputs, Dairy and Poultry

Livestock rearing is considered as a highly viable sector for generation of employment and income for the landless, unemployed youths and destitute women. Livestock play a vital role in rural economy. The combination of livestock and crop farming enables complementarily through productive utilization of farm by-products and conservation of soil fertility, thus increasing rural farm income. Bangladesh is a country of serious malnutrition where about 44 per cent of the population lives in poverty, measured by CBN method (BBS, 2007). Protein deficiency has been taken as the major contributory in malnutrition. The per capita consumption of animal protein in Bangladesh is only 11.8 gm per day (BBS, 2001) whereas the standard requirement of 36 gm was recommended by UNO. According to the report of the DLS (2006) and BBS (HIES, 2010) average per capita availability of milk, meat is 18.6 gm, 33.7 gm per day and egg is 44 (no.) per year whereas per capita requirement of milk, meat is 250 gm,120 gm per day and egg is 104 (no.) per year. The livestock sector is considered an important to reduce poverty and malnutrition as well as unemployment problems of Bangladesh. Depending upon land and climatic suitability, a farmer can produce and earn considerably more from livestock than crops alone from a unit of land, if production, processing and the marketing of livestock and livestock products are properly organized. Several studies revealed that rearing of livestock, especially dairy cows and poultry is a profitable enterprise for the farmer (Rahman 1993; Alam 1995; Kabir 1995; Ashrafuzzaman and Rahman 1995; and Paul 1995).

Livestock farming, unlike crops, is not seasonal. People in this country raise livestock mainly with a view to getting meat, milk and egg, etc. to fulfill their day-to-day consumption and some raise only commercial purpose.

Apart from providing food products like milk, egg and meat, livestock sector generates productive employment and valuable supplementary income to the vast majority of rural households, majority of who are small and marginal farmers and landless laborers. Income from sale proceeds also helps them to satisfy their various financial needs.

The folk size, structure and characteristics of rural poultry were very similar all over the world (Sonaiya, 2002) but their structure and management were so different from commercial livestock production systems in terms of input requirements. In this context, it is essential to examine the answers relating to questions concerning livestock profitability growth: How much has input variables growth contributed to the growth of profit elasticity? What have been the sources of profitability growth? The estimation of the profit elasticity of different inputs like feed, labor and veterinary services in the total inputs cost would help to allocate rationally these scarce resources by formulating suitable farm plans. With the above objectives, the present study was carried out to find the profit elasticity of different inputs like feed, labor, chicks, other inputs and veterinary services in the total inputs cost in the livestock sector.

## MATERIALS AND METHODS

### Data Collection

The study utilized the primary data. The necessary primary data were obtained from the sample livestock (dairy and poultry) farmers through personal interview with the help of pre-tested and structured schedules during April to July, 2012. The data collected from the sample farmer respondents included general information about livestock farmers, various inputs cost and profit of livestock farming. Two districts were selected purposively namely Sirajgonj and Gazipur and two Upazilas from each district were selected on the basis of concentration of livestock production. Sampling size was determined at 95% confidence level and 10% sampling error. In order to reach the maximum sampling volume p and q ratios were obtained (Newbold, 2000). One hundred poultry producers (both traditional and commercial) and One hundred dairy farmers (both traditional and commercial) were selected following random sampling technique from each of the two districts applying without replacement concept. All data from the survey were stored in Windows Excel and analyzed using STATA package.

### The Translog Profit Function

Farmer input factor demand and output supply elasticities have earlier been derived with direct or indirect application of the Cobb-Douglas production function to farm survey data [Lau and Yotopoulos (1971); Yotopoulos (1972); Yotopoulos, Lau and Lin (1976); Junankar (1980) and Sindhu and Baanannte (1981)]. The Cobb- Douglas production function is based on highly restricted assumptions such as the unitary elasticity of substitution, constant returns to scale and "a priori" imposition of separability restrictions. Therefore, it yields invalid elasticities which fail to explain the genuine relationships between inputs and outputs [Diewert (1971); Christensen, Jorgenson and Lau (1971)]. Further, such elasticities have also been estimated with the constant elasticity of substitution production function (CES), variable elasticity of substitution production function (VES), and the nested-CES production function applied to time-series data [Battese and Malik (1988); Berndt and Christensen (1973); Narasimham and Fabryey (1974); Trosper (1978); Mousa and Jones (1991)]. These production functions, though regarded superior to the Cobb-Douglas production function, are also based on rigid restrictions.

To confirm the reliability of the input demand elasticity’s, this analysis is carried out in a way that the estimates are also verified by tests applied to two separate hypotheses. The first empirical test checks the validity of the symmetry and homogeneity restrictions across profit and S¡ equations. This is a joint hypothesis and the validity of the constraints implies that, the average sample farmer, maximize profit with respect to the variable input prices. The curvature requirements are also tested by calculating the Eigen values from the Hessian matrix. The second test verifies the relevance of the Cobb-Douglas (C-D function) vis-à-vis the translog profit function for the present analysis. Theoretically, it is hypothesized that for a profit function to be Cobb- Douglas in nature, coefficients of all the second order terms should be zero. The rejection of this hypothesis on the basis of function form test (Cobb-Douglas versus translog model) will declare the translog function as superior to the C-D function for this analysis. The coefficients of the translog profit function and 5, functions are used to derive the elasticity's of input demand for variable inputs used in the analysis. More specifically, this elasticity's are functions of variable input prices and the translog profit function parameter estimates.

**The Translog Profit Function Model**

In this section we first present a brief exposition of the concept of translog profit function and then develop some basic derivations to compute various input demand elasticities. The formulations constitute the basis for empirical implementation of the model in the next section. A generalization of the restricted translog profit function is given by Diewert (1974); Christensen, Jorgensen, and Lau:

The general form of translog profit function is given below:

$$\ln \Pi = \alpha_0 + \sum_{j=1}^{5} \alpha_j \ln P_j + 1/2 \sum_{j=1}^{5} \beta_{jj} (\ln P_j)^2 + \sum_{j=1}^{5} \sum_{k=1}^{5} \beta_{jk} \ln P_j \ln P_k + u$$

Where '$\beta_{jk}$ = ' $\beta_{kj}$ for all k, j, and the function is homogenous of degree one in prices of all variable inputs. The definition of the variables and the notation used are as follows: ∏ is the restricted profit-total revenue less total costs of variable inputs; Pj is the price of variable inputs Xj (Taka/day/cow or chicken), j = k = 1, 2, 3, ... , n, In is the natural logarithm ; and $\alpha_0$, $\alpha_j$, $\beta_{jj}$, $\beta_{jk}$ and U are the parameters and error term.

**Model Specification**

From the general function (1), the restricted translog profit function for livestock production in Bangladesh can be specified in actual variables as. '

Upon expansion, equation (1) yields the following for dairy farming:

(2) $\mathrm{Ln}\prod = \alpha_o + \alpha_L \ln P_L + \alpha_G \ln P_G + \alpha_s \ln P_s + \alpha c_F \ln Pc_F + \alpha_o \ln Po + 1/2ß_{LL}(\ln P_L)^2 + 1/2ß_{GG}(\ln P_G)^2 + 1/2ß_{SS}(\ln P_S)^2 + 1/2ßc_{FcF} (\ln Pc_F)^2 + 1/2ß_{oo}(\ln P_o)^2 + ß_{LG} (\ln P_L) (\ln P_G) + ß_{LS} (\ln P_L) (\ln P_S) + ß_{LcF} (\ln P_L) (\ln Pc_F) + ß_{LO} (\ln P_L) (\ln P_O) + ß_{GS} (\ln P_G) (\ln P_S) + ß_{GcF} (\ln P_G) (\ln Pc_F) + ß_{GO} (\ln P_G) (\ln P_o) + ß_{ScF} (\ln P_S) (\ln Pc_F) + ß_{SO} (\ln P_S) (\ln P_O) + ßc_{FO} (\ln Pc_F) (\ln P_O) + \delta D + U$

Where∏* is the restricted profit (Taka) from dairy production per day per cow: total revenue less total costs of labor (including both family and hired labor); green grass, straw, concentrated feed and others cost (Taka/per day per cow).

The parameters $\alpha_o$, α and β are to be estimated and subscripts L, G, S, CF, and O stand for the variable inputs of production labor, green grass, straw, concentrated feed and others cost ( Artificial Insemination, rope , feeding pot and miscelliounus), respectively. D stands for dummy variable of districts (1 for Sirajgonj and 0 for Gazipur district).

Conversely, equation (1) yields the following for poultry farming:

(3) $\mathrm{Ln}\prod = \alpha_o + \alpha_L \ln P_L + \alpha_C \ln P_C + \alpha_{MF} \ln P_{MF} + \alpha_{VC} \ln P_{VC} + 1/2ß_{LL}(\ln P_L)^2 + 1/2ß_{CC}(\ln P_C)^2 + 1/2ß_{MFMF}(\ln P_{MF})^2 + 1/2ß_{VCVC}(\ln P_{VC})^2 + ß_{LC} (\ln P_L) (\ln P_C) + ß_{LMF} (\ln P_L) (\ln P_{MF}) + ß_{LVC} (\ln P_L) (\ln P_{VC}) + ß_{CMF} (\ln P_C) (\ln P_{MF}) + ß_{CVC} (\ln P_C) (\ln P_{VC}) + ß_{MFVC} (\ln P_{MF}) (\ln P_{VC}) + \delta D + U$

For poultry farming total cost of labor (including both family and hired labor); chicks, mixed feed and veterinary cost (Taka/ per day per chicken) were considered for calculation.

The parameters $\alpha_o$, α and β are to be estimated and subscripts L, C, MF and VC stand for the variable inputs of production labor, chicks, mixed feed and veterinary cost, respectively. D stands for dummy variable of farm category (1 for Commercial and 0 for Traditional farming).

## RESULTS AND DISCUSSION

**Profit elasticity of input variables for dairy farming**

As all the input variables are mean-corrected prior to estimation, the associate regression coefficients of the non-cross inputs in the translog function are direct elasticity's of the respective inputs. This is because of coefficients of the interaction variables multiplied by the same variable at the sample mean will be zero.

Among all the production inputs used in dairy production, the effect of labor is most dominant for dairy production (Table 1).The estimated elasticity of labor is -1.33 implying that a one percent increases in labor cost will result in 1.33 percent decrease in profit of milk in the study area. On the other hand, elasticity of straw is -0.63 implying that a one percent increases in

Table 1 Estimates of translog profit function for dairy farming

| Variables | Coefficient | Robust Standard error |
|---|---|---|
| Constant | 1.1171*** | 0.39257 |
| Labor | -1.3272*** | 0.70487 |
| Green grass | 0.3944 | 0.36496 |
| Straw | -0.6308** | 0.30434 |
| Concentrated feed | -0.0007 | 0.30361 |
| Other inputs | 0.6457** | 0.3648 |
| lDummy of location (1= Sirajgonj) | 3.3736*** | 0.3520 |
| Labor X Labor | -0.4086181 | 0.6838162 |
| Labor X Green grass | -0.1375713 | 0.500077 |
| Labor X Straw | 0.5706624 | 1.162614 |
| Labor X Concentrated feed | -0.073801 | 0.4467231 |
| Labor X Other inputs | 0.5578061 | 0.4085217 |
| Green grass X Green grass | 1.86553 | 2.795488 |
| Green grass X Straw | -1.32888 | 1.219993 |
| Green grass X Concentrated feed | -0.8033682 | 1.241178 |
| Green grass X Other inputs | 0.1724108 | 0.6187374 |
| Straw X Straw | -1.338743 | 2.787761 |
| Straw X Concentrated feed | 0.4903361 | 1.179125 |
| Straw X Other inputs | 0.7591668 | 0.975438 |
| Concentrated feed X Concentrated feed | 0.1936806 | 0.3164034 |
| Concentrated feed X Other inputs | -0.0588919 | 0.6109031 |
| Other inputs X Other inputs | -1.210083 | 0.8587534 |

Note: All resource input variables are mean-different prior to estimation, and therefore the coefficients on the first-order term can be read directly as elasticities at the sample mean. γ* is equal to $\gamma/[\lambda+(1-\lambda)\pi/(\pi-2)]$(Coelli et al. 1998). ***, ** and * denote 1%, 5% and 10% level of significance, respectively.

Table 2 Estimates of translog profit function for poultry farming

| Variables | Coefficient | Robust Standard error |
|---|---|---|
| Constant | 4.2241*** | 0.1461 |
| Labor | 0.0083 | 1.0259 |
| Chicks | 2.1572** | 0.514 |
| Mixed feed | -0.9095** | 0.189 |
| Veterinary cost | -0.8289*** | 0.1509 |
| Farming system dummy(1=Commercial) | 0.9504*** | 0.1509 |
| Labor X Labor | 0.5696998 ** | 0.2750296 |
| Labor X Chicks | -1.986395 | 1.49112 |
| Labor X Mixed feed | 0.5904919 | 0.9511021 |
| Labor X Veterinary cost | -0.5099818 | .3674496 |
| Chicks X Chicks | 78.05071*** | 21.72397 |
| Chicks X Mixed feed | 25.93137 *** | 7.986504 |
| Chicks X Veterinary cost | -4.184323** | 2.269627 |
| Mixed feed X Mixed feed | 1.212437 | 4.309447 |
| Mixed feed X Veterinary cost | -1.4001 | 1.285345 |
| Veterinary cost X Veterinary cost | 0.3331106 | 0.3891963 |

Note: All resource input variables are mean-different prior to estimation, and therefore the coefficients on the first-order term can be read directly as elasticities at the sample mean. γ* is equal to $\gamma/[\lambda+(1-\lambda)\pi/(\pi-2)]$(Coelli et al.1998).***, ** and * denote 1%, 5% and 10% level of significance, respectively.

straw cost will result in 0.63 percent decrease in profit of milk. In the study area green grass was found positive but insignificant. Along with labor and straw; other inputs and location dummy have positive significant elasticity. Location dummy suggesting that in Sirajgonj district (D=1) mean profit is higher than that of Gazipur district by about 3.37 percent.

**Profit elasticity of input variables for poultry farming**

As all the input variables are mean-corrected prior to estimation, the associate regression coefficients of the non-cross inputs in the translog function are direct elasticity's of the respective inputs. This is because of coefficients of the interaction variables multiplied by the same variable at the sample mean will be zero.

Among all the production inputs used in poultry production, the effect of mixed feed is most dominant for poultry production. The estimated elasticity of mixed feed is -0.91 implying that a one percent increases in mixed feed cost will result in 0.91 percent decrease in profit of egg in respective area. On the other hand, elasticity of veterinary care is -0.83 implying that a one percent increases in veterinary care cost will result in 0.83 percent decrease in profit of egg. In the study area labor was found positive but insignificant. Along with mixed feed and veterinary cost; chicks cost have positive significant elasticity due to quality of chick. Farming system dummy suggesting that in commercial farming (D=1) mean profit is higher than that of traditional farming by about 0.95 percent (Table 2).

## CONCLUSION

The elasticity of profit of farm inputs for livestock are estimated using analysis of translog profit function for a sample farmers in which has most effect of labor for dairy and mixed feed for poultry farming. It is assumed in this approach is tested that chick cost had the positive significant elasticity due to quality of chick with the availability of technology and resources that remain. Analysis of samples showed that the farmer maximizes profits by considering commercial poultry farming in both areas and Sirajgonj district for dairy farming.

## REFERENCES


1. Alam, J., Yasmin, F., Sayeed, M. A. and Rahman, S. M. A. (1995) Economics of Mini Dairy Farms in Selected Areas of Bangladesh. Asian-Australian Journal of Animal Sciences. 8(1): 17-22 Cited from World Agricultural Economics and Rural Sociology Abstracts June 1995. 37(6): 487.
2. Ashrafuzzaman, A.K.M. and Rahman, M.H. (1995) Status and economic efficiency of milk production: A study in two villages. The Journal of Rural Development, 25 (1): 75-88.
3. Battese, G. E., and S. J. Malik (1988) Estimation of Elasticities of Substitution for CES and VES Production Functions Using Farm-Level Data for Food Processing Industries. The Pakistan Development Review 27: 1 59-7 1.
4. BBS, (2007) Statistical Yearbook of Bangladesh, Bangladesh Bureau of statistics, Ministry of Planning. Government of the people's Republic of Bangladesh. p- 106.
5. Berndt, E. R., and L. R. Christensen (1973) The Translong Function and the Substitution of Equipment, Structures and Labour in U.S. Manufacturing 1929-68. Journal of Econometrics 1:1 81-113.
6. Coelli, T. J., D.S.P. Rao and G.E. Battese (1998) An Introduction to Efficiency and Productivity Analysis. Kluwer Academic Publishers, Boston.
7. Christensen, L. R., D. W. Jorgenson, and L. J. Lau (1971) Conjugate Duality and the Transcendental Logarithmic Production Function. Economertica 39: 255-56.
8. Christensen, L. R., D. W. Jorgenson, and L. J. Lau (1971) Conjugate Duality and the Transcendental Logarithmic


 

Production Function. Econometrica 39: 255-56.
9. Diewert, W. E. (1971) An Application of the Shephard Duality Theorem: A Generalised Leontief Production Function. J. Polit. Econ. 79.
10. Diewert, W. E. (1974) Application to Duality Theorem: In M. Intriligator and D. kindrick (eds) Frontiers in Quantitative Economics. Vol.II. Amasterdam: North Holland.
11. DLS, (2006-2007) Directorate of Livestock Services, Farmgate, Khamarbari, Dhaka.
12. HIES (2010) Report of the household Income & Expenditure Survey 2010, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning. p- 48, XX.
13. Junankar, P. N. (1988) Tests of Profit-Maximisation Hypothesis: A Study of Indian Agriculture. Journal of Development Studies 16.
14. Kabir, M. H. (1995) An economic study of subsidized private dairy farming in selected areas of Bangladesh. Un-published master’s thesis, Dept of Agril. Economics, BAU, Mymensingh.
15. Lau, I. J., and P. A. Yotopoulos (1971) A Test of Relative Efficiency and Application to Indian Agriculture. American Economic Review 61: 94-109.
16. Mousa, M. Z., and T. T. Jones (1991) Efficiency and Farm Size in Egypt. A Unit Output Price Profit Function Approach. Applied Economics 23: 21-29.
17. Narasimham, G. V. L., and M. Z. Fabryey (1974) Relative Efficiencies of Organised Industries in India. Journal of Development Studies 10: 230-41.
18. Newbold, P. (2000).” Statistics for Business and Economics.” Publisher: Prentice Hall;
19. Paul, T. K. (1995) A study on the economics of dairy cows in some selected areas of Kustia district. Un-published master’s thesis, Dept of Agril. Economics, BAU, Mymensingh.
20. Rahman, M. M., Rahman, M. H. and Farruque, M. O. (1993) A study on the economics of milk production in selected areas of Bangladesh (1991-92). Bangladesh Agricultural University Research Progress, 7: 370-378.
21. Sindhu, S., and C. A. Baanannte (1981) Farm Level Fertiliser Demand for Mexican Wheat Varieties in the Indian Punjab. American Journal of Agricultural Economics.
22. Sonaiya, E.B. (2002). Small poultry holdings, the family and community development – ethology, ethics and self interest, in: KYVSGAARD, N.C. and MONRAD, J. (Eds) Livestock, Community and Environment, Proceedings 10th International Conference of the Association of Institutions of Tropical Veterinary Medicine, AITVM, 20-23 August 2001,. Copenhagen, Denmark, pp 117-132, (Copenhagen, The Royal Veterinary and Agricultural University).
23. Trosper, R. L. (1978) American-Indian Relative Ranching Efficiency. American Economic Review 68: 503-16.
24. Yotopoulos, P. A. (1972) Proht, Supply and Factor Demand function. American Journal of Agricultural Economics 54: 11-18.
25. Yotopoulos, P. A., Lawrence J. Lau, and Wuu-Long Lin (1976) Micro-economic Output Supply and Factor Demand Function in the Agriculture of the Province of Taiwan. American Journal of Agricultural Economics.

 