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A comparative productivity analysis of subsidised and non-subsidised dairy farms in Bangladesh

S.M.A. Rahman, J. Alam and M.M. Rahman
Bangladesh Livestock Research Institute, Savar, Dhaka

Abstract

In this study, an attempt was made to analyse the productivity of subsidised and non-subsidised dairy farms for determining the income effect of subsidy provided to the dairy farmers by the government of Bangladesh. For this purpose, a sample of 200 subsidised and 200 non-subsidised dairy farms in 6 regions of the country were purposively interviewed with a pre-tested interview schedule. The results indicated that number of milk cows, concentrate feed cost, labour cost, veterinary cost and miscellaneous cost are the most determinant factors for the dairy production in study areas. The coefficients of multiple determinant (R^2) of subsidised dairy farms (SDF) and non-subsidised dairy farms (NSDF) in the output of dairy income showed 75 and 74 percent variation, respectively. The sum of the elasticities of production showed a more or less constant return to scale both for SDF and NSDF, indicating that subsidization could not financially influence the generation of income in dairy farming.

Keywords: Subsidised dairy farms, Non-subsidised dairy farms, Returns to scale

Introduction

Bangladesh is an agricultural country and her pace of economic development largely depends on agriculture. In the agricultural context of Bangladesh, livestock play an important role in mixed crop-livestock farming system. Therefore, people reared animals as a subsidiary to crop production. But with the inroads of modern technology, such as feed, breed, scientific management and veterinary medicines, there is a breakthrough in the traditional dairy farming to a commercial dairy farming (Rahman, S. M. A. 1976).

Every where in the world, dairying is a biological system. It converts large quantities of roughages into milk, the most nutritious food for human consumption. It makes efficient use of feed resources and provides a regular source of income to farmers. It is also labour intensive and supports substantial employment in production, processing and marketing. Dairy farming is both a business and way of life. It is a 365 days-a-year job. Moreover, agro-climatic condition of Bangladesh is favourable for dairy farming and it could be an effective instrument for income and employment generation in rural areas.

Although Bangladesh has a very high density of cattle population, but the productivity is very low. The per capita availability of milk in Bangladesh is only 43 ml. per day against the minimum requirement of 250 ml. (FAO, 1974). The total production of milk is 1.34 million metric tons or 13.58% of the total requirement (Alam, 1992).

During 1992-93, 1993-94 and 1994-95 government has provided subsidies to dairy farmers to boost up in-country milk production. Accordingly, in the Fourth Five Year Plan (1990-95) government of Bangladesh has supported to set up dairy farms as an agro-based industry in the private sector. As a result, government increased duty on import of dairy products. From March 1993, government has

initiated investment promotion project by providing direct financial benefit to the emergent entrepreneurs. Consequently, there has been a shift of policy emphasis from traditional to commercial dairy farming. The result was that, a large number of private entrepreneurs came forward and established mini dairy farms in the country.

Their number is 14499, who have registered their farms with the Directorate of Livestock Services. In order to encourage the farmers to establish more dairy farms in the country, the government has given an amount of Tk. 1499,93,500/= as subsidy to 3814 registered farms having at least five dairy cows of improved breeds. No subsidy was given to the farms having less than 5 cows or more than 25 cows. The rate of subsidy varies from 25 to 20 per cent depending on the size of farms. The farms having 5-10 cows of improved breed get an amount of Tk. 6250/= per cow (25% of the estimated cost) and the farms having 11-25 cows of improved breed get an amount of Tk. 5000/= per cow (20% of the estimated cost) as subsidy. The full amount of subsidy is paid to the farmers in cash. But this financial benefit has not been given to a farm for more than 25 heads of cows (Rahman, S. M. A., *et al.* 2001).

There are studies in the Faculty of AERS. The present study was an endeavour and a modest attempt to study the impact of subsidy. The main objectives of the study were to estimate the relationship between input and output of subsidised and non- subsidised dairy farms and to examine the elasticities of production of various inputs used by subsidised and non- subsidised dairy farms.

Materials and Methods

For this study 6 divisions, namely Dhaka, Sylhet, Chittagong, Rajshahi, Barisal and Khulna have been selected purposively to give a wide range of coverage of subsidised and non-subsidised dairy farms of the country. In order to achieve the objectives of the study, 200 subsidised and 200 non-subsidised dairy farms were selected from 6 administrative divisions for in-depth investigation. The selection of subsidized and non-subsidised dairy farms were made following a simple random sampling technique. The survey schedule was prepared to record the necessary information from the dairy farmers. For this purpose, a survey schedule was prepared and was tested in the Dhaka division for finalization. After field test, necessary modifications and rearrangements were made. The schedules were developed in a very simple manner and the Field Assistants were given training on it so that accurate data could be obtained without repetition and misunderstanding. The in-depth investigation was started from July/2000 and completed in December /2000. For the purpose of data collection, 5 Field Assistants and 2 Scientific Officers were engaged. Field supervision and monitoring of work was done properly so that any confusion or misunderstanding of data could be minimized.

A multiple regression analysis (Palis, R.K. *et al.* 1983; Rahman, S.M.A., 1992; Saran, R. 1964; Saha, J.K. and S. M. Elias 1990; Singh, I.J. *et al.* 1974) was carried out for determining the input-output relationship and return to scale of various inputs used by subsidised and non-subsidised dairy farmers for the generation of income. Both linear and Cobb-Douglas production functions were fitted to the data collected from the sample dairy farms by the method of ordinary least squares. However, the distribution of data fitted well to the Cobb-Douglas type of production function. Therefore, Cobb-Douglas production function was retained for the subsequent analysis. The general form of the Cobb-Douglas production function (Heady, E.O. and J.L. Dillion, 1961) is as follows:

$Y_j = a_j X_{ij}^{\ bij} + E_i$

where,
i = 1, 2.....n
j = 1, 2.....m

Y_j = Income of j^{th} dairy farms (Tk.)
X_{ij} = i^{th} input of j^{th} dairy farm
X_{1j} =Land area (ha.) of j^{th} dairy farm
X_{2j} =No. of cattle of j^{th} dairy farm
X_{3j} =No. of milk cows of j^{th} dairy farm
X_{4j} =Lactation length (days) of j^{th} dairy farm
X_{5j} =Cost of green grass (Tk.) of j^{th} dairy farm
X_{6j} =Cost of labour (Tk.) of j^{th} dairy farm
X_{7j} = Others feed cost (Tk.) of j^{th} dairy farm
X_{8j} =Concentrated .feed cost (Tk.) of j^{th} dairy farm
X_{9j} =Veterinary cost (Tk.) of j^{th} dairy farm
X_{10j} =Electricity cost (Tk.) of j^{th} dairy farm
X_{11j} =Water cost (Tk.) of j^{th} dairy farm
X_{12j} = Transp. cost (Tk) of j^{th} dairy farm
X_{13j} = Qty. of milk (litre) of j^{th} dairy farm
X_{14j} = Misc. cost (Tk.) of j^{th} dairy farm

a_j = A constant value
bij = Regression coefficients of ith (1 to 14) input variables in jth dairy farm
E_i = Error terms

The existence of multicollinearity was measured from the standard errors of inputs. The standard errors of input became larger when multicollinearity was high. In such a situation, the independent effect of individual inputs could not be measured accurately by the estimated parameters. However, the multicollinearity effect was minimized by dropping the highly correlated variables from the equations by observing the respective correlation matrix and by following a step-wise regression analysis.

The data were processed through MS-STATC computer programming. In the first run, all the input variables were kept in the equation. Several runs of the regression analysis with varying number of variables were made before the estimated production functions were finally chosen.

Results and Discussions

The estimated regression coefficient, 'bi' and the coefficient of multiple determination (R^2) for the finally selected regression equations are presented in Table 1 and 2. It can be seen from the tables that the coefficient of multiple determination (R^2) was the lowest with the cow-holding group-1 and the highest with the cow-holding group-2 of subsidised dairy farms, while the similar tendency was observed with the non-subsidised dairy farms. The value of (R^2) is interpreted as the percentage of the total variation in the dependent variables explained jointly by the independent variables present in the estimated regression equation. Thus, the number of milk cows (X_3), labour cost (X_6), concentrate feed cost (X_8), veterinary cost (X_9) and miscellaneous cost (X_{14}) jointly explained 67 and 86 percent of the total variation in the respective output (Y_j) of the cow-holding group-1 and cow-holding group-2 of subsidised dairy farms and 66 and 86 percent of total variation for cow-holding group-1 and cow-holding groups-2 in the output (Y_j) of non-subsidised dairy farms.

Table 1. The estimated regression coefficients and coefficients of multiple determination for dairy farms by the cow-holding groups of subsidised dairy farms

Variables	Regression coefficients of subsidised dairy farms		All cow-holding groups N=200
	Cow-holding group-1 N=153	Cow-holding group-2 N=47	
Regression constants	2.8527	-1.1411	1.8344
Number of milk-cow (X_1)	0.0814 (0.0116)	-0.3939* (-0.2952)	-0.0971 (-0.0808)
Labour cost (X_2)	0.0270 (0.0175)	-0.0348 (-0.0233)	0.0163 (0.0147)
Feed cost (X_3)	0.0586 (0.0405)	-0.0095 (-0.0078)	0.0357 (0.0344)
Veterinary cost (X_4)	0.0922* (0.0428)	-0.1254 (-0.1216)	0.0449 (0.0383)
Miscellaneous cost (X_5)	0.0151* (0.0101)	1.5759* (1.2031)	0.9402* (0.0857)
R^2	0.66090**	0.8630**	0.7500**
F-Values	49.23	41.96	96.60

Cow-holding group-1 have 1-10 number of cows
Cow-holding group-2 have 11-25 number of cows
N= Number of observations
*Significant at 5% level
**Significant at 1% level
Figures in Parentheses indicate the standard errors of the estimated coefficients

Table 2. The estimated regression coefficients and coefficients of multiple determination for dairy farms by the cow-holding groups of non-subsidised dairy farms

Variables	Regression coefficients of subsidised dairy farms		All cow-holding groups N=200
	Cow-holding group-1 N=177	Cow-holding group-2 N=23	
Regression constants	3.4759	2.3043	3.6822
Number of milk cow (X_1)	0.0649 (0.0615)	-0.0466 (0.0143)	0.0667 (0.0665)
Feed cost (X_2)	-0.0439 (-0.0430)	0.0748 (0.0104)	-0.0197 (-0.0099)
Labour cost (X_3)	10.0576 (0.0366)	0.0373 (0.0276)	0.0642 (0.0337)
Veterinary cost (X_4)	0.7993* (0.7394)	1.0535* (0.19070)	0.0071 (0.0065)
Miscellaneous cost (X_5)	0.1229* (0.0916)	-0.0256 (-0.0146)	0.8218* (0.6791)
R^2	0.6840**	0.8860**	0.7380**
F-Values	61.36	26.42	90.61

Cow-holding group-1 have 1-10 number of cows
Cow-holding group-2 have 11-25 number of cows
N= Number of observations
• Significant at 5% level
** Significant at 1% level
Figures in parentheses indicate the standard errors of the estimated coefficients

The F-test of R^2 showed that the computed F-values exceeded the corresponding tabular F values at 1% level of significance. It indicated that combined effect of number of milk cows, labour, feed, veterinary services and miscellaneous cost used by cow-holding group-1 and cow-holding group-2 of subsidised dairy farms and cow-holding group-1 and cow-holding group-2 of non-subsidised dairy farms have been significantly contributing to the dairy income of the study areas.

The coefficient of 'bi' of the independent variables of Cobb-Douglas production function directly measure the elasticity of production with respect to the concerned inputs. The output of dairy income, for instance, can be increased by 0.0814 percent for a unit increase in milk-cows (X_1). The other elasticity of coefficient may also be similarly interpreted.

The coefficient of veterinary cost (X_9) and miscellaneous cost (X_{14}) of cow-holding group-1 and number of milk cows (X_3) and miscellaneous cost (X_{14}) of cow-holding group-2 of subsidised dairy farms and veterinary cost of both cow-holding groups of non- subsidised dairy farms indicating a better utilization of those resources by the dairy farmers. The coefficients of veterinary cost was significant for cow-holding group-1 of subsidised dairy farms and cow-holding group-2 of non-subsidised dairy farms, indicating a better management of veterinary services by these cow-holding groups of subsidised dairy farms and non- subsidised dairy farms for income generation of dairy farming.

The sum of the regression coefficients in the production equation determines returns to scale. Returns to scale shows an output response to a proportionate increase in all inputs. If output increases by the same proportion, returns to scale are constant. It increases if output increases by a greater proportion and decreases if it increased by a smaller proportion. The returns to scale is increasing, constant or decreasing depending on whether the sum of the elasticities of production is greater than, equal to or less than unity. The sum of the elasticities of dairy farms under different cow-holding groups of subsidised and non- subsidised dairy farms are presented in Table 3 and 4.

Table 3. Returns to scale for subsidised dairy farms

Cow-holding groups	Degrees of freedom	Sum of Elasticities of production	Difference between sum of elasticities of production and unity
Cow-holding groups-1	152	0.2243	-0.7757 NS
Cow-holding groups-2	46	1.0123	+0.0123 NS
All dairy farms	198	0.9900	-0.0100 NS

NS = Not significant

In Table 3, it can be seen that the sum of elasticities of dairy farms of cow-holding group-1 and cow-holding group-2 of subsidised dairy farms are 0.2243 and 1.0123 with an average of 0.9900 exhibiting a decreasing returns to scale in stage III of production. The higher sum of elasticity in cow-holding group-2 than cow-holding group-1 of subsidised dairy farms implied that this group was more proportionally and economically utilizing their fixed and variable factors for the income generation of dairy farming, depicting an increasing return to scale (stage I of production) than cow-holding group-2 of subsidised dairy farms. The lower sum of elasticity of cow-holding group-1 of subsidised dairy

farms was seen decreasing than unity, depicting a decreasing returns to scale (stage III of production). However, the income of the cow-holding group-1 of subsidised dairy farms did not experience any economy of scale, since total output exhibited more or less a decreasing return to scale. Nevertheless, the cow-holding group-2 of subsidised dairy farms could increase dairy income with the propotionate increase of number of cows, labour, feed, veterinary services and miscellaneous cost per farm simultaneously. This implies the existence of economy of scale (rational stage II of production) so far the income of dairy farm is concerned in subsidised dairy farms.

Table 4. Returns to scale for non-subsidised dairy farms

Cow-holding groups	Degrees of freedom	Sum of Elasticities of production	Difference between sum of elasticities of production and unity
Cow-holding groups-1	176	1.0008	0.0008 NS
Cow-holding groups-2	22	1.0934	0.0934 NS
All dairy farms	198	1.0201	0.0599 NS

NS = Not significant

Similarly, from Table 4, it reveals that the sum of elasticities of dairy income under cow-holding group-1 and cow-holding group-2 of non-subsidised dairy farms varied from 1.008 to 1.0934 with an average of 1.0201. The higher sum of elasticity was observed in cow-holding group-2 followed by cow-holding group-1 of non-subsidised dairy farms. This higher sum of elasticities in cow-holding group-2 of non-subsidised dairy farms implied that cow-holding group-2 has been utilizing their fixed and variable factors more proportionally and economically for the generation of income, depicting an increasing return to scale (national stage II of production) than cow-holding group-1of non-subsidised dairy farms. The lower sum of elasticity of cow-holding group-1 of non-subsidised dairy farms was seen less proportional to unity, depicting a constant returns to scale (rational stage II of production). However, the dairy income did not experience any economy of scale since total output exhibited a more or less constant return to scale. Nevertheless, the cow-holding group-1 could increase income with an increasing rate by using number of milk cow, labour, feed, veterinary services and miscellaneous cost. This indicates an existence of economy of scale (rational stage II) so far the income of non-subsidised dairy farms is concerned.

The t-test was applied to examine whether the sum of elasticities of production for variables included in any equation differed from unity. The explanation regarding returns to scale was made cautiously since all the variables were not retained in the finally selected equations. Sum of elasticities of production of retained variables for all subsidised dairy farms and non- subsidised dairy farms were not significantly different from unity and indicated a constant returns to scale. Thus, it appears that mostly constant returns to scale prevailed on subsidised dairy farms and non-subsidised dairy farms.

The input-output relationship of all cow-holding group-2 of subsidised dairy farms and non-subsidised dairy farms indicated that number of cow, labour, feed, veterinary cost and miscellaneous cost are the most determining factors for dairy farming. They jointly explained 75 and 73 per cent of the total variation in the respective output (Y_j) of all subsidised dairy farms and non-subsidised dairy farms.

The sum of elasticities of subsidised dairy farms and non-subsidised dairy farms indicated a more or less constant returns to scale. The test of significance of mean income difference showed that the income under subsidised dairy farms and non-subsidised dairy farms did not differ significantly. This implies that subsidy did not bear any significant difference in the generation of income of the dairy farmers of the country.

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References

Alam, J. 1992. Livestock development strategies in Bangladesh: The socio-economic perspective. *Proceedings of the Workshop on Livestock Development in Bangladesh (P. 115-233). BLRI, Savar, Dhaka.*

Heady, E.O. and J.L. Dillion. 1961. *Agricultural production function*, lowa State University press, Ames, lowa.

Palis, R.K., A. Swe and K. Shinn. 1983. Comparative performance of one work animal, a team of two work animals and an 8.5 hp. power tiller in preparing lowland rice field, *Research Bulletin, Yezian, Pyinmana, Burma.*

Rahman, S. M. A. 1976. Benefit cost and productivity analysis of major crops in Bangladesh- A case study in Savar Thana irrigation Scheme. *Unpublished M. Sc. Thesis*, Division of Agricultural Economics, IARI, New Delhi, India.

Rahman, S.M.A., J. Alam and M.M. Rahman. 2001. Impact of Subsidies on Dairy Development in Bangladesh. *Final Report, Bangladesh Livestock Research Institute, Savar, Dhaka.*

Rahman, S.M.A. 1992.Productivity analysis of rice crop under single and double animal ploughing system in Bangladesh. *Bangladesh journal of Agricultural Research 17 (2): 162-170, December, 1992.*

Saran, R. 1964. Production function approach to measurement of productivity in agriculture. *Agril. Situation in India 19 (5): 461-419.*

Saha, J.K. and S.M., Elias. 1990. Productivity and input use efficiency of onion at farm level in some selected areas of Bangladesh. *Bangladesh journal of Agricultural Research 15(1): 42.*

Singh, I.J., A.C. Ganwar, Chhika and P. Singh. 1974. Production Functions for Commercial Crops in Haryana, *Indian journal of Agril, Econs. 29 (3): 143.*