AN ESTIMATION OF COST OF MILK PRODUCTION IN PAKISTAN: A MICROECONOMIC APPROACH

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ABSTRACT

There is prevalent role of livestock in rural economy of Pakistan as is known from the fact that 30-35 million populations is raising an average holding of 2-3 cattle/buffalo and 3-4 sheep/goat per household with a contribution of 35-40 percent in their income. The study aimed at finding out the net profit scenarios for livestock and their products. The final product of this research endeavor is to draw policy lessons that can help refining the imbalances and distortions in the milk market. It was conducted in Jhang district for estimation of economics of livestock production and by using random sampling techniques 100 respondents were selected. Data was collected on size of farmer land, livestock strength, status of milk animals, sale and purchase during the year, labor cost, value of shed, health cover, concentrate cost, veterinary cost and miscellaneous production cost. Multiple regression and Cobb-Douglas production function were estimated by using Ordinary Least Squares (OLS) method. It was concluded that average fixed cost per animal was 14.8, 8.22 and 4.4 of large, medium and small farmer per month. The fixed cost was Rs. 4973.95, Rs. 2905.54 and Rs. 1536.42 and variable cost were Rs. 14263.11, Rs. 8311.83 and Rs. 3653.46 for large, medium and small farmers per month. The average milk yield per day was 7.99, 7.20 and 6.73 litter. The cost of milk production per litter was Rs. 8.37, Rs. 9.50 and Rs. 8.56 for large, medium and small farmers. The econometrics result showed that livestock production is depicting" increasing return to scale" in the study area. An incentive policy focus in the sector would help alleviating poverty at a large scale in rural areas of Pakistan.

Key Words: Estimation, Cost, Milk production, Microeconomic approach

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INTRODUCTION

Agriculture plays an important role in the economy of Pakistan. This sector contributes about 20.9 per cent to the Gross Domestic Product (GDP) besides providing livelihood and employment to about 43.4 per cent of the population. Rural segment of the society either directly or indirectly linked with agriculture for their livelihood constitute about 65.9 per cent. There is prevalent role of livestock in rural economy as realized from the fact that 30-35 million populations is raising an average holding of 2-3 cattle/buffalo and 3-4 sheep/goat per household with a contribution of 35-40 per cent in their income. For the last 15 years, annual growth in buffalo population was found as 3.0 per cent followed by goats (2.8 per cent) and cattle (2.4 per cent) while sheep population experienced negative growth rate of 0.8 percent (GOP, 2007).

In the past, livestock sector was ignored both at local and national level. Empirical studies, though in good numbers, conducted in the past did not estimate the cost of milk production and identify major problems faced by livestock rearing farmers. Though Pakistan is ranked fifth regarding milk production in the world but still the country is not self-sufficient in milk production and huge amount of valuable foreign exchange is spent on import of milk and milk products (Nestle, 2003). Farooq (2005) determined gap between milk supply and demand in Pakistan and reported the gap of 3.52 million tones in 2003. The gap is likely to increase up to 55.48 million tones by the year 2020.

It is further noted that milk production in Pakistan is predominantly the realm of small and marginal land holders and landless farmers. Small farmers generally keep 1-2 milk animals as a part of the mixed farming systems and then constitute on an overall about 38 percent of the total strength of milk animals. In addition to crop production, these farmers keep few animals for milk production either for home consumption or to sell in order to supplement their income (Ahmed *et al.*, 1996).

Noting a very limited existing stuff of research in the estimation of milk production in Pakistan, this research effort with microeconomic approach was undertaken to such an estimate in addition to identifying problems associated with livestock production systems. The study also aimed at finding out the net profit scenarios for livestock and their products. The final product of this research endeavor is to draw policy lessons that can help refining the imbalances and distortions in the milk market.

MATERIALS AND METHODS

Sampling Arrangements

The present study was conducted in district Jhang being the representative area of livestock production in Punjab, Pakistan; situated at Latitude 31.15° N and Longitude 72.22° E with 2.16 per cent annual population growth spreading over 8, 809 km² areas. The district is divided into four tehsils: Tehsil Jhang, Tehsil Chiniot, Tehsil Shorkot and Tehsil Ahmad Pur Sial. This study was based on primary data and for that purpose a comprehensive questionnaire was designed to collect data. Main source of data was the farmers who were personally interviewed To collect the required information.

For this study Tehsil Shorkot of district Jhang was selected as universe. Due to time limitation others three tehsils were not considered. A random sampling technique was employed to draw representative sample. Sample size was kept 100 livestock household, each village have 50 respondents. Instead of land base classification, farmers were classified on the basis of number of animals keeping in mind the study objectives. Two Mozas was selected, first near to the Shorkot city about 6 km away from i.e. Moza Bhango and second was 10 km away from the Shorkot city i.e. Benda Surbana selected as remote village. Random sampling technique used for selection of farmers in the villages.

Collection of Data

Interviewing schedule refers to formal questions asked to the respondents by the interviewer. Interviewing schedule was designed to write questions according to the respondents and relevance of research being conducted. The interviewing schedule consisted of structural and non-structural questions. It was prepared in English but at the time of interview, the Punjabi language was used because all the respondents were Punjabi speaking. The questionnaire focused on the background information's and information about the livestock production and milk production. The pre-testing was done in order to ensure the validity and accuracy of interviewing schedule.

Estimation Arrangements

The pacca, kacha and mixed type of sheds were constructed by farmers for their livestock. In the rural areas, animals including the milk animals were commonly kept under the same shed. For the purpose of cost estimation, depreciation cost was calculated at the rate of 2.5 percent and 5 percent of the current construction cost of the pacca and kacha sheds, respectively; while the interest rate was charged at the rate of 12 percent (depending upon the opportunity cost of capital). Animal shed costs can be calculated on the basis of adult animal units, using the following formula (Ahmed *et al*., 1996).

$$\mathbf{MF = SC \times MA/TA} \qquad \mathbf{(1)}$$

MF = the shed cost for milk animals
SC = Total shed cost in rupees
MA = the milk animal units
TA = the total animal units

Different types of tools and equipment which were used for feed and fodder utilization for animals as an example sickle, hand toka, wooden manger, kacha manger, pacca manger, steel chain, khurpa, fodder cloth etc. the cost of above equipments were estimated on the basis of original purchase with respect to the rate of depreciation and interest rate.

In the study area fodder is the major input for livestock rearing. The cost of fodder was calculated on the basis of per acre price at prevailing rate in the study area and share of milk animals can be derived from the total cost on green and dry fodder by using the following formula (Ahmed *et al*., 1996).

$$\mathbf{CMA = TCF \times MA/TA \quad (2)}$$

Where
CMA = Cost of green and dry fodder fed to milk animals in rupees,
TCF = Total cost of green and dry fodder fed to livestock,
MA = Milking animals and
TA = Total animals.

For milk production total yield per household per lactation of wet animals was computed with respective price received by household and those who did not sell the milk at prevailing price in the villages and used for home consumption was taken into account to arrive at the gross income from milk production. An average animal was supposed to have produced 30 pounds (13.6 kilograms) of fresh dung per day. As in village there was a common practice to make dung cake to be used as fuel, thus the income from farmyard manure was computed in terms of dung cakes. Total number of dung cake produced per day and multiplying it with average village price of dung cake.

Econometric Model

For simple analysis, statistical package SPSS, mainly cross tabulation and frequency distribution will be executed. F- Statistics used in order to judge whether the difference between the different areas are significant. If the computed value of calculated F-statistics is greater than the tabulated F-statistics, the difference between the areas will be statistically significant. In order to check the difference between the difference areas the multiple comparison "Tuckey Test" will be applied. Following econometrics model was used for income of the farm of livestock production (Pervaz *et al*., 1985, Sadiq *et al*., 2003 and Sugiyanto, 1983)

$$\mathbf{Y = \beta_0 + \beta_1 FS + \beta_2 MA + \beta_3 FD + \beta_4 L \quad (3)}$$

Where
Y = Income from milk production
FS = Farm size
MA = Milking animal
FD = Feed cost (Green and Dry Fodder) of milk animal
L = Labour cost
β_0 = Intercept
β_s = Coefficient with respect to FS, MA, FD and L

Cost of Milk Production

Production Function is technical, mathematical and physical relation ship between inputs and outputs. The Cobb-Douglas production function was also be use to trace out the scale of return, as follow (Pervaz *et al*., 1985, Sadiq *et al*., 2003 and Sugiyanto, 1983).

$$\mathbf{Y = C\,(FS)^{\beta 1}\,(MA)^{\beta 2}\,(FD)^{\beta 3}\,(L)^{\beta 4} \quad (4)}$$

Where variables Y, FS, MA, FD and L are defined earlier and carry exactly the same meaning while C is the constant and depends on the units of measurement of Y, FS, AU, FD and L. the coefficient, β_S are the elasticity's of output with respect to FS, AU, FD and L inputs respectively. Taking log of equation 2

$$\mathbf{\log Y = \log C + \beta_1 \log FS + \beta_2 \log MA + \beta_3 \log FD + \beta_4 \log L \quad (5)}$$

This equation was estimated by using OLS method for sample areas and farmers in different size categories. These collectively measure the return to scale. Thus, if $\beta_1 + \beta_2 + \beta_3 + \beta_4 = 1$, we have constant return to scale, if $\beta_1 + \beta_2 + \beta_3 + \beta_4 < 1$, we have decreasing return to scale and if $\beta_1 + \beta_2 + \beta_3 + \beta_4 > 1$, we have increasing return to scale**.**

Following formula was used to determine the production cost of milk

Cost of milk production = Total cost /ΣMP (6)

It was used to determine the cost involved in the production of milk (it is on per unit basis) in the sample areas which is function of age, lactation period, feeding practices and calving month etc. due to these variable milk production per day varies over time. ΣMP is the sum of milk production. At the end cost benefit ratio was also calculated in order to determine the profitability of the farm (Hosking and Preez, 2004).

Benefit Cost Ratio = Total Benefit - Total Cost (7)

RESULTS AND DISCUSSION

Cost of Livestock Production

It is imperative to carry out cost analysis of livestock enterprise. It can assist to highlight indivisibility of the economies and diseconomies while exploring the avenues of cost the avenues of cost reduction.

Fixed Cost

The cost items included in the fixed cost category were shed cost, land rent cost, animal cost and equipment cost. Table 1 explained that average fixed cost for the large, medium and small farmers were Rs. 4973.95, Rs. 2905.54 and Rs. 1536.42 per adult milk animal respectively and on overall basis fixed cost of livestock producer was Rs. 3138.64 per adult animal.

Variable Cost

The various components of variable cost were labour cost, green fodder cost, concentrate cost and cost of medicine and vaccination. These costs were taken on average monthly basis. The table 4 explained the variable cost of various components. On average variable cost for large, medium and small farmers were Rs. 14263.11, Rs. 8311.83 and Rs. 3653.46 and on overall bases variable cost of livestock producers was Rs. 8742.8. The total cost per month were Rs. 19237.06**,** Rs. 11217.37 and Rs. 5189.88 for the large farmers, medium and small farmers respectively as explained in the same table. Similarly, on overall basis, total cost of livestock producer was Rs. 11881.44.

Milk Yield

Milk production is a function of milk yield per day, lactation period and its characteristics, breed and age of animal reared. The kind and quantity of concentrate fed to animals also influence milk yield. The data indicated that average yield of milk per day per milk animal was 7.99 liters, 7.20 liter and 6.73 liters for the large, medium and small livestock producing communities respectively and on overall basis average milk yield per day adult milk animals was estimated to be 7.31 liters. Average prices of milk in two Moza were 16 rupees per liter. Overall basis income generated from milk was Rs. 18773.12, for large, medium and small farmers were Rs. 36779.67, Rs. 18880 and Rs. 9691.2, respectively. The difference was due to different number of animals per farmer in the study area. On the other hand, milk output is a function of age, lactation period, calving month, feeding practice etc. Due to these variables milk production per day varies over time. From the table no.4, it was clear that the cost of milk per day liter varied from Rs. 8.37 for the large farmer, Rs. 9.50 for the medium farmer and Rs. 8.56 for the small farmer respectively.

Gross and Net Income of Livestock Producer

Gross income comprises all the receipts from the major and minor products of livestock, which are produced by livestock owners. The sources of income considered in this study were sale of milk and farmyard manure per milking animal per month. These components were evaluated at the current price rates per units prevail in the sample area. Table 4.1 showed that the gross income of large, medium and small farmers were Rs. 36894.94, Rs. 18965.69 and 9747.21 respectively and overall bases gross income was Rs. 21869.15. The difference was due to efficient management practices by the farmers. On overall basis, net incomes from livestock production were Rs. 9987.84 and for large medium and small farmer's categories were Rs. 8481.33, Rs. 2684.82 and Rs. 1907.1 per month.

Cost Benefit Ratio

The cost benefit ratio was estimated for milk animals for the three categories of rural livestock produces are depicted in the table No. 1. On overall basis, the cost benefit ratio in the sample area is 1:1.82 and for large, medium and small farmers 1:1.91, 1:1.68 and 1:1.87 respectively. The cost benefits ratio of large farmers is higher than the medium and small farmers. However, there is an only slight difference between the medium and small farmer's classes

Advance Econometric Estimation

Following econometrics model was used for income of livestock production (Pervaz *et al*., 1985, Sadiq *et al*., 2003, and Sugiyanto, 1983). Economic theory suggests that all coefficients $\beta_{1,}$ $\beta_{2,}$ $\beta_{3,}$ and β_4 have positive signs related to income. The number of animal has a positive effect on the income of the farmers, holding other variables held constant; the income of farmer will go up by increasing one animal on the farm.

Y= 2897.22 + 2021.73 FS + 821.84MA + 1.15 FD + 0.47L (8)
(1.7) (1.6) (2.3) (4.7) (0.4)
R^2 = 0.641 D. W. 1.98 F-value = 42.92

The above R^2 value represents that these independent variables are speaking good fitting (64 %) for income accrued from livestock. As we increase one milk animal on the farm, on the average income of farmer goes up by Rs. 2022, other things remaining the same, the positive t-value (1.6) at 5 % level of significant support this statement. Holding other variables constant, if we increase one milch animal in farm, as result of this income level of the farmers will increase about Rs. 822 per milch animal. The significant t-value (2.3) will also support this statement. The role of feed is obvious from its positive sign and high t-value (4.7) at 5 % level of significant indicate high return and will increase the income 1.15 more than the usual income by holding the other variables constant.

The low t-value (0.4) of labour (L) at 5 % of level of significant showed that labour plays important role in the livestock sector. If we increase one labour on the farm, it increases the income by 0.47 % and thus indicates the positive relationship between the labor and income of the farmers of livestock producer in the study area. In equation 8 the intercept value of 2897.22 reads that if all variables are assumed zero, the mean or average of income would be about Rs. 2897.22. The Durbin Waston statistics (1.98) indicated that there is no first order autocorrelation (either positive or negative) for the value is very near to the optimal threshold. And F-value showed the level of significance (fairly good) of the whole model.

Return to Scale

It is important to analyze the scale of return for livestock enterprise in order to find out whether opportunity exists for the farmers to invest more in the livestock sector or not. For this purpose, the equation (ii) specified in chapter 3 has been estimated by taken log and empirical results provided as follows

Y = 5.36 + 0.19FS + 0.27MA + 0.53FD + 0.29L (9)
(6.67) (1.51) (3.92) (5.81) (0.27)
R^2 = 0.75 D.W 1.96 F-value = 71.86

The above stated empirical results indicate the idea of the result of the earlier model that the size of the farm (FS), number of milking animals (MA), quantity of feed (FD) and labor (L) engaged largely determine the returns from livestock enterprise. This result indicates two important points; first, the coefficient βs, in fact, represents the elasticity's and suggest that if farm size (FS), number of milking animals (MA), quantity of feed (FD) and labor (L) are individually increase by 10 per cent, these would increase return respectively, about 2 percent, 2.7 percent, 5.3 percent and 2.9 percent. Second, the additive elasticity's of the all coefficients i.e. $\beta_1 + \beta_2 + \beta_3 + \beta_4$ is greater than 1; i.e. 1.28, which showed that the livestock sector in the study areas was depicting increasing returns to scale. It is suggested that more investment in this sector will change the prevailing scenario and will help in improving the socio-economic conditions of the farmers in the country.

Table I. ***Cost and revenue of livestock by farm categories***

Particulars	Large	Medium	Small	All
Costs				
A. Variable Cost				
Fodder (Green +Dry)	6834.02	3950.98	1933.74	4239.58
Concentrate	5032.54	2650.95	1035.63	2906.37
Labour	2173.29	1588.13	571.5	1444.31
Vet. & Medicine	223.26	121.77	112.59	152.54
A. Total	14263.11	8311.83	3653.46	8742.8
B. Fixed Cost				
Shed cost	830.59	588.28	342.51	587.13
Land rent	688.95	537.57	180	468.84
Animal cost (Rs)	3312.96	1680.58	915	1969.51
Equipment cost	141.45	99.11	98.91	113.16
B. Total	4973.95	2905.54	1536.42	3138.64
1. Total Cost (A+B)	**19237.06**	**11217.37**	**5189.88**	**11881.44**
Revenue				
Milk Yield/ day	7.99	7.20	6.63	7.31
Milk (Liter) /month	2298.73	1180	659.7	1376.48
a) Milk (Rs)	36779.67	18880	9691.2	18773.12
b) Farmyard Manure	115.27	85.69	56.01	85.66
2. Gross Income **(a +b)**	36894.94	18965.69	9747.21	21869.15
Net Income (**2 –1**)	17657.88	7748.32	4557.33	9987.84
Cost per Liter	8.37	9.50	8.56	8.81
Cost benefit ratio	1:1.91	1:1.68	1:1.87	1:1.82

CONCLUSION

It is summed up that if the elasticity coefficients are added up, we obtain economically important parameter called the return to scale parameter, which gives the response of output to a proportionate change in inputs. Theoretically speaking, if the sum of the elasticity coefficient of the all the variables included in the model is one, we have constant returns to scale scenario which reads that by doubling the input simultaneously, output is doubled as well. If it is greater than one, we have increasing returns to scale as is the case in this study (1.28). So, by investing one rupee in the livestock farming community could earn 1.28 rupees. It is high time to invest more in livestock sector for increasing the welfare level of the farmers on the one hand and reducing the poverty level on the other hand. A special policy package should be given by the government for maintaining and sustaining such return to scale.

REFERENCES

Ahmad, B., M. Ahmad and M.A. Chaudhry. 1996. Economics of Livestock Production and Management. Agric. Social Sci. Res. Centre, Univ. of Agric., Faisalabad. 89-90.

Chilonda, P and J. Otte. 2006. Indicators to monitor trends in livestock production at national, regional and International levels. Livestock Res. Rural Dev. 18 (8): 30.

Farooq, U. 2005. Improving opportunity for International Trade in Livestock Products. Draft paper. Social Sci. Div., Pak. Agric. Res. Council, Islamabad

GOP. 2007. Economic Survey. Econ. Advisory Wing, Finance Div., Islamabad.

Lohano, D. H and F. M. Soomro. 2006. Unit Root Test and Forecast of Milk Production in Pakistan. International J. of Dairy Sci. 1(1): 63-69.

Ngongoni, N. T., C. Mapiye, M. Mwale and B. Mupeta. 2006. Factors affecting milk production in the smallholder dairy sector of Zimbabwe. Livestock Res. for Rural Dev., 18 (5): 20.

Pervaiz, A., H. Knipscheer and J.B. Boer. 1985. Economic Analysis of on-farm livestock Trials. Working Paper No. 63, WINROCK, Int. Morrilton AR. 72110, USA.

Sadiq, G., M. Ishaq and S. H. Saddozai. 2003. Estimation of cost and revenue and analysis of the different factors affecting livestock production. Sarhad. J. Agric. 19(4): 579-584.

Sugiyanto, 1983. A Production for Sheep and Goats Enterprises in West Javanese Farming System. Working Paper No. 15. Brawijaya Univ., Malang, East Java, Indonesia.

Wanapat, M., A. Petlum, N. Wongnen, S. Matarat, S. Khampa and P. Rowlinson. 2007. Improving Crop livestock Production Systems in Rainfed Areas of Northeast Thailand. Pak. J. Nutr. 6 (3): 241-246.

Younas, M. and M. Yaqoob. 2005. Feed resources of livestock in the Punjab, Pakistan. Livestock Res. for Rural Develop. 17 (2): 20.