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RESEARCH ON MILK COST, RETURN AND PROFITABILITY IN DAIRY FARMING

Agatha POPESCU

University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti, District 1, Zip code 011464, Bucharest, Romania, Phone: +40 213182564/232, Fax:+40213182888, Email:agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper aimed to the relationship between milk cost in terms of material cost and labor cost and estimate the influence of these costs on returns coming from milk and profitability in 5 small dairy farms from the Southern Romania. The main economic indicators taken into consideration were: material cost, X_i, (feeding cost, replacing heifer, equipment and shed depreciation, electricity and water cost, fuel and lubricants cost) , labour cost, Y, and income coming from milk, Z. The Cobb-Douglas regression function $Z= a x^{\alpha} y^{\beta}$ was used to determine the variation of the studied economic indicators and relationships between them. Taking into account the close relationship between income from marketed milk and material cost and labor cost, it is enough to use it as the only criterion in farm classification. Profitability in dairy farms depends both on cost input and milk output as well as milk market price.

Key words**:** *income from marketed milk, labor cost, material cost, milk cost, profitability, return*

INTRODUCTION

Milk production cost is influenced by a large range of environment factors, but the main ones are represented by feeding cost, labor cost, heifer for replacing the culled cow, medicines and veterinary services, frozen semen from the highest breeding value bulls and artificial insemination service, depreciation of sheds and specific equipment, water and electricity cost, rental value of land owned by dairy farmer [11,12].

The highest share in milk production cost is represented by feeding, labor and veterinary services cost [2,6]

A higher milk yield requires a higher production cost, an aspect that farmers should take into consideration and handle in the most efficient way.

Returns in dairy farming are deeply determined by variable cost and production cost and the correlations existing between farm size, milk yield, variable cost, total cost and milk price are important to be studied and keep under control by farmers. [3].

Profit, as a measure of economic efficiency in dairy farming is the difference between income coming from milk and milk production cost including all the cost items [14].

Taking into account that milk production depends on various farm inputs in terms of variable costs, profit could be considered a function of milk yield and input prices [1].

An increased milk price by 1 % increased milk profit by 8.27 % in India while an increased labor by one person decreased profit by 1.8 %.

The profit margin in the dairy farming is considered the difference between milk production cost and farm gate milk price [7].

In Romania, the highest share in milk production cost is represented by feeding (69 %), replacing heifer (7.5 %) and labor cost (4.5 %) [8,9].

The main role in milk production cost is played by feeding cost, which is more sensitive to variation than average milk cost. Therefore, milk economics deeply depends on feeding cost. [4].

The relationship between milk production cost and return is studied using various methods such as cost-benefit analysis [5] and multiple regression functions [10,13].

In this context, the purpose of this paper was to examine the relationship between milk cost

in terms of material cost and labor cost and estimate the influence of these costs on returns coming from milk and profitability.

MATERIALS AND METHODS

This study is based on the data collected in the period 2011-2013 in 5 small dairy farms from the Southern Romania. The main economic indicators taken into consideration were: material cost, X_i, (i=1,2, ..6), where X_1 = material cost, X_2 = feeding cost, X_3 = biological material (replacing heifer), X_4 = equipment and shed depreciation, X_5 = electricity and water cost and X_6 = fuel and lubricants cost, labour cost, Y, and income coming from milk, Z.

In order to study the relationship between these indicators, the variables were used in terms of logarithms and the coefficients of simple and multiple linear regression were calculated. Also, Fisher Test for P=0.05, P=0.01 and P=0.001 was used for pointing out the significant differences.

The Cobb-Douglas regression function having the formula $Z= a\, x^{\alpha}\, y^{\beta}$ was also used with its solution: $\log Z=\alpha \log x + \log y + \log a$, that is the multiple linear regression between X = log x, Y = log y and Z = log z.

The parameters α and β were determined using the formulas:

$$\alpha = \frac{r_{XZ} + r_{YZ} + r_{XY}}{1 - r_{XY}^2} \qquad \beta = \frac{r_{YZ} + r_{XZ} + r_{XY}}{1 - r_{XY}^2}$$

and $\log a = \bar{Z} - \alpha\, \bar{X} - \beta\, \bar{Y}$.

The regression functions, Z_i, were determined for various items of material cost X_i, (i=1,2, ..6), so that to assure a minimum residual variance.

Also, the influence of the variation of X and Y factors on the variation of Z factor was also calculated as follows: $A_{(X,Y)}$= total influence of the pair of factors material cost (X_i) and labor cost (Y), $A_{(X,Y)}$ = the partial influence of the variation of X_i when Y = constant, $A_{(Y,X)}$= the partial influence of Y when X_i = constant, $A_{(XY)}$= the influence of the variation of the interraction between X_i and Y, A_E= the influence of other factors.

RESULTS AND DISCUSSIONS

Coefficients of simple linear regression between material cost, labour cost and income from milk are presented in Tabel 1. As one can see the sense and intensity of correlation coefficients varied from a pair of indicators to another.

Income coming from marketed milk was closely correlated to material cost, r = 0.660, and by item of material cost r = 0.680 for current and main equipment repairs, r = 0.622 for fuel and lubricants cost, r = 0.524 for feeding cost, and r = 0.549 for depreciation of fixed assets.

A closer positive relationship it was found between income coming from milk and labor cost, r = 0.802.(Table 1).

Table 1. Coefficients of simple linear correlation between material cost, labor cost and income coming from milk

Indicator	Labor cost	Income from marketed milk
Material cost	0.945	0.660
Feeding cost	0.864	0.524
Medicines and biological material (replacing heifer)	0.343	0.172
Equipement current repairs and maintenance cost	0.729	0.680
Depreciation cost	0.772	0.549
Fuel and lubricants cost	0.786	0.622
Income from marketed milk	0.802	-

Source: Own calculations

Coefficients of multiple linear correlation are given in Table 2 and reflect that there is a close and postive relationship between income coming from marketed milk, material cost and labor cost.

The Fisher statistic registered lower values than the quantiles for $F_{P=0.05}$= 19, reflecting that the indicators are not linearlly correlated.

Partial coefficients of multiple linear correlation are presented in Table 3.Their values between theincome frommarketed milk and various material cost items, on one side, and labor cost, on the other side, reflected weak links and of oposite sense in most of cases ($-0.5 < r_{Z.XY} < 0$).

Table 2.Coefficients of multiple linear correlation ($r_{Z.XY}$) between material cost, labor cost and income coming from milk

Indicator	$r_{Z.XY}$	F
Material cost	0.947	9.10
Feeding cost	0.864	3.59
Medicines and biological material (replacing heifer)	0.343	2.34
Equipement current repairs and maintenance cost	0.729	2.39
Depreciation cost	0.772	2.32
Fuel and lubricants cost	0.786	2.31

Source: Own calculations

But one can easily notice that between income from marketed milk and labor cost,on one side, and various material cost items, on the other side, it is a strong positive correlation.
The calculated F values < $F_{0.05}$ =18.51 reflected that these indicators are not partially linearlly correlated when labor cost is constant.

Table 3.Partial coefficients of multiple linear correlation ($r_{Z.XY}$) between material cost, X_i, (i=1,2, ..6), labor cost, Y, and income coming from marketed milk, Z

Indicator	$r_{ZX.Y}$	$r_{ZY.X}$	F
Material cost	- 0.497	0.726	2.23
Feeding cost	- 0.573	0.818	4.04
Medicines and biological material (replacing heifer)	- 0.183	0.804	3.65
Equipement current repairs and maintenance cost	0.234	0.611	1.19
Depreciation cost	-0.184	0.695	1.87
Fuel and lubricants cost	-0.021	0.648	1.45

Source: Own calculations

The influences of factors variation of material cost (X_i), and labor cost (Y) on the variation of income from marketed milk (Z) are presented in Table 4. One can notice that the total influence of the simultaneous variation of the pair factors material cost and labor cost on the variation of income from marketed milk was a substantial one.

When labor cost was constant, the influence of the material cost variation as a whole and also by cost item on income could be ignored, because it had a low value. When material cost was considered a fixed factor, the influence of the labor cost variation had a considerable value and for this reason it deserves to be taken into account (30%) when we analyze its influence on income. Other factors cumulated in the term of error had an influence of 10-35 % on income from marketed milk.

Table 4.The influences of the factors variation of material cost (X_i), labor cost (Y) to the variation of income from marketed milk

Indicator	$A_{(X,Y)}$	$A_{(X.Y)}$	$A_{(Y.X)}$	$A_{(XY)}$	$A_{(E)}$
Material cost	0.89	0.09	0.30	0.02	0.11
Feeding cost	0.75	0.12	0.49	0.32	0.25
Medicines and biological material (replacing heifer)	0.65	0.01	0.63	0.67	0.35
Equipment current repairs and maintenance cost	0.66	0.02	0.20	0.23	0.34
Depreciation cost	0.65	0.01	0.34	0.40	0.35
Fuel and lubricants cost	0.64	0.001	0.26	0.35	0.36

Source: Own calculations

The Cobb-Douglas regression functions reflecting the variation of income in relation to material and labor cost are presented in Table 5.

Table 5. Cobb-Douglas regression functions of income (Z) in relation to material cost (X_i), and labor cost (Y)

Material cost items	$Z_i = a\, x_i^{\alpha}\, y^{\beta}$ (i-1,2,...6)
Material cost (X_1)	$Z_1 = 1.44\, x_1^{-0.91}\, y^{1.67}$
Feeding cost (X_2)	$Z_2 = 2.64\, x_2^{-0.69}\, y^{1.37}$
Medicines and biological material (replacing heifer) (X_3)	$Z_3 = 1.55\, x_3^{-0.12}\, y^{0.85}$
Equipment current repairs and maintenance cost (X_4)	$Z_4 = 4.76\, x_4^{0.20}\, y^{0.65}$
Depreciation cost (X_5)	$Z_5 = 2.50\, x_2^{-2.88}\, y^{3.02}$
Fuel and lubricants cost (X_6)	$Z_6 = 2.02\, x_6^{-0.02}\, y^{0.82}$

Source: Own calculations

CONCLUSIONS

Material cost and labor cost represent the most important cost item in total milk production cost.
They are closely correlated with income from marketed milk.
For the same level of labor cost in dairy farms, material cost has a negative influence on income.
In the dairy farms where material cost is similar and constant, labor cost is deeply correlated with income coming from marketed milk.
The existence of some nonlinear relationships among various financial indicators involves the establishment of corresponding production functions which should be used in order to determine the optimum level where income is maximized and material cost and labor cost are minimized.
Income coming from marketed milk represents a significant economic indicator for establishing the optimum farm size. Taking into account its close relationship with material cost and labor cost, it is enough to use only income from milk as a criterion for farm classification.
The evaluation of profitability in dairy farms requires to take into account both cost input and milk output as well as milk market price.

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