# Productive Efficiency Of Milk Production In Tamil Nadu

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## INTRODUCTION

Agriculture has always been the backbone of the Indian economy. It provides employment to around 60 per cent of the total work force. Agricultural growth has a direct impact on poverty eradication. The change in the agricultural sector, whether positive or negative, will have a multiplier effect on the entire economy. Besides, the allied sector like horticulture, animal husbandry, dairy and fisheries have an important role in improving the over all economic conditions of rural India. To maintain the ecological balance, there is need for sustainable and balanced development of agriculture and allied sectors. From our first plan onwards, planners have given priority to the allied sector for the economic development of the rural sector. Dairy farming is described as a small industry which provides gainful employment opportunities. It comprises of about six per cent of the national income.

The core of any activity is to strive for the maximum possible efficiency. Efficiency refers to efficient allocation of goods to be produced, efficient allocation of resources in production of these goods and efficient choice of methods of production and efficient allotment of the goods among the consumers. It is important to examine the resource use efficiency and returns to scale parameter in production process since it will help to formulate the policies designed to promote efficiency in this sector.

India's first co-operative dairy with processing and marketing facilities was established at Ayyanavaram in Tamil Nadu in 1927. The State Dairy Development was taken over by the Tamil Nadu Dairy Development Corporation in 1972. Tamil Nadu is one of the leading producers of milk. Hence, this study has made an attempt to analyse the efficiency of dairy farming in Tamil Nadu.

## OBJECTIVES OF THE STUDY

1. To estimate the marginal value productivities of various inputs in order to suggest the possibilities of their reallocation for further increase in milk production of Tamil Nadu.
2. To measure the returns to scale parameter in milk production of Tamil Nadu.

## METHODOLOGY OF THE STUDY

## SAMPLE DESIGN AND COLLECTION OF DATA

As the State of Tamil Nadu is characterized by considerable heterogeneity in agro climate, resource endowments and economic performance, the production function is here carried out at the district level. Madurai district has been selected for the study. This district is basically agro based and agriculture is the main occupation. It is situated on the banks of the river Vaigai. This district offers scope in the field of dairy farming.

This study is based on primary data. The data has been collected from the milk producers through well designed interview schedules. The structural schedules administered through personal interview method were extended to 200 milk producers. The convenient sampling method has been used for the study. Among these 200 milk producers, 148 milk producers have their own milch cows and 36 milk producers have own milch buffaloes and 16 have own both milch cows and milch buffaloes. The field survey has been conducted during the months of December 2006 to March 2007.

## TOOLS OF ANALYSIS

The Cobb-Douglas production function has been fitted in order to determine the efficiency of each variable in the production of milk. The estimated production function was of the following form.

$$\text{Ln } Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + u.$$

Where

Y = Value of milk yield per animal per day during the lactation period in rupees.

$X_1$ = Value of green fodder fed per animal per day during lactation period in rupees.

$X_2$ = Value of dry fodder fed per animal per day during lactation period in rupees.

$X_3$ = Value of concentrates fed per animal per day during lactation period in rupees.

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$X_4$ = Maintenance cost per animal per day during lactation period in rupees.
$X_5$ = Miscellaneous expenditure per animal per day during lactation period.
U = Disturbance term.
$\beta_0, \beta_1, \ldots. \beta_5$ are the parameters to be estimated.
As the resource use efficiency has been judged on the basis of neo classical criterion, each production is paid according to its marginal productivity.
The marginal value productivity (MVP) of a particular resource represents the expected addition to the gross revenue caused by an addition of one unit of that resource, while other inputs are held constant. The marginal value productivity of any particular input say Xi can be derived as

$$MVP_{xi} = \frac{dy}{dxi}$$

$$MVP_{X1} - \text{Green fodder} = \beta_1 \frac{\bar{Y}}{\bar{X}_1}$$

$$MVP_{X2} - \text{Dry fodder} = \beta_2 \frac{\bar{Y}}{\bar{X}_2}$$

$$MVP_{X3} - \text{Concentrates} = \beta_3 \frac{\bar{Y}}{\bar{X}_3}$$

$$MVP_{X4} - \text{Maintenance Cost} = \beta_4 \frac{\bar{Y}}{\bar{X}_4}$$

$$MVP_{X5} - \text{Miscellaneous Expenditure} = \beta_5 \frac{\bar{Y}}{\bar{X}_5}$$

The returns to scale could be assigned by sum of these coefficients of Cobb- Douglas production function. Returns to scale mean the change in the output resulting from a simultaneous change in all the inputs in same proportion.
In order to find out the value of economic efficiency at different inputs, the MVPs of inputs have been compared with the respective acquisition costs. Then the ratio (P) of MVPs to marginal costs were calculated. For P=1, the use of given resources has been considered optimum, P>1 indicated that the employment of a given resource could be increased till P become equals to unity and on the other hand P<1 indicated that employment of a given resource should be decreased till it becomes unity.
In order to examine the structural difference regarding the yield of milk between cow and buffalo, chow test has been applied for the study.

$$F = \frac{[\sum e^2 - (\sum e_1^2 + \sum_2^2)]/k}{[\sum e_1^2 + \sum e_2^2] / n_1 + n_2 - 2k}$$

$\sum e^2$ = Unexplained sum of squares for pooled category.
$\sum e_1^2$ = Unexplained sum of squares for cows
$\sum e_2^2$ = Unexplained sum of squares for buffalos.
$n_1$ = Number of observations for cows.
$n_2$ = Number of observations for buffaloes.
k = Number of parameters including the intercept term.

## RESULTS AND DISCUSSIONS

## ESTIMATED REGRESSION RESULTS OF MILK PRODUCTION

**Table 1 : Regression Coefficients of Multiple Determinations in Milk Production**

| Sl. No. | Category | Regression Co-efficients | | | | | | $R^2$ | F-value |
|---|---|---|---|---|---|---|---|---|---|
| | | $\beta_0$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | | |
| 1. | Cow | 1.4810 | 0.2231** (1.974) | 0.1955 ** (2.645) | 0.2468** (2.755) | 0.1665*** (1.878) | 0.4101** (2.802) | 0.82 | 27.88 |
| 2. | Buffalo | 0.6380 | 0.1624** (2.054) | 0.2522** (2.627) | 0.0991** (3.609) | 0.0483** (3.371) | 0.7041** (5.179) | 0.85 | 12.88 |
| 3. | Pooled | 1.8095 | 0.4327** (9.185) | 0.5166** (4.017) | 0.1490** (2.497) | 0.0512** (2.107) | 0.7300** (2.69) | 0.83 | 94.56 |

Source: Compiled from Primary data.

Note. 1.Figure in Parentheses represent t-values 2.** and *** indicate 5 per cent and 10 per cent level of significance respectively.

It can be seen from the table 1 that the adjusted coefficients of determination are 0.82, 0.85 and 0.83 for cow, buffalo and pooled data respectively. This indicates that the selected inputs are important factors for explaining the variation in the production of milk.

It is observed that green fodder, dry fodder, concentrates and miscellaneous are statistically significant at 5 per cent level and they were positively related to yield of milk production in the case of cow. It indicates that one per cent increase in these variables may lead to 0.2231, 0.1955, 0.2468 and 0.4101 per cent increase in yield of milk production respectively.

In the case of Buffalo, all the variables are statistically significant and they are positive. It indicates that one per cent increase in green fodder, dry fodder, concentrates, maintenance cost and miscellaneous expenditure may lead to 0.1624, 0.2522, 0.0991, 0.0483 and 0.7041 increases in yield of milk production respectively.

It is also observed that all the inputs in influencing milk production have significant regression coefficients in the case of pooled category. One per cent increase in green fodder, dry fodder, concentrates, maintenance cost and miscellaneous expenditure leads to 0.4327, 0.5166, 0.1490, 0.0512 and 0.7300 per cent increase in yield of milk production respectively in the case of pooled category.

The regression coefficients of all the inputs are positive in all the equations fitted. This indicates that there is great scope of increasing production of milk by increasing the use of these inputs. The regression coefficients of miscellaneous expenditure have been found maximum for cow, buffalo and pooled category. It is noted that among the five inputs, miscellaneous expenditure items such as minor repairs of cattle shed, dairy equipment, electricity, water charges, health care expenses etc is more influencing variables in milk production in the study area. The maintenance cost has been found minimum in all the cases. That is, maintenance cost had uniformly poor influence on milk production.

## RETURNS TO SCALE

**Table 2 : Estimated Returns to Scale Parameter in Milk Production**

| Sl. No. | Category | Returns to Scale Parameter |
|---|---|---|
| 1. | Cow | 1.24 |
| 2. | Buffalo | 1.26 |
| 3. | Pooled | 1.47 |

The returns to scale have been estimated from the estimated coefficients at the production functions. The magnitude of returns to scale indicates the percent increase in milk production when all the inputs are increased simultaneously by one per cent. In the case of cow, buffalo and pooled, the returns to scale shows that the production milk is expected to increase by 1.24, 1.26 and 1.47 per cent respectively when all the inputs are simultaneously increased by one per cent. The scope for increasing of milk production can be increased by increasing the input factors.

## STRUCTURAL DIFFERENCES IN THE YIELD OF MILK PRODUCTION BETWEEN COW AND BUFFALO

Chow's test has been applied in order to examine whether structural relations of the cow and buffalo are different from each other regarding the yield of milk.

**Table 3 : Test for Structural Differences Between Cow and Buffalo**

| $\Sigma e^2$ | $\Sigma e_1 2$ | $\Sigma e_2 2$ | $F^*$ | Inference |
|---|---|---|---|---|
| 4.1592 | 0.2161 | 0.4228 | 157.98 | Structural Difference exists between cow and buffalo |

From the Table 3, the computed value of F* is found to be higher than its table value at one per cent level with 172 degrees of freedom. Therefore, a null hypothesis is reflected. Hence, it can be inferred that there is structural differences between cow and buffalo.

## RESOURCE USE EFFICIENCY

The basic condition to be satisfied to obtain efficient resource use is the equality of marginal value productivity to factor cost. Since all the inputs and output are expressed in monetary terms in the present study, the acquisition cost of inputs is taken as one rupee. The criterion used to assess the resource allocation efficiency is to test the MVPs against unity.

**Table 4 : Marginal Value Productivity (MVP) and Resource-use Efficiency of Inputs in Milk Production for Cow and Buffalo**

| Inputs | MVP | Price | Difference Between MVP and Price |
|---|---|---|---|
| Green Fodder | | | |
| **Cow** | **1.115*** | **1** | **0.115** |
| | **(1.974)** | | |
| **Buffalo** | **1.101*** | **1** | **1.101** |
| | **(2.054)** | | |
| Dry Fodder | | | |
| **Cow** | **0.692*** | **1** | **0.308** |
| | **(2.645)** | | |
| **Buffalo** | **0.594*** | **1** | **0.406** |
| | **(2.627)** | | |
| Concentrates | | | |
| **Cow** | **1.234*** | **1** | **0.234** |
| | **(2.755)** | | |
| **Buffalo** | **1.826*** | **1** | **0.826** |
| | **(3.609)** | | |
| Maintenance Cost | | | |
| **Cow** | **0.542*** | **1** | **0.468** |
| | **(1.878)** | | |
| **Buffalo** | **0.439*** | **1** | **0.561** |
| | **(3.371)** | | |
| Miscellaneous Expenditure | | | |
| **Cow** | **2.051*** | **1** | **1.051** |
| | **(2.802)** | | |
| **Buffalo** | **3.654*** | **1** | **2.654** |
| | **(5.179)** | | |

Source: Compiled from Primary data.
Note: 1. Figure in parentheses indicates t-values. 2. Indicates that 5 per cent level of significance.

The marginal value productivity (MVP) has been found greater than unity for green fodder, concentrates and miscellaneous expenditure in the case of both cow and buffalo. This indicates that the added returns at this level is higher than the additional cost incurred for the additional unit of these inputs. Therefore, it is concluded that these inputs could be enhanced to increase the returns.

The MVPs of dry fodder and maintenance cost has been registered lower than the acquisition cost for both cow and buffalo. This indicates that there is over utilization of these inputs. Therefore, withdrawal of one unit of these inputs could improve the gross returns. It is suggested that employment of these resources should be decreased till the ratio (P) becomes unity. In other words, the part of dry fodder and maintenance cost should be transferred to green fodder, concentrates and miscellaneous expenditure in order to attain maximum level of output.

## CONCLUSION

The foregoing analysis indicates that miscellaneous expenditure has been the most important input affecting milk production. All the regression coefficients have been found positive and statistically significant in all the equations fitted, indicating that the producers can increase their milk production by increasing their inputs. Besides, the returns to scale parameter have been greater than unity. The dairy farming in the study area operates under increasing returns to scale. This indicates that there is scope for increasing milk production by increasing the input factors. The marginal value productivity analysis revealed that there is a significant scope for raising milk production in the study area by reallocation of these inputs for both cows and buffaloes.

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