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Farm Size and Resource Use Relationship

by

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It is generally agreed that the efficiency of industrial enterprises increases with size, atleast upto a point. But in agriculture, size and efficiency relationships differ for different size of farms but evidence concerning these relationship is inconclusive.

The objective of this paper is to empirically examine the nature of resource use between selected farm sizes in Coimbatore district

Materials and Methods : The main statistics of the empirical model used are based on multi-stage random sampling of irrigated farms in Coimbatore district with village as the primary unit and the farm holdings as the ultimate unit. Three villages in each of the nine taluks of Coimbatore district was selected at random and 130 holdings were selected by random from the selected villages. The selected farms were classified into three groups based on the cropped area as small (0 to 4·99 acres), medium (5 to 9·99 acres) and large (10 acres and above).

The empirical model of Cobb-Douglas type of production function computed by least square multiple regression was used as shown below :—

$$Y = a\ x_1^{b1}\ x_2^{b2}\ x_3^{b3} \ldots\ldots\ x_n^{bn}$$

where Y = Value of gross output in rupees,

X_1 = Cropped area in acres,

X_2 = Irrigation charges in rupees,

X_3 = Human labour in mandays,

X_4 = Manures and fertilisers in rupees,

a = Constant, and

$b_1, b_2 \ldots\ldots\ldots b_n$ = Regression Coefficients.

The marginal value products of the factors considered in the equation were worked out by the equation

$$MVP = \frac{\Delta X}{\Delta X} = b_1 \frac{\bar{Y}}{\bar{X}}$$

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Results and Discussions: The correlation coefficients of the different factors are worked out for the three size groups. To study the relationship of one factor on other in the presence of other factors the production function for the farm was fitted to the three size groups of farms and are presented below:

Small :—

$$Y = 0\ 796\ X_1^{-0.079}\ X_2^{0.108}\ X_3^{0\ 591\ **}\ X_4^{0.389\ **}$$

Medium :—

$$Y = -0{\cdot}182\ X_1^{-0.758\ **}\ X_2^{-0\ 078}\ X_3^{1.253\ **}\ X_4^{0.499\ **}$$

Large :—

$$Y = 0\ 327\ X_1^{-0.586\ **}\ X_2^{-0.340\ **}\ X_3^{0.851\ **}\ X_4^{0.227\ **}$$

** = Significant at 0.01 level.

One other measure of resource efficiency in marginal analysis is to derive the marginal productivity of resources, with the quantity of all other resources held constant at the per farm mean level of the sample. The estimates were predicted from the production functions and the estimated marginal value productivities for the input factors are given in table 1.

TABLE 1.

Marginal Value Productivity

Particulars	Small	Medium	Large
Land (Rs/acre)	–5.43	–717.64	–451.66
Irrigation (Rs/Rupee)	0.96	–0.73	–3.87
Labour (Rs/Manday)	5.95	11.94	9.56
Manures and Fertilisers (Rs/Rupee)	2.64	3.81	7.33

Land: The estimated parameters of the equation, namely, the regression coefficients, are the elasticities of the product that show the percentage change in product if the input of a factor of production is increased by one percent keeping other factors constant at their geometric mean level. For discussing the effects of land input, the inplication of a one percent increase in X_1 when X_2, X_3 and X_4 are held constant is examined. It means an expected change in Y of b_1 per cent. But it also implies a one per cent increase in X_2, X_3 and X_4; otherwise they will not remain constant and the *ceteris paribus* assumption will not hold good. Hence the effect of the average product of land for a one per cent change in land input is equivalent to the effect of a one percent change in all factors. Therefore it is the same as that for the change in the average product of land due to

change in all factors. Moreover we impute to land the effects of a decreasing productivity of all resources. In all the three size groups, the regression coefficient for land turned out to be negative, because of the diminishing productivity of all factors taken together and not just land. In the medium and large size groups the coefficients for land is not only negative but also significant from zero at one percent level. Not much importance need to be attached to the negative productivity of land in small farms since it is not significant. In medium and large farms if land is increased by one percent there will be a reduction in total output by 0.75 and 0.58 percent respectively. This shows that though the land area in these groups is more, the intensity of cropping may be less. The greater the intensity of utilisation of land the larger the elasticity of output that could be expected with respect to this factor. Hence instead of increasing the land area if the land area is reduced by one percent from the geometric mean level the total output would be increased by 0.75 and 0.58 percent respectively for medium and large farms. This is clearly shown by the marginal value productivity of land.

The marginal value productivity indicates the returns, which, on the average, are expected from the additional use of one more unit of the production factor keeping other factors constant. From table 1, it can be seen that the M. V. P. of land resource are negative and are of the order of Rs. 717.64 and Rs. 451.66 respectively for medium and large farms. This shows that if land area is increased by one percent there will be a reduction in total output by the order of Rs. 717.64 and Rs. 451.66 respectively for medium and large farms. The high as well as negative level of M. V. P. can be attributed to the low intensity of cropping. This is clearly shown that if land area is reduced from the mean level by 5 and 10 per cent the total output will be increased by Rs. 259 and Rs. 546 from the mean level for medium farms. It has also been broadly observed in several field studies that the fertility of soils on smaller farms are relatively higher than large farms and they may also account for the lower M. V. P. in large farms. The level of management can also be attributed as a reason for the above.

Irrigation Charges : The production coefficients obtained for factor input on the irrigation charges for the different size groups of farms are 0.108, –0.078 and –0.340 respectively. If the irrigation charges are increased by one percent, other factors remaining contstant, the production will increase by 0.108 percent in small farms and decrease by 0.078 and 0.340 percent in medium and large farms respectively. Only the coefficient of the large farm is statistically significant. This means that in the large farms irrigation water is used more than the requirement and the wastage of water may also be more than the other size groups.

The marginal value productivity for small, medium and large farms worked out to be Rs. 0.96,—Rs. 0.73 and—Rs. 3.87 respectively. It shows that in small farms it gives an output of only Rs. 0.96 for an input of Rs. 1/-. Though there is a decrease in output by Rs. 0.73 in medium farms it is greater in large farms. Hence there is necessity to reduce irrigation level and to minimise the wastage in large farms. The small farmer is almost in the optimum stage.

Human labour : The elasticities with respect to human labour inputs in different size of farms are 0.591, 1.253 and 0.851 respectively. All the three coefficients are significant at one percent level. This means that one percent increase in the unit of human labour, keeping other factors constant, the total output of the small, medium and large farms will increase by 0.591, 1.253 and 0.851 percent respectively. The defference in the elasticity of labour input can be reasonably attributed to the already high intensity of labour inputs used on small farms and vice versa. The low elasticity in small farms many also be explained in terms of fixity of land and family labour supply. This is again revealed by the marginal value productivity of labour for the different size of farms. It is Rs. 5.95, Rs. 11.94 and Rs. 9.56 for small, medium and large farms. This means that if the labour input is increased by one manday, there will be an increase in total output by Rs. 5.95, Rs. 11.94 and Rs. 9.56 respectively for the three size of farms. One manday unit costs Rs. 2.50. Therefore there is greater scope for increasing labour input in medium and large farms than small farms.

Manures and Fertilisers : The regression coefficient for the input manures and fertilisers is 0.389, 0.499 and 0.927 respectively for small medium and large farms. The coefficients are significantly different from zero. The product elasticity is comparatively high and tends to go up as size of the farm increases. It may be interpreted as done earlier for other input factors. The behaviour of this factor seems worthy of particular mention in that when on large farms, this input appears comparatively more productive. The marginal value product for the three groups is Rs. 2.64, Rs. 3.81 and Rs. 7.33 respectively. Hence there is possibility of getting relatively larger output for additional use of this factor from large farms. Though it is generally believed that large farms usually have more capital to invest, the per acre availability will be less. The small farmers must have used more manures and fertilisers than their counterparts.

As the elasticities except the one for labour in medium farms are less than unity and therefore indicate diminishing marginal returns to each factor input, holding each of the other factors constant, the marginal returns of each factor will decrease as the more of the factor is used.

The coefficients of multiple determination indicates the proportion of variation in output explained by the four factors included in the analysis. In the present study 71, 89 and 87 percent of the observed variation in output in small, medium and large farms is explained by the four independent variables taken together in the equation. The sum of elasticities indicates the change in output when all the factors are increased by one percent. It is almost constant returns to scale (1.016) for small farms, whereas for medium (0.917) and large (0.852) farms it is decreasing returns to scale. The relatively higher returns to scale for smaller farms may be attributed partly to the managerial factor being relatively more efficient than other size groups. Also it is certain that the level of income itself is an important variable motivating the small cultivators to work on the land more intensively.

Conclusions : This study shows that under the irrigated conditions of Coimbatore district a relatively larger marginal product could be obtained on the medium and large farms for additional doses of labour and manures and fertilisers. The productivity of land is explained as the productivity of all factors and not just land. The empirical results obtained clearly show that small farms are more efficient than large and medium farms. It also reveals intensity of cropping is also more in small farms and the area can be reduced in medium and large farms and total output can be increased by intensive cropping.

REFERENCES

Heady, E. O. and J. L. Dillon. 1961 *Agricultural Production Function.* Iowa State University Press.

Hanumantha Rao, C. H. 1965 *Agricultural Production Functions, Costs and Returns in India.* Asia Publishing House, Bombay.

Suryanarayana, K. S. 1965 Resource Productivity and Size of Farms. *Asian Econ. Rev.*, 8 :

Jha, S. C. 1966 An empirical analysis of farm size and resource use relationship in Ahmednagar and Nasik Districts. (Unpublished).