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The Influence of Farm Size on Resource Productivity

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ABSTRACT

The study indicates that output per unit of input is more in farms below five acres. The net profit per acre is more i.e., Rs. 883/- in group I farms. The Cobb-Douglas model of production function revealed that all the variables viz., labour, manures and fertilizers, seed and plant protection and management have significantly influenced the gross income in all the size groups of farms. It can be concluded that careful thought have to be bestowed in deciding the size groups. The opportunities for employment for family labour is the highest in small farms while it is more for permanent and casual labourers in larger farms. The higher productivity in small farms is due to the cumulative effect of all the available resources.

INTRODUCTION

In India, productivity has become a byword both in industry and agriculture in the present context of rapid economic development ushered through the plans. More than seventy per of our people depend on agriculture for their livelihood. Hence, the productivity in agriculture holds the key to further economic prosperity of this country. In an old and less developed country, like ours, where the scope for increasing production through extensive method is very much limited, the only alternative to push up production is through intensification of agricultural production. Under the present condition of scarcity of farm resources, the farm business has to play a major role to feed the growing million by efficiently using the available limited resources. Among various limited inputs, land is deemed to be a critical and crucial one, which influences production and thus productivity also. Hence, the relationship of resource productivity to size of farm business receive special attention in agriculture.

The concept of productivity is commonly used to denote the ratio between output and input. Eventhough the productivity of a farm depends on various inputs like labour, manures and fertilizers, seeds, plant protection and managerial ability of the farmer, size of holding limits the level of technical investment which, in turn, limits the productivity. Hence, the main objective of the study is to assess the relative productivity of farms over small ranges of size (acre) by applying both conventional as well as production function (Cobb-Douglas type) analysis.

MATERIAL AND METHODS

The sample consisting of seven revenue firkas upon which the study is based, was drawn from Coimbatore taluk, Tamil Nadu. This area is fairly

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homogenous with regard to climate, soil type, cropping pattern etc. The stratified random sampling technique was adopted for drawing the samples. A total of ten villages were selected at random with probability proportion to area under each firka. The farm holding in each of the selected villages were further stratified into five size groups namely 0 to 5.00 acres, 5.01 to 10.00 acres, 10.01 to 15.00 acres, 15.01 to 20.00 acres and above 20.00 acres. A total of fifteen farms in each village among five size groups were selected. Thus in all one hundred and fifty farms spread over Coimbatore taluk were selected for the study.

With a view to have a meaningful comparison of productivities between different sizes of farms, standardisation was effected by a yardstick of flexible nature. In this part of the country, where intensive cultivation is practised, rent reflects, in a way, the productive capacity of the land and hence this particular procedure of standardisation was resorted to.

In order to measure the productivity of farming under different size of groups of farms, two types of analytical tools have been employed. They are the conventional farm management analysis and the more recent production function analysis. In the conventional method, land area cultivated was used as the criterion for calculating the productive factors such as output and inputs of farm business. In the functional analysis, the product or output is expressed as a function of resource inputs. Among the large number of functions, Cobb-Douglas function analysis has a choice, because it automatically ensures diminishing productivity, diminishing marginal rates of substitution among factors and is relatively easy to fit. This function is linear in logarithms and it takes the following general formula.

$$Y = ax_1^{b1} \times_2^{b2} \times_3^{b3} \ldots X_n^{bn}$$

where Y refers to the value of output, x^s refer to the specific resources, b^s denote the elasticities of production and 'a' denotes a constant.

With a view to indicate the returns that are expected on an average, from an addition of one more unit, marginal value productivities were estimated using the respective elasticities of production function analysis.

The estimated marginal value productivities have been used to compute the optimum use of resources.

The output-input ratio was used to estimate productivity of resources in different size of farms, which enables us to determine the level of prductivities of resources in different size groups.

RESULTS AND DISCUSSION

The productivity of the different size of farms as analysed by conventional farm management analysis and functional analysis is discussed. The standardised area of farms in different size groups are grouped into five sizes with a class interval of five acres.

1. Conventional farm management analysis

The productivity of farms in terms of factors like gross output, farm business income, imputed cost or indirect expenses, net profit per acre and cost per unit of output of farm business is presented in Table 1.

TABLE 1. Costs and returns per acre

Size group	Mean size of farms in standardised acre.	Gross output	Paid out cost *	Farm business income	imputed cost (in rupees)	Net profit
I	3.43	3178.80	1929.30	1249.50	356.50	883.00
II	7.70	2523.40	1993.70	218.90	218.90	310.80
III	12.30	2585.20	2105.00	480.20	194.00	286.20
IV	17.60	2340.40	1854.70	485.70	75.40	410.30
V	31.13	1910.00	2016.90	104.90	75.20	180.10

(* includes also cost of animal labour and interest on capital)

Gross output of the farm is the aggregate value of output of all crops including livestock and other resources. Paid out costs according to Khusro (1964) are the expenses which are met directly by paying out from the farm. They include all costs excluding imputed costs or costs of farm produced inputs, namely family labour, owned land, interest on fixed capital, seed, fodder, farm yard manure etc. Farm business income equals gross output minus the paid out costs or direct expenditure incurred by the farm business. Since it excludes the imputed costs of the farm, this gives the correct picture of the productivity of inputs for which the farmers tend to pay more. Table 1 exposes that the farm productivity is higher in group I than in rest of the size groups.

If the term productivity is accepted to reflect the relation between output and input of the farm business as laid down by Mackenzie (1965) and Sazon (1965) the ratio between output and input is an important measure to ascertain the productivity differences in the different size groups considered in this study. A high degree of productivity in the crop than that of livestock enterprise may be observed from Table 2.

TABLE 2. Total productivity - per acre productivity of livestock and crop enterprises.

Size group	Total output of livestock	Total input of livestock	Total productivity of livestock	Total output of crops	Total input of crops	Total crop productivity	Gross productivity per acre
I	560.40	555.60	1.09	2829.40	1004.60	2.82	1.36
II	455.10	451.50	1.09	2179.20	1031.70	2.11	1.14
III	395.30	340.40	1.16	2288.40	1128.40	2.03	1.12
IV	250.50	255.70	1.00	2169.30	1024.30	2.12	1.21
V	211.30	180.40	1.17	1750.40	1264.30	1.38	0.91

Gross productivity or total productivity indicates the relation between total output of the farm and total input of the farm. Table 2 indicates a high degree of productivity in group I. This ratio indicates that farm resources are utilized relatively more efficiently in group I than in the other four groups.

The conventional farm management analysis does not estimate the resource productivity allocated to the farm, but gives only general indications of their productivity. In order to have more reliable estimates, functional analysis has been attempted.

2. Functional analysis

In this study, the output (Y) was taken as the gross income of the farm in rupees. The aggregate value of human and bullock labour (x_1) in rupees was arrived by converting man-days and bullock-days into rupees. The value of manures and fertilizers (x_2) and seeds and plant protection (x_3) was considered in rupees. The last factor management (x_4) was derived in rupees by considering the educational status of the manager on the basis of opportunity cost principle suggested by Reiss (1960) and Baumel and Fuller (1964). A Cobb-Douglas function with four input factors was fitted in this study. The elasticities were computed and presented in Table 3.

The coefficient of multiple determination (R^2) were estimated as 0.76, 0.74, 0.77, 0.75 and 0.99 for the first five functions. For the merged four groups A, B, C and D the R^2 were estimated as 0.59, 0.76, 0.58 and 0.49 respectively. The coefficient of determination showed that 76 per cent of the variations in gross income was explained by the factors included in the analysis of group I. Similar explanation holds good for other groups of this study. The unexplained portion might be due to the sampling errors and other factors not considered in this study.

The elasticities show the unit change in product if the input of the factor of production is increased by one unit. From Table 3, it can be seen that the factor labour was significant in both groups II and V. This implies that an increment by one unit in the labour employed, keeping other factors at mean level, would bring about a significant increase, on an average, in the gross income by 1.66 units in group II and 0.62 unit in group V. Since the labour is not statistically significant in the other groups it can be stated that the effect of this factor in rest of the size groups is negligible.

The estimated elasticities for manures and fertilizers revealed that they are significant in most of the size groups. The elasticities attached to this factor is highest in group V (0·94). It implies the possibility of increasing output by further increase in this input. When the farms were reclassified into four groups by merging the five original size groups, there are better possibilities of securing higher income in the smaller size groups by application of this factor than in the bigger size groups.

This trend gives a further clue that the coefficients of elasticity follow theoretical expectations only when size groups are properly stratified. Otherwise, the effect of one group tends to

TABLE 3. Coefficient of multiple determination and elasticities of production with their standard errors

	Size group in acres	Labour x_1	Manures and fertilizers x_2	Seeds and plant protection x_3	Management x_4	b_1	R^2
I	0.01 to 5.00	−0.24095 (0.143)	0.92367** (0.2387)	0.07045 (0.132)	0.07882 (0.118)	0.83209	0.761
II	5.01 to 10.00	1.66405** (0.451)	−0.73580 (0.150)	−1.12579** (0.358)	0.30222 (0.140)	0.76690	0 736
III	10.01 to 15.00	0.17985 (0.185)	0.71669** (0.266)	0.00112 (0.163)	0.01277 (0.112)	0.91065	0.775
IV	15.01 to 20.00	0.53616 (0.306)	0.28587 (0.298)	0.17944 (0.166)	−0.17240 (0.132)	0.82907	0.753
V	> 20.00	0.61512** (0.042)	0.93803** (0.059)	−0.36303 (0.027)	−0.50757** (0.034)	0.68255	0.988
A	0.01 to 10.00	−0.01910 (0.114)	0.63710** (0.152)	0.10880 (0.112)	0.17000 (0.094)	0.89680	0.595
B	10.01 to 20.00	0.28250 (0.155)	0.42820* (0.178)	0.23550* (0.109)	0.04480 (0.061)	0.99100	0.758
C	0.01 to 15.00	0.03190 (0.148)	0.62380** (0.150)	0.08800 (0.150)	0.15890 (0.097)	0.09260	0.585
D	> 15.00	0.02380 (0.127)	0.26990* (0.165)	0.47250** (0.114)	−0.00490 (0.165)	0.76130	0.493

* = Denotes significance at 5 per cent level.

** = Denotes significance at 1 per cent level.

(Figure within parenthesis indicates Standard error)

merge or vitiate the results of another group, of which it does not represent. The present study, therefore, affords a clue that proper classification of farm size is a prime need before analysing its behaviour or trend.

The functional analysis in respect of seeds and plant protection yield certain interesting conclusion. In the original classification of five groups, two groups namely, groups II and V have negative elasticities attached to them. This implies that the output could be increased by withdrawing the excess application of this factor in such of the classes of farms where the elasticities are negative. However, in the reclassified four size groups all the elasticity coefficients are not only positive but a couple of them namely, groups B and D are highly significant.

In a large farm one would naturally expect that the scope for increasing output by application of improved seeds and plant protection measures is relatively more than in small farms since large sized farms follow a system of extensive cultivation rather than intensive cultivation. Here again it is seen that the reclassification of size groups not only improves the findings but seems to lend support to theoretical expectations.

Management is one of the weakest links in Indian agriculture today. The problem of measurement of managerial ability bristles with technical and conceptual difficulties that most of the workers have found it convenient to ignore the problem altogether. Workers like Reiss (1960) and Baumel and Fuller (1964) estimated the quality of management by considering the personal characters. Since education is the primary factor which affects the personal character, in this study the ability of the manager was measured by taking into account his educational standards and his response to new agricultural practices.

The elasticity for the factor management reveals negative coefficient for group V which implies that an increase in the management input would result in a decrease in the output. By virtue of the fact that educational status was taken as the index to measure managerial ability, only in big farms the influence of the manager is felt because it is significant, though negative. The small farms are generally managed by the less educated classes that their contribution to output is not significant enough to be visible. The reclassification of size has not materially altered the effect of managerial abilities in the different size groups because of the low educational standards among the agriculturists.

Marginal value productivity for the four factors has been obtained at the geometric mean level. Marginal value productivities measure the amount by which the output is expected to increase for successive additional units of inputs. Table 4 gives the marginal value productivities for the inputs considered in this study. The marginal value productivities have been calculated in value terms and hence, the changes are in rupee units.

For group I an addition of one unit labour will cause a sacrifice of Rs. 1.37 from total income and for one unit increment of manures and fertilizers the total income will go up by

TABLE 4. Marginal value productivities of different inputs for farms under different size groups

	Size group in acres	labour x_1	Manures and fertilizers x_2	Seed and plant pro- x_3	Management x_4
I	0.01 to 5·00	−1.37234	7.12443	1.87490	0.71992
II	5.01 to 10.00	6.80962	−0.53846	−0.07298	5.46519
III	10.01 to 15.00	0.70153	5.04011	0.02001	0.31395
IV	15.01 to 20.00	2.16914	2.04575	3.24547	−4.90256
V	> 20.00	1.73012	5.40944	−5.44317	−16.43638
A	0.01 to 10.00	−0.09226	4.28615	2.37023	2.18530
B	10.01 to 20.00	1.12192	3.03162	4.23014	1.18417
C	0.01 to 15.00	0.10712	0.19842	0.96351	0.00781
D	> 15.00	0.01076	0.40084	1.45140	−0.482380

Rs. 7.12. Similarly for seeds and plant protection and management, an addition of one unit of these two factors will result in an increase in the total income by Rs. 1.87 and Rs. 0.72 respectively. Similar interpretations could be made for rest of the size groups studied.

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