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Research paper

Stochastic Frontier Production Function an Application of the Coconut Farms in Coimbatore District

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Abstract

In most of the developing countries agriculture is a source of livelihood and sustenance for majority of the people and its growth provides the greatest hope for improving the living standards of the people. It provides food for the population and raw materials capital and labour to other sectors of the economy. Thus the development of agriculture plays a major role in total economic development of a country. Hence formulation of agricultural development strategies needs much care and attention.

1. Introduction

At any point of time agricultural production system can be characterized by four basic resource technology situations viz., unlimited land static technology, limited land static technology, unlimited land dynamic technology and limited land dynamic technology. In the first situation though land and labour supplies increase with static production techniques, the growth of agricultural output depends on the quality of land. In the second situation with increasing labour supply keeping other factors of production constant or declining, agricultural output will not increase. Under these circumstances development policies play an important role in raising the productivity in agriculture. In the third situation with all the factors of production increasing agricultural output will increase. The last situation is where land is a scarce factor of production. So the growth of the output depends on the intensive use of land with optimal mix of other inputs. This is the situation that involves the great majority of farmers in developing countries.

The existence of various combinations of resources and technology in different countries and even in different parts of a country means that there are multiple paths of technology development. But two constraints exist for agricultural development, i.e., an inelastic supply of land and labour scarcity. The former problem could be overcome by improving existing biological technology whereas the later could be offset by developing mechanical technology. The ability of a country to achieve rapid growth in agricultural output and productivity seems to hinge on its ability to make an efficient choice among the alternative paths.

The performance of farms is largely determined by technical efficiency given the positive dependency of allocative efficiency upon technical efficiency. Variations in technical efficiency were found to be partly explained by differences between farmers in a range of technical practices followed within each environment and season. Even after two decades of experience with the new rice technology wide differences in technical practices between environments and within environment, Within season and between seasons exist. These differences represented the managerial ability of farmers with their production conditions in any season and over time. Production conditions vary within each environment owing to microphysical and microclimatic factors. There are rare exceptions where most farmers clustered near their frontiers. . With in view the present study was undertaken.

2. Basic Concepts

(i) Technical Efficiency

SI. No	Particulars	Estimated Coefficients	Standard Error	Level of Significance
1.	Constant	0.525	1.618	NS
2.	Trees per hectare	0.526	0.276	*
3.	(NO)	0.455	0.109	**
4.	Human Labour (mandays)	0.022	0.005	**
5.	Expenditure on farmyard manure (Rs.)	0.145	0.005	**
6.	Expenditure on	0.005	0.036	NS
7.	chemical fertilizer	0.0057	-	-
8.	(Rs.)	0.0997	-	-
9.	Age of the crop	5.007	-	-
10.	(years)	0.997	-	-
11.	σv^2	0.8467	-	-
	σu^2			
	$\lambda = \sigma u^2/\sigma v^2$			

	$\gamma = \sigma u/\sigma v$ $TE = 1 - \sigma_u \sqrt{\sqrt{2} / \pi}$ $TE = 1 - \sigma_u \sqrt{\sqrt{2} / \pi}$	———		

The basic concept of measuring technical efficiency is concerned with describing the production technology. The basic assumption underlying the measurements of technical efficiency is that a gap normally exists between a firm's actual and potential level of technical performance.

(ii) Efficiency

Sl. No	Particulars and the form in which used	Estimated Coefficients
1	Constant	5.176 NS
2	No of trees per hectare (x_1) – lnx_1	5.992 *
3	Labour (man days)(x_2) – lnx_2	8.136 **
4	Farm Yard manure (x_3) – lnx_3	2.709 **
5	Chemical Fertilizer (x_4) – lnx_4	5.002 **
6	Age of the crop (x_5) – lnx_5	1.165 NS
7	lnx_1 x lnx_1	0.851 NS
8	ln x_2 x lnx_2	0.574 NS
9	lnx_3 x lnx_3	0.240 NS
10	lnx_4 x lnx_4	0.325 NS
11	lnx_5 x lnx_5	0.172 NS
12	lnx_1 x lnx_2	0.202 NS
13	lnx_1 x lnx_3	0.212 NS
14	lnx_1 x lnx_4	0.349 NS
15	lnx_1 x lnx_5	0.201 NS
16	ln x_2 x lnx_3	0.819 *
17	ln x_2 x lnx_4	0.512 *
18	ln x_2 x lnx_5	0.240 NS
19	lnx_3 x lnx_4	0.557 *
20	lnx_3 x lnx_5	0.101 NS
21	lnx_4 x lnx_5	0.161 NS
22	σ_v^2	0.0147
23	σ_u^2	0.0499
24	$\lambda = \sigma_u/\sigma_v$	3.012
25	$r = \sigma_u^2 / (\sigma_u^2 + \sigma_v^2)$	2.30
26	MTE	0.991

Farrell (1957) defined the efficiency of a farm as its success in producing as large as possible an output from a given set of inputs. He used three measures of efficiency viz., technical, allocative and economic efficiency on the assumption that the efficient production function is known. Technical efficiency measured the farm's success in producing maximum output from a given set of inputs with the available production technology. Allocative or price efficiency measured its success in choosing an optimal set of inputs. Economic inefficiency was analysed by separately examining its two components viz., technical efficiency and allocative efficiency. These measures were usually derived from production function.

(iii)Sampling Design

Coimbatore District is purposively selected for the study since the crop selected in coconut, which occupies the major Agriculture land in this District. The data utilized in the analysis were collected directly by the researcher through a pretested structured questionnaire. The number of farms selected is 350. The primary data collected for the study related to the agricultural year 2016-2017 and the data were collected during the year 2018. The size of the holding was measured as the operated area of the farm in hectares. This included the area owned plus the area leased in minus area leased out.

3. Stochastic Frontier Production Function

A major limitation of the frontier production function is its assumption of deterministic relationship which ignores the very real possibility that a farm's performance may be affected by factors entirely outside its control as well as by factors under its control. The former is the collective effect of exogenous shocks both favoruable and unfavourable and the latter is due to inefficiency in use of technology.

4. Results and Discussion

In the background of the agro-climatic features of the study area the data collected were analysed with reference to the set objectives and the results are presented and discussed in this chapter. For better understanding of the various facets of the subject the results are presented in the following headings.
1. General characteristics of the sample farms
2. Resource use efficiency
3. Economic performance

Estimates of Stochastic frontier Production Function
Maximum likelihood estimates of the translog production function.
The results presented in the above table reveal that the translog production function gives almost parallel results. Two things are extra here

The interaction effect of the three important variables are significant
An increase in the overall Technical efficiency
Thus the translog form of production function and the Cobb-Douglas type of production function gave identical results. This might be due to the homogeneity of these farms in the study area.

5. Conclusion

The present study focused on the resource use efficiency of the coconut farms in Coimbatore District.
The results indicated that a one percent increase in the number of trees per ha cetarisparibus would increase the yield by 0.67 percent. Similarly a one percent increase in Human Labour, expenditure on farm yard manure and expenditure on chemical fertilizer Cetarisparibus would increase the yield by 0.486 percent, 0.015 percent and 0.115 percent respectively. By using the results of OLS estimates, the ratio between VMP and P_x were calculated. The ratio for the Human Labour, amount spent on farm yard manure and that for fertilizer were 1.38, 1.33 and 0.39 respectively. The results indicated that the labour and chemical fertilizers were under utilized and farm yard manure was over utilized. Therefore, there is scope to optimize the use of these factors.
The results of maximum Likelihood Estimate (MLE) showed that the variance of one sided error term σu^2 and the symmetric error σv^2 were estimated as 0.0997 and 0.057. The variance ratio parameter was estimated as 0.955 which implied that the output difference from the frontier yield was mainly due to the technical inefficiency. The ratio of one sided error term to that of the symmetric error term was 4.65. This indicated that one sided error term which depicted the technical efficiency was more than that of the statistical error.

The mean Technical Efficiency was calculated to be 0.7496. It indicated that the technical efficiency of the coconut farms in Coimbatore District was 74.96 percent and hence the yield can further be increased by 25.04 percent by adopting a technically efficient plan without making any addition in the cost of production.

Analysis on the resource use efficiency indicated that the inputs like labour and fertilizer were under utilized and manure was over utilized. The mean Technical Efficiency was only 74.96 percent which indicated that the yield of coconut could still be increased by 25.04 percent through the adoption of technically efficient plan. The allocative efficiency was 77 percent.The overall economic efficiency was 58.7 percent and hence it can be increased to 40 percent more.The investment analysis indicated that this farming were financially viable for both with and without intercrops.The sensitivity analysis indicated that investing on coconut farming was a viable option, even if the output price was reduced up to 30 percent from its mean level.The major problem faced by these farmers is the unstability in the price of their products.

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