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ASSESSMENT OF RISK IN MULTI PRODUCT FIRMS*

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ABSTRACT

The model suggested by Hallam et al (1989) was employed to find out risk increasing/risk decreasing inputs in multi-product firms in North Arcot district. The results revealed that labour use and seed use were risk increasing inputs for paddy and groundnut, respectively. The elasticity of the above inputs were also statistically significant. This indicated that those inputs were also important to increase the yield.

INTRODUCTION

Farming being a biological phenomenon farmers receive only low income which is fluctuating year-to-year. Farmers generally combat risk through diversification. Although diversification of enterprises may reduce market risk, its impact on individual crop yield variability could be unfavourable. If farmers respond to risk then the rate of adoption and diffusion of such farming methods and technologies are dependent on their risk effect as well as their yield effect. To understand the producer's behaviour for making sound and successful agricultural policies, it is essential to adequately investigate and quantify the relationship between factors of production and the upper moments of distribution of crop yield. Hence the present study was undertaken to identify the agricultural inputs which have risk increasing / risk decreasing character in the farms where diversification of enterprises existed.

Table. 1. NUMBER OF FARM HOLDINGS ENGAGED IN DIFFERENT ACTIVITIES

S.No.	Activity	Number of farm holdings
1.	Paddy	380
2.	Groundnut	256
3.	Sugarcane	84
4.	Blackgram	114
5.	Cotton	99
6.	Sesamum	56
7.	Sorghum	167
8.	Onion	35
9.	Ragi	75
10.	Chilly	61
11.	Bullock	56
12.	Cow	104
13.	Buffalo	77

MATERIALS AND METHODS

The data for the present study were collected from the records of the Cost of Cultivation of Principal Crops (CCPC) Scheme maintained by the Centre for Agricultural and Rural Development Studies (CARDS), Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamilnadu.

The present study was undertaken during 1990-91. The total number of holdings engaged in each activity is given in Table 1.

The information on the number of farms engaged in three activities was collected since the need for the present study was multi-product firms under production uncertainty. The combination of three activities was decided based on the number of holdings engaged in each activity. The combinations were 1) paddy, groudnut and sugarcane 2) paddy, groundnut and ragi 3) paddy, groundnut and sorghum 4) paddy, groundnut and blackgram and 5) paddy, groundnut and livestock (buffalo, cow and bullock). The details of the number of farm holding in each of the above combinations of activities are furnished in Table. 2.

It was found that 'paddy, groundnut and livestock combination of activities was followed in 40 farm holdings. Since the aim of the present study was find out the risk increasing / risk decreasing inputs, the activities which involved combination of crop and livestock was not selected. The next combination followed by 36 farm holdings i.e., 'paddy, groundnut and blackgram', was also not selected for want of sufficiently large sample size for statistical precision. So, the information on the farm holdings engaged in combination of two activities was collected (Table

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Table.2. NUMBER OF FARM HOLDINGS IN DIFFERENT ACTIVITIES.

S.No.	Activities	Number of farm holdings
1.	Paddy, groundnut and sugarcane	27
2.	Paddy, groundnut and ragi	24
3.	Paddy, groundnut and sorghum	27
4.	Paddy, groundnut and blackgram	36
5.	Paddy, groundnut and livestock	40

3) with a view to find out a combination of activities in which sufficiently large number of farm holdings were engaged.

From the information collected on the number of farm holdings involved in different combinations of two activities it was found that a maximum number of 206 farm holdings were in the combination of 'paddy and groundnut'. So this combination was selected for the present study. The 206 farm holdings were distributed in 16 study districts.

Having selected the combination'paddy and groundnut', the number of farm holdings in different districts was taken as the selection criterion for selecting the study area. In 'paddy and groundnut' combination there were 53 farm holdings in Vellore district which was the maximum number when compared to the number of farm holdings in other districts. Therefore North Arcot district was selected as the study area and all the 53 farm holdings were selected to assess risk increasing / risk decreasing inputs of multi product farms.

The data on plant protection cost (in Rs/ha), irrigation cost (in Rs/ha), quantity of fertiliser used (in kgs/ha), fertiliser cost (in Rs/ha), seeds used (in Kg/ha), seed cost (in Rs/ha), labour used (in mandays/ha), labour cost (in Rs/ha) and yield (quintals/ha) were collected for paddy & groundnut of the 53 farm holdings from the records of the CCPC scheme.

Hallam *et al.*, (1989) specification of stochastic technology was employed to represent the multi-crop production technology. Multi (Three) stage non-linear system estimation (MNLS)* was employed to estimate the parameters of the mean

Table 3. NUMBER OF FARM HOLDINGS IN DIFFERENT COMBINATIONS OF TWO ACTIVITIES IN THE STUDY DISTRICTS.

S.No.	Activities	Number of farm holdings
1.	Paddy and groundnut	206
2.	Paddy and sugarcane	74
3.	Paddy and cotton	41
4.	Paddy and blackgram	83
5.	Paddy and sesamum	52
6.	Paddy and sorghum	87
7.	Paddy and onion	26
8.	Paddy and ragi	73
9.	Paddy and chilly	58

yield function and the variance yield function for the Cobb-Douglas production function form.

Just and Pope (1979) followed the model.

$$Y = f(x, \beta) + h(x, \alpha) \quad \ldots\ldots (1)$$

The proposed form in (1) defines separate effects of the decision variables (x) on the deterministic (f) and random (h) components of production, respectively measured by the parameter vectors β and α. This heteroscedastic additive error form allows for risk-increasing and risk-reducing as well as zero risk effects of factor inputs ($\sigma h/\sigma x_i >=< 0$). Given that is an independently distributed random vector with zero mean vector and vaiance Σ model (1) has the moments :

$$E(y) = f(x, \beta) \quad \ldots\ldots (2)$$

$$V(y) = h \Sigma h = h_i \sigma_{ij} h_j \text{ for all } i, j = 1, 2, \ldots n \quad \ldots\ldots (3)$$

Further theoretical details are given in Just and Pope (1978).

RESULTS AND DISCUSSION

The mean, co-efficient of variation of production and input use for paddy and groundnut are given in Tables 4 & 5 respectively

1. PADDY

The average production of paddy was 39.84 quintals per hectare. The expenditures on plant protection, irrigation and fertilisers per hectare were Rs. 212.68, Rs. 1458.62 and Rs. 987.80.

* Computer Program in BASIC, written by the author is available with him.

Table. 4. MEAN, STANDARD DEVIATION AND CO-EFFICIENT OF VARIATION OF INPUT USE IN PADDY.

Variable	Mean	SD	CV%
Production (Q/ha)	39.84	9.40	23.59
Plant protection cost (Rs/ha)	212.68	211.46	99.43
Irrigation Cost (Rs/ha)	1458.62	908.25	62.27
Fertiliser Cost (Rs/ha)	987.80	414.41	41.95
Seeds used (Kg/ha)	73.87	6.49	8.79
Labour used (Mandays/ha)	211.99	67.52	31.85

SD - Standard Deviation
CV - Co-efficient of Variation

Table. 5. MEAN, STANDARD DEVIATION AND CO-EFFICIENT OF VARIATION OF INPUT USE IN GROUNDNUT.

Variable	Mean	SD	CV%
Production (Q/ha)	14.41	6.91	47.95
Plant protection cost (Rs/ha)	59.22	97.18	164.10
Irrigation Cost (Rs/ha)	342.28	445.28	130.10
Fertiliser Cost (Rs/ha)	375.56	362.83	96.61
Seeds used (Kg/ha)	126.46	21.24	16.80
Labour used (Mandays/ha)	95.71	41.44	43.30

SD - Standard Deviation
CV - Co-efficient of Variation

respectively. The mean value of seed rate in the sample farms was 73.87 Kg per hectare. On an average each farm used 211.99 mandays per hectare for raising paddy.

The co-efficient of variation of paddy production was 23.59 per cent. The co-efficient of variations of the different inputs used for paddy ranged from 8.79 per cent to 99.43 per cent. The seeds used had the lowest variation of 8.79 per cent since farmers used more or less the recommended seed rate to have adequate plant population. Plant protection cost had the highest variation of 99.43 per cent. This might be due to the fact that the expenditure on plant protection depended on the infestation of pests and diseases. The sample farmers generally spent less on plant protection measures for paddy. Though the cost of irrigation was the highest it has relatively less variation. The co-efficient of variation of 41.95 per cent for fertiliser cost indicates that there was comparatively more consistency in the fertiliser use among the farmers rather than in the use of plant protection and irrigation.

2. GROUNDNUT

The average production of groundnut was 14.41 quintals per hectare. Each farm had spent Rs. 59.22, Rs. 342.28 and Rs. 375.56 per hectare for plant protection, irrigation and fertiliser, respectively to grow groundnut. The average quantity of seeds used was 126.46 Kg per hectare and the labour used was 95.71 mandays per hectare. The co-efficient of variation ranged from 16.8 per cent to 164.10 per cent. The minimum co-efficient of variation was found for seeds use. The maximum co-efficient of variation was for plant protection cost.

The estimates of the parameters of the mean yield (I moment) function and variance yield (II moment) function and their asymptotic standard errors are furnished in Table 6 for paddy and groundnut.

The magnitudes of asymptotic standard errors of mean output function are lesser than those of output variance function for paddy. The significance of R^2 (0.62) of mean output function further confirmed the importance of included variables. The output elasticity of labout use is 0.4166 and statistically significant. The output elasticity of other inputs were not significant. The labour use appeared to be the most important and also promising input for paddy production. The smaller magnitude and statistical insignificance of other elasticities might be due to their low level usage.

The significant value of R^2 (0.65) of output variance function for paddy revealed that the variability in paddy output depended on the inputs under consideration. Among the variables considered, labour use was the only significant contributor to production variance in paddy. Thus labour use which is an important input for paddy

Table 6. ESTIMATES OF THE COBB-DOUGLAS PRODUCTION FUNCTION FOR PADDY AND GROUNDNUT.

Production Inputs	PADDY		GROUNDNUT	
	I moment	II moment	I moment	II moment
Plant protection cost (Rs/ha) - X	0.0139 (.0155)	0.0238 (.0229)	0.0371 (.0309)	0.0324 (.0541)
Irrigation Cost (Rs/ha) - X	-0.0761 (.0606)	-0.0897 (.0745)	-0.0123 (.0278)	0.0476 (.0368)
Fertiliser Cost (Rs/ha) - X	0.0074 (.0317)	-0.0072 (.0444)	0.0103 (.0284)	-0.0051 (.0031)
Seeds Use (Kg /ha) - X	0.1481 (.3551)	0.1284 (.4365)	0.4893** (.1892)	0.3648** (.1384)
Labour Use (Mandays/ha) - X	0.4166** (.1140)	0.4482** (.1377)	0.1627 (.1931)	0.1110 (.1741)
Constant	3.53 (4.32)	3.75 (7.64)	0.6073 (.4281)	0.9984 (.6724)
R^2	0.62**	0.65**	0.53**	0.47*

Figures in parentheses are asymptotic standard errors.
* = Significant at 5% level
** = Significant at 1% level

production is also a risk increasing input.

The significance of R^2 (0.53) of mean output function of groundnut implied that the inputs under consideration have contributed collectively to the changes in groundnut output. The output elasticity of seed use (0.4893) was the highest and significant revealing that seed use is an important input in groundnut production. The output elasticity of other inputs were not statistically significant.

The magnitude of R^2 of output variance function for groundnut is 0.47 and statistically significant. This showed that the combined effect of all the inputs under consideration contributed to the production variability of groundnut. The positive relationship of seed use to output variance of groundnut was significant, while others were not significant. Thus the seed use is not only an important input for groundnut production but also a risk increasing input.

The above results indicate that inputs which increase mean yield also increase risk effects in multi-product firms. So the policies and innovations prescribed for multi-product firms should be based not only on their favourable yield effects but also on their risk effects. Otherwise the farmers who diversify their activities may face risk of loss in increased use of inputs.

The significant values of elasticities indicated that labour is an important input for paddy and seed for groundnut. Labour is the risk increasing input in paddy, whereas in groundnut it is the seed. So the farmers should be educated about the optimal use of labour in paddy and seeds in groundnut.

REFERENCE

ANONYMOUS (1990). CCPC Scheme Report - Tamil Nadu Agricultural University, Coimbatore.

HALLAM, A., HASSAN, R.M. and SILVA, B.D. (1989). "Measuring Stochastic Technology for the multi Product Firm. The Irrigated Farms of Sudan". **Canadian Journal of Agricultural Economics.** 37(3) : 495-512.

JUST, R.E. and POPE, R.D. (1978). "Stochastic Specification of Production Functions and Economic Implications", **Journal of Econometrics.** 7 : 67-86.

JUST, R.E. and POPE, R.D. (1979). "Production Function Estimatin and Related Risk Considerations", **American Journal of Agricultural Economics.** 61(2) : 276-284.

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