Response of paddy area to price and Time elements — A functional study

by

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The principal focus of this study was to measure the influence of price and time elements on the area under paddy in Coimbatore district over a period of 21 years from 1940-'41 to 1960-'61 and to empirically verify the hypothesis that peasants in less developed countries do not generally respond or respond very little or negatively to price movements. Similar studies were undertaken by Rajkrishna (1963) for the Punjab region. Coimbatore district was chosen for the study on account of the competing claims of commercial crops like Sugarcane and Cotton over food crops like paddy and millets due to industrialisation of the district. Moreover, since agriculture is a location bound industry the real alternatives faced by the farmers can be formulated and the relevant variables defined more appropriately for a region than for an aggregate of heterogeneous regions.

The Model: The basic model used was the following multiple regression type of function fitted by conventional gauss multipliers.

$$Y = a + b_1 x_1 + b_2 x_2 + \ldots\ldots b_i x_n$$

Where 'a' is a constant

$b_1 \ldots b_i$'s are partial regression coefficients

$Y =$ the dependent variable

$x_1 x_2 \ldots\ldots x_n =$ independent variables

Five variates were postulated to influence the area under paddy in Coimbatore district namely (1) gross area irrigated, (2) price of rice, (3) price of cotton, (4) price of sugarcane and (5) time.

Results of Analysis: The simple correlation coefficents among the variables in the equation are furnished below:

Correlation coefficients among variables

	Y	x_1	x_2	x_3	x_4	x_5
Y	1.000	0·959**	0·585**	0·062	0·262	0·781**
x_1		1·000	0·570**	—0·199	0·204	0·785**
x_2			1·000	—0·041	0·702**	0·864**
x_3				1·000	—0·107	—0·232
x_4					1·000	0·673**
x_5						1·000

** Significant at 0·01 level.

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Significant correlation existed among the following :

(i)   Area under paddy and gross area irrigated ;

(ii) Area under paddy and price of rice ;

(iii) Area under paddy and time ;

(iv) Gross area irrigated and price of rice ;

(v)   Gross area irrigated and time ;

(vi) Price of rice and price of sugarcane ; and

(vii) Price of sugarcane and time.

Inter-correlation among the independent variate made it impossible to estimate the net effect of any given variate when it was significantly correlated with other variates. Amick and Purcell (1962) found the same difficulty in correlation studies. The price of cotton was not correlated with either 'Y' or any of other varieties. But all other factors had significant correlation with time. Thus time was an important element in the analysis of response of paddy area to external influences. Hence it was included in the multiple regression analysis.

In absence of any specific inference to be made from the above correlation coefficients owing to the existence of high inter-correlation between independent variables, they could be made useful for analysing the trend in acreage under paddy when the variates are expressed in terms of an equation or a set of equations. One method of accomplishing this objective is by the use of multiple regression analysis. The method of gauss multipliers was adopted to obtain an estimating equation of the form.

$$Y = a + b_1 x_1 + b_2 x_2 + \ldots\ldots\ldots b_1 x_n$$

By recombination of different variables the following set of equations were drawn :

(i) $\hat{Y} = 139.5 + 0.78796 x_2 + 0.06381 x_3 - 0.28511 x_4$

(ii) $\hat{Y} = 156.5 + 0.29414 x_2 - 0.23267 x_3 + 0.24972 x_4 + 0.68129 x_5$

(iii) $\hat{Y} = 486.5 + 1.04556 x_1 - 0.06310 x_2 + 0.01743 x_3 + 0.04040 x_4$

In equation (i) regression coefficient (b_2) for price of rice was significant and b_4 of price of sugarcane was not only significant but also it was a negative coefficient. When time as a factor was included in the equation (i) the change noted was in the from of equation (ii) and also no other factor except time was significant. When time was omitted with the inclusion of gross area irrigated it raised the R^2 value to 99.8 per cent,

where gross area irrigated alone was significant. The partial regression coefficients as well as the coefficient of determination of the three equations are furnished below :

	b_1 of x_1 (Gross area irrigated)	b_2 of x_2 (Price of rice)	b_3 of x_3 (Price of cotton)	b_4 of x_4 (Price of sugarcane)	b_5 of x_5 (Time)	$\leqq b_i$	R^2 (Co-efficient of determination)
Equation (i) ...	0.78796*	0.06381	— 0.28511*		...	0.56666	0.39042
Equation (ii) ...	0.29414	— 0.23267	0.24972	0.68129*	0.99248	0.75528	
Equation (iii)	1.04556*	— 0.06310	0.01743	0.04040	....	1.04029	0.99791

* Significant at 0·05 level

Discussion : A review of trend of acreage under paddy and sugarcane in Coimbatore district indicated that during the past 21 years (1940–'41 to 1960–'61) the paddy area has only doubled while the sugarcane area has increased by four times its area prevailed in the year 1940–'41. The reason attributed for this lopsided development of commercial crops like sugarcane over food crops like paddy is the competing price relative. Under Coimbatore conditions the price of cotton and sugarcane might have influential effect on the price and area of paddy. Hence in order to evaluate the effect of price relatives on the acreage of paddy, a function (i) was estimated. From the function (i) it was evident that the price of rice has a significant influence on paddy area. For every increase in the price of rice by one per cent, there will be a corresponding increase in paddy area by 0.79 per cent. The price of cotton did not have any influence. However, the price of sugarcane had a significant negative influence on the paddy area. That is to say, for every increase in the price of sugarcane by one per cent there will be a corresponding reduction in the area under paddy by 0.28 per cent. The reason for this influential effect might have been the diversion of area under food crops like paddy to commercial crops like sugarcane owing to the possibility of substitution under similar set of agronomic conditions as influenced by the higher price relative. It was also evident that since b_2 and b_4 was less than one, the influence of price of rice and sugarcane was independently acting at a diminishing rate while keeping all the other factors at constant level. The cumulative effect of all factors on the area under paddy was also at a diminishing scale since $\leqq b_i$ was less than one i. e., 0.56666. Since b_3 was not significant, it did not have any influence. The factors considered in the equation answered only 39 per cent of the contribution towards the paddy area as explained by the coefficient of determination $R^2 = 0.39042$.

Poduval and Sen (1958), Joshi and Dhenkey (1954), Mahesh Chand (1958), and Misra and Sinha (1958) are of different view that the peasants in poor countries like India do not respond or respond very little or negatively to the price movements.

The opinions of Madan (1958), Neale (1959) and Olson (1960) are distinctly in favour of negligible or negative supply response which in turn depends upon the area under individual crops. If the peasants in the study were not responding to price movements the reason for differential development of commercial crop like sugarcane over paddy might be due to time element. Hence time was included as the fifth variable. The method indicated by Foote (1958) was followed in estimating the function with time as a variable. When the equation was refitted, it gave an increased R^2 value of 75 per cent. This was represented by the equation (ii).

In the second equation, time element alone had contributed to a significant partial regression coefficient meaning that among all other factors time was the major element which had the maximum influence for the doubling of area under paddy in Coimbatore District. The negative influence of price of sugarcane on paddy area as indicated by equation (i) was only in the absence of time and when time was involved the negative influence vanished. Hence from this equation it could be inferred that it was only a question of time for increased area under paddy and sugarcane and not the price. Thus it was evident that the peasants were not moved by price movements of either the crop concerned or the competing price relatives of commercial crop. The main factor influencing the crop area was only time.

An attempt was also made to study the effect of time besides the evaluation of time element in acreage response of paddy. The impact of time might be in the order of starting of river valley projects and bringing more area under irrigation. In equation (iii) the gross area irrigated was included deleting the time element in which case the factor "gross area irrigated" alone was significant. A review of partial regression coefficients of equation (iii) indicated that b_1 factor contributed a significant influence on paddy area on an increasing rate. The cumulative effect of all the factors in the equation (iii) was on the increasing rate since $\lessgtr bi = 1.04029$. The coefficient of determination (R^2) had also increased to 99.8 per cent. Thus it was evident that the most significant factor on paddy area was gross area irrigated which in turn was highly inter-correlated with time element.

Conclusion : The analysis showed that the more correctly we specify the relevant non-price variables, the more significant were the net regaression coefficients. In the context of econometric work on area response of

individual crops, though the net effect of price variables could be properly measured, it could be well measured only if the non-price variable like time, gross area irrigated determining the area under individual crop are well specified and vice versa. It was also evident from the present study that time was the major element in the determination of acreage under paddy in Coimbatore District and the price of competing crop namely sugarcane influenced only in the absence of time element. Because of high intercorrelation between price and time, the price effect vanished when time was introduced.

Thus the *priori* beliefs about the responsiveness of area under individual crop like paddy to price movements of other competing crops like cotton or sugarcane could not be accepted at their face value. The general presumption in favour of the irresponsiveness of the acreage under individual crop like paddy to price movements in poor economies was thus upheld by this analysis supported duly by the previous findings of Neale (1959), Olson (1960) and others mentioned elsewhere in this article.

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