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A STATISTICAL STUDY OF SCHULTZIAN THESIS CONCERNING MISALLOCATION OF RESOURCES IN TRADITIONAL AND NON-TRADITIONAL AGRICULTURE—A SUPPLEMENT*

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SUMMARY

In continuation of earlier findings by the authors [8]. Schultzian Thesis concerning misallocation is studied through the two objectives of functions : value of gross output and value added· A nonsignificant change in misallocation or a significant decline is observed when agriculture moves from traditional era to the non-traditional one. None of the measures showed significant increase in misallocation. Resource allocation in traditional agriculture (1956-57) is not perfect.

Schultz [4] pointed out (while describing the major characteristics of traditional agriculture) that there was a perfect allocation of resources in traditional agriculture and that the symptoms of misallocation of resources were noticed only in a non-traditional agriculture.

Soni and Bagai [8] have proved that resource allocation is not perfect in traditional agriculture and that contrary to what the Schultzian thesis implies, it improves (i.e. becomes less imperfect) as the agriculture moves from the traditional era to the non-traditional era. In proving it 'profit' was used for measuring the difference between the actual and the optimum allocation of resources. 'Profit' was preferred to other maximands simply because Schultzian conclusions were based upon this objective function.

*Before going through this paper, reader is referred to go into the earlier paper by the authors [8] for its detailed background. This Supplement and [8] are both parts of Ph.D. thesis by the first author [7].

However, 'Profit' is not the only objective function which a farmer tries to maximise. There can be many other objective functions which a firm (i.e. a farmer in this case) may keep in mind while allocating its resources. For example, whereas Baumol [1] refers to sales maximisation as an objective alternative to that of profit maximisation, Dillon and Anderson [3] hold that the farmers maximise a utility function. Soni [7] has discussed four out of many maximands for optimising resource allocation in agriculture. Wiles [9] refers to a large number of non-quantifiable objective functions as the objectives of a price policy e.g., to be known for honesty, to find a place in a commercial delegation or to simply to feel elated over a long queue, in front of the premises of one's productive unit.

In our view, misallocation could also be suitably studied with reference to two other objective functions, namely, the 'value of gross output' and 'value added'. The supplementary note in hand is aimed at studying Schultzian thesis via these two objective functions.

Before we analyse the results it is desirable to elaborate the two concepts. 'Value of gross output' does not need much explanation. It is simply the value of the gross output of any crop including its byproducts. Dhawan and Kahlon [2] and Sen [5], [6] have carried on their analysis in certain cases on the assumption that the objective of a firm is to maximise the 'value of gross output'.

'Value added' is an appropriate objective function if one is interested in knowing how the national income is affected by misallocation of resources in agriculture. 'Value added' in the case of production of a crop is found by deducting from the value of gross output of the crop, the value of all intermediate inputs and the depreciation of farm equipment.

Symbolically, the two objective functions as used in the linear programming model can be put as under :

$$Z_1 = \sum_{i=1}^{n} P_i \times Q_i$$

and

$$Z_2 = \sum_{i=1}^{n} (P_i - C_i)\, Q_i - M_0$$

where Z_1 and Z_2 denote respectively 'value of gross output' and 'value added'. C_i stands for the value of all variable inputs used for the ith crop and depreciation charges imputed to this crop. M_0 refers to the cost of fixed input. (In the present case M_0 refers the cost of maintenance of bullock labour only). P_i is the gross value per acre of the ith crop at previous years' average price and Q_i is the acreage under the ith crop.

Z_1 and Z_2 have been maximised subject to the same activity and resource constraints relating to land, labour, irrigation and cash and with the same methodology as used in [8]. The relevant actual as well as the derived data obtained after the application of the linear programming method to different farm situations (defined in [8]) are shown in Tables 1 and 2 for the periods 1956-57 and 1969-70, respectively.

TABLE 1—(1956-57)

Farm situations \ Objective Functions	Value of Gross Output		Value Added		Total Cost of Cultivation for the Year (Rs.)
	Value of the Objective Function (Rs.)	Area Under Major Crops (Acres)	Value of the Objective Function (Rs.)	Area Under Major Crops (Acres)	
I Small farms	1,696 (1,949)	6.80 (12.64)	982 (1,266)	6.80 (12.64)	1,284
II Large farms	5,799 (6,299)	24.41 (35.61)	3,987 (4,601)	24.41 (25.61)	3,419
III Large non-tractorised farms (1956-57)/Large tractorised farms (1969-70)	6,653 (7,312)	32.23 (46.17)	4,597 (5,371)	32.23 (46.17)	4,098
IV Large bullock operated farms	5,665 (6,163)	29.78 (37.42)	3,893 (4,416)	29.78 (33.40)	3,566
V All farms	3,747 (4,145)	15.23 (24.91)	2,488 (2,990)	15.23 (24.91)	2,351

Notes: 1. For definition of major crops and synthetic farm situations, reference may be made to authors' earlier paper (8).

2. Figures without brackets indicate the values in the actual plan while those in brackets indicate the values in the optimum plan.

A glance through Tables 1 and 2 reveals that the area under major crops in the optimum plan pertaining to a good number of the synthetic farm situation is the same for both the objective functions, i.e. 'value of gross output' and 'value added'. This should not be surprising. This only implies that the crop pattern required to maximise the value of two objective functions which are otherwise different from each other, is the same. This is quite possible in a linear programming exercise when the resource constraints remain the same and the coefficients of an objective function change within a certain range. This is exactly what has happen-

TABLE 2—(1969-70)

Farm Situations \ Objective Functions	Value of Gross Output		Value Added		Total Cost of Cultivation for the Year (Rs.)
	Value of the Objective Function (Rs.)	Area Under Major Crops (Acres)	Value of the Objective Function (Rs.)	Area Under Major Crops (Acres)	
I Small farms	9,010 (9,442)	9.96 (12.01)	6,085 (6,526)	9.96 (12.00)	5,520
II Large farms	29,517 (32,312)	33.38 (41.33)	20,011 (23,146)	33.38 (41.79)	17,275
III Large non-tractorised farms (1956-57)/Large tractorised farms (1969-70)	30,748 (37,283)	30.31 (36.61)	20,070 (26,758)	30.31 (36.61)	18,863
IV Large bullock operated farms	25,240 (27,287)	32.78 (40.79)	18,332 (20,691)	32.78 (40.79)	13,291
V All farms	19,479 (21,497)	22.03 (29.41)	13,197 (15,283)	22.03 (29.47)	11,520

Notes : 1. For definition of major crops and synthetic farm situations, reference may be made to authors' earlier paper (8).

2. Figures without brackets indicate the values in the actual plan while those in brackets indicate the values in the optimum plan.

ed in the study in hand where resource constraints are the same but the coefficients involved in each of the two objective functions are different for any given synthetic farm situation. The extent of difference in the coefficients in most of the cases happens to be within a range which does not change the ultimate solution so far as the level of activities in the optimum plan are concerned.

From Table 1, we find that the actual and optimum values of the objective functions as well as the areas under the major crops for all the farm situations for the year 1956-57 are different. This only means that in that year resource allocation was not perfect. This finding directly rejects the Schultzian thesis that resource allocation is perfect in traditional agriculture. However, for the confirmation of this assertion, we also try to find whether or not the misallocation of resources increases as the agriculture moves from the traditional era to the non-traditional era. For this we refer to Tables 1 and 2 and calculate the values of the three measures namely, *PMD* I, *PMD* II and *RCAMC* described in [8] for the two years

1956-57 and 1969-70 and then compare them for each synthetic farm situation.

Tables 3 and 4 give the values of *PMD*-I, *PMD*-II and *RCAMC* for the years 1956-57 and 1969-70 for various synthetic farm situations for

TABLE 3—VALUES OF PMD-I, PMD-II AND RCAMC FOR THE YEARS 1956-57 AND 1969-70 UNDER THE OBJECTIVE FUNCTION : 'VALUE OF GROSS OUTPUT'

Synthetic Farm Situations	*PMD-I*		*PMD-II*		*RCAMC*	
	1956-57	*1969-70*	*1956-57*	*1969-70*	*1956-57*	*1969-70*
I	0.1298 ($n = 25$)	0.0458 ($n = 23$)	0.1970 ($n = 25$)	0.0783 ($n = 23$)	0.8583 ($n = 25$)	0.2055 ($n = 23$)
II	0.0794 ($n = 25$)	0.0865 ($n = 24$)	0.1462 ($n = 25$)	0.1618 ($n = 24$)	0.4588 ($n = 25$)	0.2380 ($n = 24$)
III	0.0901 ($n = 12$)	0.1752 ($n = 12$)	0.1608 ($n = 12$)	0.3464 ($n = 12$)	0.4325 ($n = 12$)	0.2083 ($n = 12$)
IV	0.0808 ($n = 11$)	0.0750 ($n = 11$)	0.1396 ($n = 11$)	0.1540 ($n = 11$)	0.2565 ($n = 11$)	0.2444 ($n = 11$)
V	0.0960 ($n = 50$)	0.0939 ($n = 47$)	0.1693 ($n = 50$)	0.1752 ($n = 47$)	0.6358 ($n = 50$)	0.3352 ($n = 47$)

TABLE 4—VALUES OF PMD-I, PMD-II AND RCAMC FOR THE YEARS 1956-57 AND 1969-70 UNDER THE OBJECTIVE FUNCTION: 'VALUE ADDED'

Synthetic Farm Situations	*PMD-I*		*PMD-II*		*RCAMC*	
	1956-57	*1969-70*	*1956-57*	*1969-70*	*1956-57*	*1969-70*
I	0.2188 ($n = 25$)	0.0676 ($n = 23$)	0.2158 ($n = 25$)	0.0799 ($n = 23$)	0.8586 ($n = 25$)	0.2055 ($n = 23$)
II	0.1334 ($n = 25$)	0.1354 ($n = 24$)	0.1796 ($n = 25$)	0.1814 ($n = 24$)	0.4588 ($n = 25$)	0.2520 ($n = 24$)
III	0.1441 ($n = 12$)	0.2499 ($n = 11$)	0.1889 ($n = 12$)	0.3546 ($n = 11$)	0.4325 ($n = 12$)	0.2083 ($n = 11$)
IV	0.1184 ($n = 11$)	0.1140 ($n = 11$)	0.1467 ($n = 11$)	0.1775 ($n = 11$)	0.1215 ($n = 11$)	0.2444 ($n = 11$)
V	0.1679 ($n = 50$)	0.1365 ($n = 47$)	0.2135 ($n = 50$)	0.1811 ($n = 47$)	0.6358 ($n = 50$)	0.3352 ($n = 47$)

the objective functions, 'value of gross output' and 'value added', respectively.

We then compare the value of each measure (ratio), given as in Tables 3 and 4, at two points of time, i.e 1956-57 and 1969-70, for each synthetic farm situation under each objective function. We use Z-test or t-test (whichever is appropriate) for testing the significance of the differences in the corresponding ratios for the two years for each synthetic farm situation and under each objective function. Table 5 gives the bird's eye-view of the results obtained after the application of these tests.

The results either show a nonsignificant change or a significant decline in misallocation of resources, when agriculture moves from traditional era to the non-traditional one. Further, as shown above resource allocation in traditional agriculture (1956-57) is not perfect. These findings tend to repudiate the Schultzian thesis as far as our data and findings are concerned.

TABLE 5—SUMMARY OF THE STATISTICAL RESULTS YIELDED BY THE MEASURES, PMD-I, PMD-II AND RCAMC REGARDING CHANGES IN MISALLOCATION FOR DIFFERENT SYNTHETIC FARM SITUATIONS UNDER EACH OBJECTIVE FUNCTION AT 5% LEVEL OF SIGNIFICANCE

Synthetic Farm Situations	*Objective Functions*	*Measures*			*Remarks*
		PMD-I	*PMD-II*	*RCAMC*	
I	(i) 'Value of Gross Output'	*NS* decline	*NS* decline	*S* decline	Overall trend towards decline
	(ii) 'Value Added'	*NS* decline	*NS* decline	*S* decline	
II	(i) 'Value of Gross Output'	*NS* increase	*NS* increase	*S* decline	Overall trend towards decline
	(ii) 'Value Added,	*NS* increase	*NS* increase	*S* decline	
III	(i) 'Value of Gross Output'	*NS* increase	*NS* increase	*NS* decline	Change non-significant
	(ii) 'Value Added'	*NS* increase	*NS* increase	*NS* decline	
IV	(i) 'Value of Gross Output'	*NS* decline	*NS* increase	*NS* decline	Change non-significant
	(ii) 'Value Added'	*NS* decline	*NS* increase	*NS* increase	
V	(i) 'Value of Gross Output'	*NS* decline	*NS* increase	*S* decline	Overall trend towards decline
	(ii) 'Value Added'	*NS* decline	*NS* decline	*S* decline	

NS : Non-significant
S : Significant

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