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RESPONSE OF AGRICULTURAL PRODUCERS TO PRICES—THE CASE OF JUTE AND RICE IN INDIA*

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A STUDY of the nature and extent of the response of agricultural producers to price-changes is important for a wide range of issues of analytical as well as practical significance. There are, however, well-known and serious difficulties in measuring the degree of responsiveness of producers to price-changes. Absence in the real world of anything resembling the *ceteris paribus* of the theoretical formulation of functional relationships in economics is a basic problem. The farmer's decision to raise a crop in any season may be influenced by a complex group of factors like consumption needs, weather conditions at the sowing time, prices of competing crops and requirements of crop rotation. It is, therefore, rather difficult to isolate the impact of the price factor on production, or acreage. Parenthetically it may be added that in an economy like India where production is dependent to a considerable extent on climatic factors, the response is reflected more directly in acreage.

The case of the two substitutable crops, rice and jute, in India may be said to be rather unique. In the first place, the bulk of the jute crop is grown in a comparatively limited compact area, namely, West Bengal, Bihar and Assam, which together account for about 93 per cent of the jute production in India.[1] The substitutability seems to be almost perfect in the sense that land, labour and equipment are readily inter-changeable between paddy and jute cultivation. Moreover, jute is grown as a cash crop largely by cultivators whose main production would otherwise be rice for their own consumption requirements.

* The views expressed in this article are the personal views of the authors.

1. Orissa, Uttar Pradesh and Tripura account for 4, 2 and 1 per cent, respectively. These percentages are triennial averages for the year ending 1960-61.

I. Relative Prices and Acreage

This note seeks to demonstrate the fact that the area planted to the cash crop jute is influenced by the relative prices of jute and rice. Investigations conducted by the Indian Central Jute Committee go to show that the jute grower spends a major part of the cash receipts obtained by selling jute in purchasing paddy for consumption during the lean period. Thus, the price of rice may be considered largely to determine the opportunity cost of using land for jute production; because normally rice production has to be forgone in order to grow jute. Further, the size of holding of the average jute grower being small, the marketable surplus of rice, even if he were to plant his entire holding with rice, would be small. Thus, it is not so much the price which he expects to receive in selling paddy, as the price which he expects to have to pay to purchase rice which really influences his decision to sow jute or paddy. From this point of view, it is the relative prices of jute and rice which prevail during the period preceding the sowing[2] season of jute that are of crucial importance.[3]

To illustrate this hypothesis, data for the 14 years between 1950-1964 relating to the price parity of the two crops and the acreages sown to them in the three States—West Bengal, Bihar and Assam—have been presented in Table I. The price parity is worked out on the basis of the average for four months—January to April—of the all-India index numbers of wholesale prices of jute and rice. These data indicate that by and large when the price parity (col. 2) has increased, that is, when prices have moved in favour of jute, acreage under jute (col. 3) has

Table I—Jute/Rice Price Parity and Acreages

Crop Year	Jute/Rice parity before sowing time*	Area under Jute (West Bengal, Bihar and Assam) ('000 acres)	Area under rice (West Bengal, Bihar and Assam) ('000 acres)
1	2	3	4
1950-51	1.48	1,258	28,335
1951-52	1.97	1,691	27,061
1952-53	1.68	1,593	27,507
1953-54	0.84	1,127	27,764
1954-55	1.17	1,103	26,052
1955-56	1.96	1,574	27,408
1956-57	1.46	1,740	27,472
1957-58	1.39	1,558	27,339
1958-59	1.24	1,654	27,803
1959-60	1.22	1,557	27,458
1960-61	1.36	1,381	28,642
1961-62	2.60	2,072	27,885
1962-63	1.42	1,899	28,276
1963-64	1.35	1,918	28,887

* Based on the average for four months—January to April—of All-India Index Numbers of Wholesale Prices (1952-53 = 100) of Jute and Rice.

2. The sowing and harvesting period of jute are April-May and July-September, respectively.
3. See Report of the Jute Enquiry Committee, Government of India, 1957.

also increased and *vice versa*. This holds true for all the years except the five : 1954-55, 1956-57, 1958-59, 1960-61 and 1963-64. On the other hand, one would expect that during the years when acreage under jute has increased because of a favourable price-ratio, acreage under paddy would tend to decline and *vice versa*. Figures in column 3 show that such a relationship holds true with some exceptions.

Apart from extraneous factors, that is, factors other than the price parity, which might be responsible for these exceptions, the deviations from the normal correspondence between the price ratio and acreages may be partly attributable to imperfections in the data themselves. In the first place, the price indices used are for all-India and hence may not reflect faithfully the situation in these States. This deficiency may not be very significant for jute because the bulk of the jute is produced in these States; but is certainly so for rice.[4] To illustrate, during the years 1959-60 to 1961-62, the January-April average of the all-India index of wholesale prices of rice moved within a range of 93 to 100 whereas the relevant range for West Bengal was between 103 to 124 and for Assam between 81 to 90. Thus, while rice prices in West Bengal were higher by 10 to 24 points in terms of indices, they were lower by 10 to 12 points in Assam as compared to the all-India position. To the extent to which the variations in price-indices influence the parity ratio the situation for the State stands altered. Then again, in Bihar sugarcane which occupies about 4.35 lakh acres, (that is more than the area under jute which stands at 4.05 lakh acres[5]) is a third crop substitutable to rice and jute. For instance, in 1959-60 a shrinkage in jute area was accompanied by an increase in sugarcane acreage. Hence, for a fuller appreciation of the shifts in acreage, sugarcane has also to be taken into account. Because of these limitations, although the data do indicate the broad trend in regard to response of jute-acreage to prices, the shifts in acreage from rice to jute or *vice versa* are not clearly discernible.

II. The Case of West Bengal and Assam

Such shifts in acreage between rice and jute brought about by price changes are concretely illustrated in the case of West Bengal and Assam in both of which these two crops alone account for about 80 per cent of the area under all crops.[6] In Table II the year-to-year variations in the area under jute and rice are presented for the 14 years between 1950-64.

In the case of West Bengal it can be seen that an increase in the price parity ratio (column 2) has resulted in an increase in the area under jute (column 3) ; and *also* as a consequence, a decline in the area under rice (column 4). The reverse of this trend also holds true generally. These data, therefore, go to establish unmistakably the correspondence between the acreage under jute/rice and the relative prices of these commodities prevailing during the period preceding the sowing season of jute.

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4. These States account for only 34.3 per cent of rice production (triennial average for 1958-61).

5. Triennial averages for 1958-1961.

6. Reference here is to forecast crops.

Proceeding further in the analysis, in a situation of near perfect substitutability and in the absence of extraneous factors, one can reasonably expect that the magnitude of the decline in the area under one crop, say jute, would roughly correspond to the increase in the area under other crop, *i.e.*, rice; and *vice versa*. To comprehend the magnitude of the shifts in the acreage between the two crops, however, a third factor has also to be introduced, namely, changes in the area under all crops. This is necessary because it may so happen that when a decline in the area under one crop is dictated by the price-ratio, in point of fact, the acreage might have gone up simply because during the year a net addition to the total cropped area has come about. Similarly, when there is a net decline in the total cropped area perhaps a deviation from the trend indicated by the price-ratio may manifest itself. In column 5, changes in the area under all crops (forecast) are indicated.

TABLE II—VARIATIONS IN AREA UNDER JUTE AND RICE AND PRICE PARITY: WEST BENGAL AND ASSAM

(Area in thousand acres)

Year	Jute/Rice price parity before sowing*	West Bengal			Assam		
		Actual variation over the previous year in the area under			Actual variation over the previous year in the area under		
		Jute	Rice	All forecast crops	Jute	Rice	All forecast crops
1	2	3	4	5	6	7	8
1950-51 ..	1.48						
1951-52 ..	1.97	+ 231	— 332	+ 154	+ 85	+ 139	+ 191
1952-53 ..	1.68	— 56	+ 701	+ 666	— 21	+ 56	+ 115
1953-54 ..	0.84	— 289	+ 320	+ 301	— 29	— 1	— 38
1954-55 ..	1.17	+ 38	— 825	— 798	— 2	— 42	— 24
1955-56 ..	1.96	+ 228	+ 321	+ 627	+ 85	+ 113	+ 201
1956-57 ..	1.46	— 106	+ 23	— 167	— 12	+ 5	— 6
1957-58 ..	1.39	+ 39	+ 64	— 272	— 33	— 102	+ 80
1958-59 ..	1.24	+ 117	— 376	+ 300	+ 1	+ 125	+ 134
1959-60 ..	1.22 (1.22)a (1.30)b	— 52	+ 382	+ 352	+ 11	— 128	— 102
1960-61 ..	1.36 (1.15)a (1.77)b	— 104	+ 463	+ 249	— 35	+ 111	+ 143
1961-62 ..	2.60 (2.53)a (3.14)b	+ 424	— 453	+ 150	+ 64	+ 60	— 140
1962-63 ..	1.42 (1.31)a (1.61)b	— 70	+ 58	+ 91	— 28	+ 70	+ 376
1963-64 ..	1.35 (1.05)a (1.36)b	+ 23	+ 212	+ 215	— 1	+ 109	+ 131

* Based on the average for four months—January to April—of the All-India Index Numbers of Wholesale Prices (1952-53=100) of Jute and Rice.

a The parity ratios in brackets for the years 1959-60 to 1963-64 are for West Bengal based on the rice index for that State and all-India jute index of wholesale prices.

b The parity ratios in brackets for the years 1959-60 to 1963-64 are for Assam based on the rice index for that State and all-India jute index of wholesale prices.

The magnitude of the shifts in acreage between the two crops lend themselves for a fuller explanation when they are read together with the changes in the total cropped area. One or two instances may be cited to illustrate the point. In the year 1952-53 when the jute/rice price parity ratio declined from 1.97 to 1.68, while the area under jute in West Bengal declined by only 56 thousand acres, area under rice increased by as much as 701 thousand acres. The apparently abnormal increase in rice acreage is explained by the fact that during the year the total cropped area itself increased by 666 thousand acres. Obviously, because of the fact that relative prices were in favour of rice, bulk of the additional area was switched over to rice. Again, in 1955-56 when the price-ratio increased from 1.17 to 1.96, the area under jute, no doubt, increased by 228 thousand acres; but at the same time the area under rice which should normally have shown a corresponding decline actually increased by about 321 thousand acres. At least partly, this is explained by the fact that the total area under crops itself increased by 627 thousand acres. Thus, the additional area seems to have been distributed between the two crops.

A similar trend is discernible with respect to Assam also (see columns 6, 7 and 8). The general response of jute/rice acreage to the price parity ratio holds true for all the years with one or two solitary exceptions. In regard to the magnitude of the shifts in acreage some instances could be cited in the case of Assam also. In the year 1951-52, although jute acreage increased by 85 thousand acres in response to a favourable parity, the acreage under rice instead of declining actually increased by 139 thousand acres. This is partly explained by the fact that during the year there was a net addition of 191 thousand acres to area under all crops. The year 1953-54 presents a contrast to this picture. Here the acreage under jute declined in keeping with the parity ratio; the rice acreage instead of showing a rise actually declined marginally because there was a substantial decline in the total cropped area itself. The increase in rice acreage during the year 1955-56 is also a result of a substantial increase in the total area under all crops.

It, therefore, follows that changes in the total cropped area from year to year also influence the magnitude of the shifts in acreage from rice to jute or *vice versa*. The deviations from the normal trend indicated by the variations in the price-parity ratio are, at any rate partly, explained by the variations in the total cropped area.

III. Parity Based on State Indices

Even in respect of these States it can be seen that the hypothesis that the area under jute varies directly with changes in the jute-rice price-parity does not hold good for two or three years. A reference has already been made to the imperfections in the data. Ideally, the parity should have been worked out on the basis of State indices for both rice and jute. Moreover, in the case of rice retail price index would be more meaningful than the wholesale price index. In the absence of such indices, use has been made of the all-India indices. However, since the State indices have become available for the years since 1959-60, as illustrative of how the ratio based on these indices would mean an improvement in the correspondence, we have given the State parity ratios for both West Bengal and Assam for five years in column 2 (Table II) itself. Taking the case of West Bengal for 1959-60 and 1960-61, it can be seen that the parity based on all-India indices

shows a rise from 1.22 to 1.36. This would naturally demand that the area under jute should increase. Actually, however, the area has declined. On the other hand, the parity worked out on the State indices for West Bengal shows that the ratio has actually declined from 1.22 to 1.15. Thus, the decline in the area under jute during 1960-61 becomes explicable in terms of the State index.

In respect of Assam the changes in the area under jute and rice for the year 1959-60 are not explainable in terms of the parity worked out on the basis of the all-India indices, which show a decline from 1.24 to 1.22. On the other hand, the parity ratio worked out with the help of the State indices shows an increase from 1.24 to 1.30. Viewed from this angle, an increase in the area under jute by 11 thousand acres seems to be justified; a rather disproportionate decline in the area under rice during the year has to be understood in the context of a decline in the total area by 102 thousand acres.

In spite of the limitations of the data pointed out above, it is clear that at least in these two States the shifts in the acreage between rice and jute have shown a consistent response to the variations in the relative prices. If there are any solitary deviations from the trend, partly they are explained by the imperfections in the data themselves and partly by factors other than prices. An additional refinement which could be introduced is to take into account only the acreage under autumn (*aus*) paddy because jute is substitutable to autumn and not winter (*aman*) paddy. The size of the winter crop may, however, also influence the acreage allocation between paddy (*aus*) and jute. The point is that if more refined data are available, possibly a precise co-relationship between the two could be established.

IV. Concluding Comments

The existence of this close correspondence between the relative prices and acreage goes to suggest a possible policy implication. The Third Plan has explicitly stated that the price policy "must ensure that the movements of relative prices accord with priorities and targets that have been set in the plan."[7] Perhaps the parity ratio could be used, within certain limits, as an instrument for regulating the shifts in acreage from one crop to another in the desired direction. In this connection it may be relevant to refer to Clark's article in which he has demonstrated that it is possible to assess with reasonable precision the magnitude of the shifts in acreage in response to a given change in prices.[8] Using a more sophisticated statistical technique he has estimated, on the basis of the empirical data for East Bengal, that a rise of 50 per cent in the prices of jute, rice prices remaining same, brought about an increase, on an average, of about 395 thousand acres in the area under jute. On the other hand, a decline in the prices of jute by 50 per cent, with rice prices remaining the same, caused a reduction, on an average, of 667 thousand acres. The point is that apart from operational problems, it seems possible to regulate the acreage under these crops by a suitable manipulation of the parity ratio.

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7. Third Five-Year Plan, p. 119.

8. "The Economic Determinants of Jute Production," Ralph Clark, *F. A. O. Monthly Bulletin of Agricultural Economics and Statistics*, September, 1957.