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EFFECT OF PRICE CHANGES ON COST STRUCTURE AND FACTOR DEMAND: A CASE STUDY ON SELECTED FARMS IN DELHI TERRITORY

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Concern over increase in input prices stems from two related sources—expected decline in output through input demand effect and likely impact on earnings of the farm sector. Both these issues are crucial for price policy decisions. While input prices had, by and large, been steadily rising over time, recent spurt in prices of fertilizers and other petroleum based inputs, has made the analysis of such effects highly relevant and timely. This paper attempts to examine (i) changes in input prices, levels and cost structure, and (ii) demand for labour and fertilizers, on selected farms in Delhi territory over the period 1968-69 through 1975-76.

The data collected under a farm records project¹ were used for this study. Only those farmers for whom data were available for at least five years were considered. The analysis is thus based on a time-series of cross-sections. It must also be borne in mind that because of the meagre coverage of data, the results presented here can at best be interpreted as indicative of the nature of changes going on. Changes in price, income and cost structure for Mexican wheat and hybrid bajra, the most important *rabi* and *kharif* crops of this area, have been examined in the first section and subsequently, the effect of input price changes on demand for labour and fertilizer for these two crops has been analysed.

I

CHANGES IN PRICE AND COST STRUCTURE

Table I gives figures for prices, costs and incomes at different points of time for Mexican wheat and hybrid bajra crops. The table reveals a sharp rise in the total cost of production (cost C) in 1974-75 for both the crops. The input price index figures suggest that in the earlier period (1968-69 to 1973-74), the cost changes were more due to an increase in the level of input use than increase in input prices. However, in 1974-75, the effect of input price increase appeared to be completely swamped by the high level of yield and also an abnormally high price for wheat. For bajra too, a very high product price enabled farmers to reap high net incomes in this year. If we consider the 1975-76 figures, the decline in net income as compared to the pre-1974 level reflects partly the effect of increase in prices and also

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1. Under this project, detailed information for two villages, namely, Paprawat and Singhola are being collected by the cost accounting method since 1968-69.

that of lower yields. The cost of production (cost C) has more than doubled between 1968-70 and 1975-76. The price-cost ratio has dwindled gradually (with the exception of 1974-75) to slightly above unity for wheat and a little lower for bajra.

TABLE I—CHANGES IN COSTS AND INCOMES

(A) MEXICAN WHEAT

Year	Price index of inputs*	Cost C per hectare (Rs.)	Cost of production per quintal (Rs.)	Price of grain per quintal (Rs.)	Yield per hectare (quintals)	Net income per hectare (Rs.)	Price-cost ratio
1968-70	100.00	1,266.12	43.05	95.51	29.41	1,775.95	2.22
1972-74	101.29	1,480.25	56.04	100.37	26.41	1,439.32	1.79
1974-75	159.52	2,290.94	69.54	167.16	32.94	3,604.26	2.40
1975-76	164.32	2,343.88	95.12	119.18	24.64	890.59	1.25

(B) HYBRID BAJRA

1968-70	100.00	735.66	41.44	68.45	17.75	714.29	1.65
1972-74	110.79	929.33	66.66	95.05	13.94	498.29	1.42
1974-75	148.20	1,217.44	71.91	167.26	16.93	1,817.04	2.32
1975-76	175.28	1,259.71	97.05	93.35	12.98	271.72	0.96

* Calculated as $\left[\frac{\sum_{i=1}^n P_{ti} \bar{q}_i}{\sum_{i=1}^n P_{oi} \bar{q}_i} \right]$ where P_{ti} = price of i th input in year ' t ', P_{oi} = price of i th input in the base period, \bar{q}_i = average level of use of i th input and $\sum_{i=1}^n$ = sum over n inputs.

The nature of changes become more clear if we compare the 1972-74 and 1975-76 figures. For both wheat and bajra, the latter year gave slightly lower yield. But gross income did not decline due to an increase in output prices. Yet, for wheat, there was nearly 58 per cent increase in the cost of cultivation per hectare and the net income went down by nearly 38 per cent. For bajra, the costs went up by about 36 per cent but net income went down by 45 per cent or so. Between these two periods, the cost of production per quintal went up by about 70 per cent for wheat and 45 per cent for bajra. Thus, while the increase in input costs has made heavy inroads into farmers' profits from both wheat and bajra, the latter has been affected relatively more. A comparison of the price-cost ratio also makes it clear that the farmers' profits have almost entirely been squeezed out.

Table II provides more detailed information about changes in cost structure over time. For wheat, taking the entire time period into consideration, the shares of human labour and fertilizer inputs have gone up. These two accounted for 35 per cent of the total cost in 1968-70 and this rose to 54 per

TABLE II(A)—CHANGES IN INPUT PRICES, QUANTITIES USED PER HECTARE AND SHARES FOR MEXICAN WHEAT

Input cost					1968-70	1972-74	1974-75	1975-76
<i>Human labour</i>								
Price (paise/hr.)	..	..	..	..	53	58	111	124
Level of use (hrs.)	..	..	..	..	438	367	405	333
Share in total cost (%)	..	..	..	..	22	20	24	28
<i>Bullock labour</i>								
Price (paise/hr.)	..	..	..	..	125	150	170	180
Level of use (hrs.)	..	..	..	..	73	43	41	31
Share in total cost (%)	..	..	..	..	9	6	4	3
<i>Tractor</i>								
Price (paise/hr.)	..	..	..	..	13	15	19	20
Level of use (hrs.)	..	..	..	..	14	16	15	16
Share in total cost (%)	..	..	..	..	17	21	15	17
<i>Irrigation</i>								
Price (Rs./irri./hect.)	..	..	..	..	31	24	26	24
Level of use (No.)	..	..	..	..	5	5	5	5
Share in total cost (%)	..	..	..	..	15	12	7	6
<i>Seed</i>								
Price (paise/kg.)	..	..	..	..	185	99	200	165
Level of use (kg.)	..	..	..	..	94	102	109	103
Share in total cost (%)	..	..	..	..	17	10	12	10
<i>Farmyard manure</i>								
Price (paise/quintal)	..	..	..	..	125	200	243	274
Level of use (quintals)	..	..	..	..	7	2	5	15
Share in total cost (%)	..	..	..	..	1	0	1	2
<i>Chemical fertilizers*</i>								
Price (paise/kg.)	..	..	..	..	201	225	443	441
Level of use (kg.)	..	..	..	..	74	101	110	111
Share in total cost (%)	..	..	..	..	13	22	27	26
<i>Thresher use</i>								
Price (Rs./hrs.)	..	..	..	..	5	10	12	12
Machine use (hrs.)	..	..	..	..	8	10	12	10
Share in total cost (%)	..	..	..	..	5	9	9	6

* Total plant nutrients.

TABLE II(B)—CHANGES IN INPUT PRICES, QUANTITIES USED PER HECTARE AND SHARES FOR HYBRID BAJRA

Input cost	1968-70	1972-74	1974-75	1975-76
<i>Human labour</i>				
Price (paise/hr.)	36	47	59	95
Level of use (hrs.)	366	377	383	405
Share in total cost (%)	26	33	30	48
<i>Bullock labour</i>				
Price (paise/hr.)	125	150	170	180
Level of use (hrs.)	43	10	15	18
Share in total cost (%)	10	3	3	4
<i>Tractor</i>				
Price (paise/hr.)	13	15	18	20
Level of use (hrs.)	7	8	12	7
Share in total cost (%)	18	20	29	18
<i>Irrigation</i>				
Price (Rs./irri./hect.)	29	22	22	22
Level of use (No.)	2	2	2	0
Share in total cost (%)	13	9	6	0
<i>Seed</i>				
Price (Rs/kg.)	9	8	8	9
Level of use (kg.)	4	4	4	4
Share in total cost (%)	7	6	5	5
<i>Farmyard manure</i>				
Price (paise/quintal)	125	175	239	273
Level of use (quintals)	23	1	8	7
Share in total cost (%)	6	0	3	3
<i>Chemical fertilizers*</i>				
Price (paise/kg.)	197	201	417	441
Level of use (kg.)	43	63	34	33
Share in total cost (%)	17	24	19	18
<i>Tresher use</i>				
Price (Rs./hr.)	8	9	10	11
Machine use (hrs.)	2	3	4	3
Share in total cost (%)	3	5	5	4

* Total plant nutrients.

cent in 1975-76. Prices for both these inputs have more than doubled. The use of labour declined by 24 per cent but fertilizer use went up by about 49 per cent. The fertilizer case appears puzzling. The only explanation for this result could be that farmers are convinced that without the use of chemical fertilizers, they can not get the best out of Mexican wheat. In other words, the new wheat production technology involves a high level of rigidity in resource use. We shall come back to this point later. Bullock labour use has recorded a consistent decline and this input has been substituted by tractor and threshers. Even an increase in tractor and thresher charges by 57 and 222 per cent respectively over 1968-70 was not enough to offset the advantage of using these mechanical inputs over bullock labour. Irrigation and seeds, the other two crucial inputs have both recorded decline in their shares in total costs. The data for wheat thus suggests that the increase in prices of labour and fertilizer has been associated not so much with the decrease in their levels but with a relative decline in expenditures for irrigation, seed and bullock labour.

For bajra, the figures presented in Table II(B) indicate a relatively more flexible pattern. The share of labour in total cost has gone up substantially while that of other inputs has either fallen or remained constant. The increase in the share of labour has primarily come about on account of rise in wage rates. The use of bullock labour, irrigation and farmyard manure has gone down. A significant decline has also occurred in the use of chemical fertilizer but its share in total cost has remained more or less constant on account of price increase.

Importance of Purchased Inputs

The effect of price changes is expected to be felt more strongly on purchased inputs. Table III presents the share of purchased inputs in total costs for both wheat and bajra crops.

TABLE III--SHARE OF PURCHASED INPUTS IN TOTAL COSTS AND IMPORTANCE OF NON-FARM SECTOR INPUTS

Year	Share of purchased inputs in total cost (cost C)		Share of non-farm sector inputs in purchased inputs	
	Wheat	Bajra	Wheat	Bajra
1968-70	51.3	46.1	78.3	76.8
1972-74	52.1	44.0	88.5	76.6
1974-75	49.1	44.8	84.4	78.5
1975-76	51.0	41.9	86.8	60.6

For wheat crop, the share of purchased inputs in total costs appears to have remained more or less the same. This implies that, by and large, the farmers were not able to make adjustments in response to price changes. For bajra crop, a mild declining trend in the share of purchased inputs can be discerned. For this crop, therefore, some adjustment mechanism seems to be on.

The share of non-farm sector inputs, *viz.*, fertilizers, machinery and equipment, in purchased inputs provides an idea of inter-sectoral flow of cash funds. As expected, this proportion is fairly large and in 1968-70, more than three-fourth of the cash expenditure went for non-farm sector inputs. This proportion shows a somewhat increasing trend for wheat crop. For bajra, on the other hand, a significant decline in this proportion over time can be noticed. To start with, the share of non-farm sector inputs was more or less the same for both wheat and bajra but, over time, the proportion of farm sector purchased inputs like labour, farmyard manure and seed, recorded a significant increase for bajra crop. This difference in trend between the two crops is perhaps related to their relative profitability. As can be seen from Table I, net income per hectare for bajra is quite low as compared to wheat. Analysis of yearwise data² also showed substantially larger variation in the yields of bajra, implying a higher element of risk. This, perhaps, provides an explanation for the kind of trend observed for bajra crop.

II

DEMAND FOR LABOUR AND FERTILIZERS

The data presented so far seem to suggest that, by and large, the increase in input prices has not really brought about significant changes in the level of use of factors. We have analysed this aspect a little more deeply with respect to human labour and fertilizer (total plant nutrients) inputs. Following Nerlove and Griliches,³ factor demand functions have been estimated relating quantity of input used to real price and other variables. The final equations are presented in Tables IV and V. These log-linear regressions are based on data for 1969-70 through 1975-76.

TABLE IV—DEMAND FUNCTIONS FOR HUMAN LABOUR

Crop	n	Intercept	Regression coefficients				R ²	Adjustment coefficient
			P ₁	H _{t-1}	M _t	A _t		
Wheat	90	-0.7786	-0.6256** (0.2193)	0.4424** (0.0705)	-0.0658* (0.0308)	0.5011** (0.0818)	0.7971	0.5576
Bajra	72	-0.0077	-0.2768 (0.1844)	0.0434 (0.0918)	-0.0756* (0.0346)	0.7042** (0.0900)	0.6069	0.9566

P₁ = wage rate/lagged output price; H_{t-1} = lagged labour use;

M_t = expenditure on machine/machine price; A_t = area under the crop in hectares.

*Significant at 5 per cent. **Significant at 1 per cent.

2. Results are not presented here.

3. M. Nerlove: Distributed Lags and Demand Analysis of Agricultural and Other Commodities, USDA Handbook No. 141, Washington, 1958. Z. Griliches, "The Demand for Inputs in Agriculture and Derived Supply Elasticity," *Journal of Farm Economics*, Vol. 41, No 2, May, 1959.

The wheat equation indicates that the level of labour use is significantly influenced by changes in real wage rates. This effect could also be discerned from the figures presented in the Table II(A). For wheat a short-run elasticity of 0.62 is indicated. The long-run elasticity is 1.12. The equation also bears out the expected inverse relationship between level of mechanization and total labour use. The magnitude of the coefficient of adjustment indicates a fairly quick rate of response.

For the bajra equation, the real wage coefficient is negative but not significant. But in this case also the labour displacing effect of mechanization is apparent.

TABLE V—DEMAND FUNCTIONS FOR TOTAL PLANT NUTRIENTS

Crop	n	Intercept	Regression coefficients			R ²	Adjustment coefficient
			P _t	A _t	F _{t-1}		
Wheat	90	-3.1206	0.8364 (0.5804)	0.5535** (0.1457)	0.5054** (0.0853)	0.6652	0.4946
Bajra	73	-1.5319	-0.4744 (0.9808)	0.4447† (0.2671)	0.4569** (0.1353)	0.2216	0.5431

P_t = Price of fertilizer/lagged output price; A_t = area under the crop;

F_{t-1} = lagged fertilizer use.

† Significant at 10 per cent.

** Significant at 1 per cent.

The results for fertilizer demand presented in Table V are not very satisfactory. For both wheat and bajra, the use of plant nutrients does not appear to be influenced by real price. Figures presented in Table II(A) also indicated this phenomenon for wheat. For bajra, however, tabular analysis did reveal a sizeable decline in fertilizer use in 1974-75—the year fertilizer prices jumped. The fertilizer demand function for bajra gave only a mild indication of this. The answer to the trend for wheat seems to be in the movements of real prices. These figures are indicated in Table VI.

TABLE VI—CHANGES IN REAL PRICE* OF FERTILIZERS

Year					Wheat	Bajra
1969-70	..	..	..	..	1.95	3.03
1970-71	..	..	..	..	2.97	3.65
1971-72	..	..	..	..	2.98	3.67
1972-73	..	..	..	..	2.98	3.44
1973-74	..	..	..	..	3.09	3.47
1974-75	..	..	..	..	3.15	3.39
1975-76	..	..	..	..	2.64	2.64

* Price of fertilizer/lagged output price.

A look at Table VI shows that movements in real and absolute prices of fertilizers do not correspond. A word here about the interpretation of the real price figures. These have been defined as the ratio of input price and lagged output price. The rationale for using lagged output price rests on the presumption that it is the expected rather actual output price which is relevant for *a priori* decisions on resource use. We have taken price received last year as the expected price. Now, fertilizer (real) prices showed very little variability between 1970-71 and 1974-75, a very sharp rise in absolute price in 1974-75 notwithstanding. This is probably the reason behind non-significance of this variable in the wheat fertilizer demand function. The data presented in Table II(A) also showed very mild increase in fertilizer use after 1970—a trend which was clearly arrested in 1975-76. The last year, *viz.*, 1975-76, needs an explanation. Table VI shows a substantial decline in real factor price. But the level of use in this year was stagnant at 1974-75 level. As is well-known, output prices in 1974-75 were abnormally high and use of this price as a deflator in 1975-76 resulted in a decline in relative price. But a significant downswing in output price started in 1975-76 and alarmed by this the farmers did not go for higher fertilizer use. This line of reasoning explains the relative constancy in fertilizer use in the post-1970 period and also the non-significance of the price coefficient in the fertilizer demand function for wheat.

For bajra, movements in relative prices and quantities of resources used [Table II(B)] do not correspond even though the estimated demand function does have a negative price coefficient. Between 1970-71 and 1974-75 relative prices remained nearly the same with a slight downward trend. The 1975-76 figure, as we have indicated already, does not represent the real price properly. The reason for the decline in fertilizer use in bajra probably lies in the high yield risk for this crop. Also the efficiency of fertilizer use is lower in the *kharif* season on account of greater losses due to leaching and volatilisation. This further adds to risks. High yield risks affect the productivity of all resources. Fertilizers are the most important cash inputs for this crop and the farmers appear to be minimizing the chances of cash losses by using less fertilizers.

III

CONCLUSIONS

The results presented above illustrate very clearly that profits from Mexican wheat and hybrid bajra have been declining under pressure of rising input prices. The share of purchased inputs in total costs has remained largely unaltered for wheat but for bajra, it has gone down. Increase in prices notwithstanding, the share of non-farm sector inputs has gone up for wheat. For bajra, it has gone down. The only inputs which have consistently recorded declines in shares are irrigation, bullock labour and seed. For both wheat

and bajra, the shares of labour and fertilizer inputs have gone up substantially. It is quite clear that if the conflicting trends in input and output prices are not arrested, farming will soon cease to be a paying proposition. In other words, the present structure of input-output prices poses a threat to the viability of the new cereal production technology.

The factor demand analysis reveals that for wheat, relative price movements have affected the use of labour. There is a suggestion of this influence for bajra crop also. But with respect to fertilizers, no such influence could be discerned for either crop. This, we have argued, could be attributable to lack of variability in relative prices of fertilizers over a major part of the period analysed.

THE IMPACT OF THE INCREASE IN THE PRICES OF INPUTS ON THE PROFITABILITY AND PRODUCTION OF SUGARCANE AND PADDY IN MANDYA DISTRICT OF KARNATAKA

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INTRODUCTION

Prices have been increasing at a relatively high rate during the period covering the three years ending with 1975. This is apparent from the study of the price index. The general price index has risen from 132 in 1973 (base year 1961) to 143 in 1975.¹ Thus, the prices have increased by 12 points in two years in this period, as against 32 points in the eleven years prior to it. However, the increase in the price of all commodities has not been of the same dimension in all sectors of the economy. Agricultural prices, both of products and factors, especially of fertilizers and labour, have increased in greater proportion than of other commodities.

It is generally hypothesized that farmers, at least at the present time, respond to prices. When the prices of factors increase substantially, their input would be decreased. On the other hand, when the prices of products increase, the input of factors would be increased. Therefore, the relative prices are taken into account.

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1. *Commerce*, Annual Number, 1975.