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AN ECONOMETRIC ANALYSIS OF SUGAR-CANE PRODUCTION IN THE PUNJAB.

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The total production of sugarcane in the Punjab province during 1966/67-1978/79 was significantly influenced by the lagged acreage under sugarcane, adequate supply of irrigation water at the farmer's fields and the price of sugar-cane in the preceding year. Overtime changes in the level of technology represented by 'Time' did not influence sugar-cane production function during the period of our study.

INTRODUCTION

The present studies were undertaken to identify and analyse the various variable factors influencing the production of sugar-cane in the province of Punjab during the period 1966/67-1978/79 by developing an econometric model. The production of sugar-cane crop in the province of Punjab during mid sixties and in the subsequent years is said to have been influenced due to complex variable factors. It is usually argued that sharp fluctuations in the production of sugar-cane over the period under study were due to improper and inefficient use of fertilizers, pesticides and other improved farm inputs. Experts also argue that inadequate supply of irrigation water at the farmer's fields, higher costs of production of sugar-cane as compared to other crops, high insect infestation and supply of poor seed-cane are some of the major factors responsible for keeping the yield levels almost constant and thus influencing the production of sugar-cane. In the light of aforementioned arguments it becomes necessary to conduct an econometric analysis of all the possible variable factors which influenced the production of sugar-cane in the Punjab during 1966/67-1978-79. This analysis would help in determining and quantifying the individual and combined effect of all the variable factors on sugar-cane production and provide instrumental information for their economic relevance in the production process of sugar-cane crop for the years to follow.

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The knowledge resource base would also help the government in designing scientific and viable policies with regard to production, inputs, procurement prices, imports and exports of sugar by providing timely, reliable and adequate information about sugar-cane production.

MATERIALS AND METHODS

The methodology consists in the construction of a generalized economic model which takes into consideration all the possible variable factors influencing sugar-cane production in the Punjab (Johnston, 1972; Khan and Ahmad, 1980; Mustafa and Khan, 1977). It was hypothesised that the total sugar-cane production in the Punjab was influenced by a number of factors like acreage of sugar-cane, use of fertilizers to sugar-cane crop, adequate availability of irrigation water from canals and supplemented by private tube-wells, credit supply for the purchase of improved farm inputs, price of sugar-cane and its products like gur and 'desi' sugar and level of technology and its adoption by the farmers. The selection of vriables considered relevant from the view point of economic analysis was made after preliminary graphic analysis of data. The basic data about these variables is given in Table I.

Variables selected for statistical analysis are mentioned as below :

a) *Dependent Variable* :

SCP_t = Total production of sugar-cane in the Punjab in year t (in 000 tons).

b) *Explanatory Variables* :

A_{t-1} = Acreage of sugar-cane sown in year (t-1) in 'OOO' hectares.

P_t = Total number of private tubewells installed in the province in year t.

CWS_t = Total canal withdrawl at farm gate in year t, (in million acre feet).

FSC_t = Total nutrients of fertilizer applied to sugar-cane cropped acreage in year t (in 'OOO' N/tons).

PG_{t-1} = Average wholesale price of gur over twelve months at Lahore in year $_{t-1}$ (Rupees per 37.324 kg.).

PDS_{t-1} = Annual average wholesale price of desi sugar at Lahore in year $_{t-1}$ (Rupees per 37.324 kg.).

Table: 1. ***Basic data relating to sugar-cane acreage, production, prices, fertilizer use and water supplies, in the Punjab*** 1966/67 - 1978/79.

Years	Production of sugar-cane (in 000 tons)	Acreage of s-cane (in 000 hectares)	Procurement price of s-cane (Rs./37.32 kg.)	Av. price of Desi sugar (Rs./37.32 kg.)	Price of gur (Rs./ 37.32 kg.)	Total fertilizer for s-cane (in 000 N/ton)	Canasl with drawl at farm gate (in m.a. feet)	Total No. of private Tubewells
	1	2	3	4	5	6	7	8
1966–67	15443	478	2.00	40.45	19.77	12.30	29.4	44888
1967–68	13040	367	2.42	60.57	34.29	18.18	32.7	54930
1968–69	15900	396	2.75	60.15	39.97	23.00	31.56	63891
1969–70	19402	455	2.75	55.00	35.15	29.35	28.26	72852
1970–71	16568	476	2.75	35.37	18.82	24.78	26.95	81814
1971–72	13557	391	2.50	63.28	39.07	34.84	26.21	90456
1972–73	13510	368	4.25	104.63	71.15	40.84	31.75	99025
1973–74	16355	456	4.25	130.60	65.06	34.15	29.59	109293
1974–75	14576	474	5.25	139.00	67.72	39.66	25.84	130398
1975–76	17979	500	5.75	180.82	85.97	40.05	32.40	134782
1976–77	21444	575	5.75	141.84	78.44	44.78	32.33	140724
1977–78	21745	607	5.75	130.35	80.21	50.34	33.52	144121
1978–79	19039	537	5.75	169.76	83.74	63.73	31.34	149002

SOURCES OF DATA

COLUMN 1 & 2 Development statistics of the Punjab–1971, 1977, 1978.

COLUMN 3: a) Pakistan Economic Survey 1969–70. 1971–72, 1974–75, 1978–79

b) Year book of Agricultural Statistics 1970. 1971, 1978.

COLUMN 4: a) & 5: b) Data for 1966–70 taken from 25 years of statistics in Pakistan

Data for 1971–78 Office Files, Economics and Marketing Deptt. Govt. of the Pb.

COLUMN 6: Data for 1972-76 Annual plan 1976-77, Data for remaining years was estimated by giving a share of 14% of total fertilizer consumed to sugar-cane for 1966-71, and 11% for years 1977-79.

COLUMN 7: Development Statistics of the Punjab 1970, 1977, 1978.

COLUMN 8: a) Private Tubewells Numbers in Pakistan: A Synthesis: Pak, Dev. Rev. Vol. xiii (1) 1974.

b) Office Files Agri. Deptt. Lahore, 1972-78.

It was hypothesised in the light of economic theory that the production of sugar-cane was a function of one year lagged acreage of sugar-cane sown, total canal withdrawl at farm gate during sugar-cane cultivation and the procurement price of sugar-cane in the preceding year. Moreover, it was hypothesised that overtime changes in the sugar-cane production function were influenced due to improved knowledge of farmers about the level of technology and its adoption, better extension services, adequate supply of chemical fertilizers, pesticides and other improved farm inputs.

The results of our study revealed that the coefficient of one year lagged sugar-cane acreage was positive with a value of 0.074. The coefficient was significant at 0.05 probability level thus indicating that acreage of sugar-cane significantly influenced sugar-cane production in the province over the period of our study. This revealed that increased acreage of sugar-cane during mid sixties and in the subsequent years influenced the sugar-cane production in the province of Punjab.

The coefficient of lagged price of sugar-cane had a value of 0.0029 and was also significant at 0.05 probability level showing thereby that higher income to sugar-cane growers during sixties and onward, provided an incentive to farmers to bring an increase in acreage of sugar-cane and also to reconsider the allocation of improved farm inputs like chemical fertilizers, pesticides etc. to the cropped acreage of sugar-cane.

The variable of canal withdrawl at farm gate, determining the supply of irrigation water to the farmers fields was also Positive with a value of 0.932. The coefficient was significant at 0.05 probability level. This clearly revealed that there had been an increased supply of canal water at the farmers fields thus meeting adequate water requirements of sugar-cane crop. Moreover, the enhanced water supplies ecouraged the farmers to increase sugar-cane acreage as well as to make use of judicious quantities of chemical fertilizers to increase sugar-cane production.

The 'Time' variable representing over time changes in the level of technology in the agriculture sector and its adoption by the farmers, was found to be negative and insignificant from statistical view point. This was contrary to what was hypothesised. This lead us to conclude that increased supplies of improved farm inputs like chemical fertilizers, pesticides and supervised credit along with technical know-how were not efficiently used by the farmers. It appears that the inefficient use of inputs at the farmers

fields was most probably, due to the subsidy provided by the Govt. on sale price of these inputs to increase sugar-cane Production. The negative sign for 'Time' also revealed that overtime improvements in sugar-cane breeding for evolving high yielding varieties did not co-incide with the economic objective of maximizing production.

CONCLUSIONS AND SUGGESTIONS

On the basis of our econometric analysis it can safely be concluded that the production of sugar-cane was influenced by its acreage, support price of sugar-cane and the supply of irrigation water. This analysis predicts that changes in the production function of sugar-cane in future would rest in the fluctuations in these variable factors and any viable policy for increasing sugar-cane production would prove ineffective if proper attention was not given to these variable factor inputs. Our analysis also reveals that rate of change in the level of technology for sugar-cane crop was very poor as little attention was given to evolving high yielding varieties of sugar-cane over the period of study. Moreover, the best use of fertilizers, pesticides and other improved farm inputs could not be made in the past because of high subsidy provided by the government on the distribution price of these inputs which led to their economic wastage, thereby having a negative influence on the sugar-cane production in the Punjab during the years 1966/67-1978/79. Keeping in view the results of our analysis following broad policy suggestions are given to increase sugar-cane production in future.

a. Procurement price of sugar-cane should be fixed by taking into account the price of inputs, acreage of sugar-cane sown in the preceding year and the total supply of irrigation water in the year (t-1).

b. Efficient and dynamic breeding programme for evolving pest resistant and high yielding varieties be streamlined and strengthened by the experts in sugar-cane breeding.

c. Subsidy on fertilizers, etc. be gradually withdrawn so as to make their effective use by the farmers. Economic loss realised by the farmers should be compensated by granting relatively attractive support prices before the sowing of sugar-cane every year.

d. The findings of the sophisticated scientific researches on sugar-cane be simplified and translated in "farmers language" so that the improved technical know-how for sugar-cane crop can readily be used by the tiller of soil.

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