Technical Report

Relationship of Consumption and Production in Changing Agriculture, A Study in Surat District, India -- A Summary

by

B. M. Desai

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ABSTRACT (within 250 words)

This is a summary of the study entitled "Relationship of Consumption and Productio in Changing Agriculture: A Study in Surat District, India" published in the occasional paper series of the Technological Change in Agriculture Project at the Department of Agricultural Economics, Cornell University. The summary reports the objectives, analytical and methodological approach, data and the main findings of this study. . . . . .

. . . The study assumes that at the beginning of a crop-year the farmers' consumption and production decisions are recursive instead of simultaneous. This is because income from crops accrues only at the end of a crop-cycle, while consumption is continuous. The study further argues that crop-pattern is the single most important determinant of farmers' working capital investment and income decisions. Hence the study considers it more important to explain crop-pattern rather than invensity of a given crop. Finally, both dairy plus non-farm incomes and consumption being continuous in character, can form net family capital that would influence, among other factors, the crop-pattern. This linkage between family finance and crop-pattern is justified because under conditions of inadequacies of capital market and risks credit may not be perfectly substitutable for internal finance. Considering these assumptions, a four-part econometric model is presented. The four parts are dairy-farming, crop-farming, level and pattern of aggregate consumption. For empirical application of the model, data for agricultural years 1969-70, and 1970-71 from a group of farm-families of Surat District are utilised.

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Please indicate restrictions if any that the author wishes to place upon this note . . . . None . . . . . .

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Date : Oct. 5, '75

Signature of the author

RELATIONSHIP OF CONSUMPTION AND PRODUCTION IN CHANGING AGRICULTURE, A STUDY IN SURAT DISTRICT, INDIA——A SUMMARY

By

BM Desai

I

INTRODUCTION

This reports a summary of the study entitled "Relationship of Consumption and Production in Changing Agriculture, A Study in Surat District, India". This study is published as a monograph in the occasional paper[1] series of the Technological Change in Agricultural Project directed by Professor John W Mellor of Department of Agricultural Economics in Cornell University. The summary broadly presents objectives, analytical and methodological approach, data and main findings of this study.

II

OBJECTIVES

Consumption and production decisions are innately interwoven in the economy of farm-families as they are not in the economy of industrial firms. The study examines short-run interrelation of the aggregate consumption and working capital investment decisions of farmers. It also examines expenditure patterns that are related to the aggregate consumption of farmers. Recursive instead of simultaneous relation between current consumption and current production decisions of farm-families is assumed in specifying a descriptive economic framework for analysis.

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1 Desai, BM, "Relationship of Consumption and Production in Changing Agriculture, A Study in Surat District, India", Occasional Paper No.80, Technological Change in Agriculture Project, Department of Agricultural Economics, Cornell University, 1975.

The detailed objectives of the study are to explain and predict changes in farmers':

1. input requirements for and revenue from dairying;
2. crop pattern and hence changes in use of inputs and revenue;
3. aggregate consumption expenditure; and
4. allocation of this expenditure between various goods and services.

Analysis of factors constraining increases in use of inputs for and revenue from dairy enterprise is important in view of the macroeconomic objectives of growth in incomes and employment. Moreover, dairy income being characterized by continuity of flow of funds may help farmers by providing minimum assured income. Such characteristic of dairy income can also be considered indicative of relaxing capital as well as risk-bearing constraints of farmers in growing various crops. Technological change as embodied in the breed of buffaloes can play an important role in determining these functions of dairying.

Farmers' choice of crops is the most crucial aspect of their working capital investment and revenue decisions. This is so because crops vary in their per acre use of working capital as well as in net returns. Therefore, the single most important determinant of multi-crop producing farmers' per acre input requirements and per acre revenue is crop pattern.[2]

The crop pattern can be considered as a function of farm size, availability of net irrigable land, wealth, family labor, per acre expected net returns, and net flow of family finance. From the viewpoint of a farm-family the net flow of funds can be considered as being formed of past saving and current dairy plus non-farm incomes minus current aggregate consumption expenditure. Family finance could have decisive influence on crop pattern because credit may not be perfectly substitutable for internal finance under conditions of imperfection in capital market and risks in farming.

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[2] This is consistent with the sample data under study.

After analyzing the relationship of crop pattern with the above mentioned variables the study predicts the shifts in crop pattern from low-return low-working-capital-intensive crops to high-return crops, due to change in the initial availability of net net irrigable land, and internal capital through dairy income.[3] The effect of change in initial prices of crops and that in credit on crop pattern could not be examined because the econometric model in the study is based on data in which these factors do not vary.

Increases in the availability of net irrigable land are important for they encourage the adoption of such high-return crops as HYV paddy, and sugarcane. Similarly, increases in the availability of internal capital through dairy income, by relaxing capital and risk-bearing constraints, could also lead to the adoption of new technologies including new crops.

Such shifts in crop pattern are important for increases in the use of inputs including labor, and in incomes of farmers. These increases provide potentialities for employment-oriented intersectoral and interregional growth linkages.[4] These linkages may differ

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[3] In the sample for this study, the high-return crops are sugarcane, banana, HYV paddy and wheat, whereas low-return crops are jowar, tur, val, cotton, and groundnut.

[4] See, for example, Nurul Islam, "Employment and Output as Objectives of Development Policy", in Theme Papers for 15th International Congress of Agricultural Economists (Oxford: 1973). John W. Mellor and Uma Lele, "Growth Linkages of the New Foodgrain Technologies", Indian Journal of Agricultural Economics, Vol. 28, No.1 (January/March, 1973), p.35. Also, Uma Lele and John W. Mellor, "Jobs, Poverty and the Green Revolution", International Affairs, Vol. 48, No.1 (January 1972), p.20.

in two broad respects. Frist, they may differ in the magnitude of employment and capital use that may be created due to increases in production of goods in other sectors of the economy. Second, they may also differ in the type of industries that may get encouraged, whether small or large regionally dispersed or concentrated. Similar potentialities for growth linkages are also provided by changes in expenditure on various consumption goods and services. Hence, it is important to analyse the consumption patterns of farm-families.

Thus, it is important to consider both the production and consumption aspects of farm-families inasmuch as the agricultural sector provides markets for various production, investment, and consumption goods. This role of agriculture is crucial in determining the pace, and the pattern of economic development in low income countries.[5]

An ideal set of data for the study would be a cross-section cum time-series data from the same group of farmers on their cash flows of input costs, dairy production, output of each crop, non-farm incomes, consumption expenditure, lending and borrowing. In addition, these data should cover prices of various crops, crop pattern, availability of net irrigable land, credit, past saving, hired labor, wealth, size of family, and size and composition of dairy herd. Such data would be ideal for examining the influence of interrelation of consumption and production, prices, risk, and other factors on crop pattern. In particular, data on cash flow would enable the analysis of relative importance of family finance, including dairy income, non-farm income and past saving, and external finance in determining crop pattern. In the absence of such data, an attempt is made in the study to develop an analytical and methodological approach suitable to the available data.

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5 For a survey of literature on role of agriculture in economic development see Bruce F. Johnston, "Agriculture and Structural Transformation in Developing Countries: A Survey of Research," Journal of Economic Literature, Vol. 8, No.2 (June 1970), p.369. Also, see John W. Mellor, India and the New Economics of Growth, (New York: Twentieth Century Fund, Forthcoming, 1975), in this book, with his characteristically wide-sweeping economic analysis, researchers an employment-oriented strategy of economic growth which uses technological change in agriculture as a major stimulus to overall growth.

III

ANALYTICAL AND METHODOLOGICAL APPROACH

The study utilizes a recursive descriptive economic framework that consists of four parts, namely, dairy-farming, crop-farming, level, and pattern of aggregate consumption expenditure. This framework identifies various behavioral relationships to explain the changes in these four economic activities of farmers. The analysis begins with the following simplifying assumptions:

(1) That it is more important to explain inter-crop rather than intra-crop input and revenue differences for the study of incomes and input requirements of farmers. The per acre output and also per acre use of each input for every crop are therefore considered as fixed.[6]

(2) That at the beginning of a crop-year, the farm-families make recursive decisions about consumption and production. This is justified because farmers' income from crops accrues to them only at the end of a crop-cycle, whereas their consumption is continuous. For the same reason, it is assumed that farmers' current aggregate consumption is influenced by their expected rather than current income.

(3) That in the sequential decision-making process at the beginning of a crop-year farmers take their aggregate consumption and dairy-farming decisions followed by crop-farming activity. This is justified because aggregate consumption and dairy-farming activities being characterized by a continuity of flow of funds can form internal funds that would influence, among other factors, the choice of crop pattern.

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[6] This implies a Leontief production function for each product as is used in Input-Output and Linear Programming analyses.

(4) That the integration of internal finance and crop pattern decisions of farm-families is important. This is justified under the conditions of imperfection in capital market as well as under situations of risk.

(5) That the decision to expend on individual items of consumption follows after the aggregate consumption expenditure decisions. Restricting expenditure to that on non-durable and regular items of consumption can justify this consumption.

Considering the above assumptions, various factors are identified to explain changes in (1) investment in variable inputs for dairy-farming of year t, (2) gross revenue from dairying activity of year t, (3) allocation of land to alternative crops and hence use of inputs and level of crop income of year t, (4) aggregate consumption expenditure of year t + 1, and (5) allocation of this expenditure between various goods and services.

The relationship of these factors with the relevant explanatory variables is estimated using econometric methods. A single equation technique of estimation, namely, Ordinary Least Squares, is used because the study assumes recursive relation about consumption and production decisions.

IV

DATE SOURCE, SAMPLING DESIGN, AND SALIENT FEATURES OF SAMPLE FARMERS

Data Source

The study utilizes input-output data of dairy and crop enterprises, in addition to data on family budget, non-farm incomes, wealth of a group of farm-families in Surat district, India. These data were obtained from the Agro-Economic Research Centre, Vallabh Vidyanagar, Gujarat, sponsored by the

Directorate of Economics and Statistics in Ministry of Food and Agriculture.[7]

These data are unique in the sense that the survey covered both the production and consumption aspects of the same group of farm-families. Hence, this research on inter-relation of these two aspects which are intertwined in the economy of farm-families is made possible. Such data are not available in published form. Collection of such data by undertaking a survey of farmers is time consuming and expensive.

Sampling Design

The Agro-Economic Research Centre collected detailed data on land holding and its use, input pattern, farm and non-farm incomes, and consumption patterns from 99 farmers of Surat district in Gujarat. These farmers were selected from two adjoining talukas, Bardoli and Palsana, which have common characteristics such as crop pattern, irrigation facilities, and institutional and marketing facilities.[8]

From each of the two talukas, five villages were randomly selected using a sampling method of probability proportional to size, the size being the percentage of irrigated area to gross cropped area of the villages. Ten farmers were selected from each sample village, using stratified random sampling design, the basis of stratification being operational land holding. Moreover, the sample was drawn from a universe that excluded those farm households which operated less than three acres.[9] This was done because the

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[7] M.D. Desai, "Saving and Investment in An Agriculturally Prosperous Area," Research Study No. 30 (Vallabh Vidyanagar, Agro-Economic Research Centre, Sarder Patel University, 1973).

[8] For data on some features of institutional facilities in Surat district, two sample talukas and Bardoli town, see B.N. Desai, "Relationship of Consumption and Production in Changing Agriculture, A Study in Surat District, India," (Unpublished Ph.D. Thesis, Cornell University, 1975), Appendix Table 1.

[9] The results of this study may, therefore, be evaluated after considering this feature of the sampling design.

study undertaken by the Centre was mainly concerned with those farmers whose primary occupation was cultivation. The data refer to the agricultural years July to June 1969-70, and 1970-71. For the collection of required data, a recall instead of cost accounting method of survey was conducted. Each farm household was interviewed twice a year.[10]

Salient Features of Crop Pattern, Dairy Enterprise, and Consumption Patterns of Sample Farm-Families

An average farm-family allocated about the same proportion of its land to the high-return-high-input-use crops namely, sugarcane, banana, HYV paddy, and wheat (52%) as to the low-return-low-input-use crops such as jowar, tur, val, and cotton (48%). However, the former group of crops contributed about 86 per cent to the total net crop-income of an average farm-family. These crops also shared between 86 and 93 per cent in the total use of labour and other cash purchased inputs.

Net income from dairying formed about 12 percent of the family net income in 1969-70. The average size of herd including young calves was five. Only nine percent of the herd was of improved breed. About 27 per cent of the owned land was kept by farm-families as grass or fodder land.

The consumption patterns of 1970-71 revealed about an equal importance of three groups of commodities:

(a) milk, ghee, vegetables, and fruits, (19%)
(b) manufactured nonfood items such as tobacco and its products, washing soap, toiletry goods, footwear, and clothing (19%), and
(c) services such as domestic and medical services, education, travel, and recreation, (19%). The remaining 43 per cent of total expenditure was claimed by foodgrains (26%), and processed foods (17%). Sugar, gur, and edible oil claimed 64 per cent share in the expenditure on processed foods.

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[10] For details on this and sampling design, see Desai, op. cit., pp.5-13.

V

RESULTS OF THE ESTIMATED MODEL

The results of the four-part econometric model are discussed in this section. This is followed by a discussion of the effects of change in initial availability of irrigation and dairy herd resources on crop pattern, input use, incomes and hence on consumption which are predicted by the model.

Dairy-Farming of Year t

(1) Both per animal per month investment and gross revenue from dairying are largely influenced by the composition of herd. The effect of improved breed milking buffalo on both the monthly input expenditure and revenue per animal is larger than that of "desi" breed buffalo. An increment to investment in variable inputs for a dairy herd caused by the addition of an improved instead of "desi" breed buffalo is 40 per cent higher. The corresponding change in gross returns is 63 per cent. Hence, the additional annual net returns (Rs 334) to farm-families from an acquisition of improved instead of "desi" breed milking buffalo would enable them to recover the additional fixed capital cost (Rs 600) in about a year and three quarters.

(2) This period of recovery will be further reduced since the additional dairy income, by providing internal finance, would generate additional net crop income of the order of Rs 60 by causing larger shifts to high-return crops. Considering the total effect, a farmer can gain the additional fixed capital investment of Rs 600 in about a year and a half. Thus, the analysis of predicting changes in incomes and input use as a result of change in size of dairy herd concentrates on policies to increase the herd size of improved breed buffalo.

Crop-Farming of Year t

(1) Over 85 per cent of variation in per acre gross returns and input use of the sample farmers are associated with their crop pattern and hence the emphasis on analyzing crop pattern.

(2) The proportion of land allocated to such high-return-high-working-capital-intensive crops as sugarcane, banana, and HYV paddy is found to

be inversely related to the size of a farm. Constraints such as marketing, timely and adequate availability of inputs, and diseconomies of managing labor force on large farms could be responsible for this. Marketing constraint is particularly important for sugarcane and banana which farmers in this district grow primarily for cooperative marketing and processing societies.

(3) The analysis of influence of net irrigable land on crop pattern reveals that the estimated parameters have expected signs as well as pattern of their size. Thus, the sign is positive for high-return crops of sugarcane, banana, HYV paddy, and wheat, whereas it is negative for such low return crops as jowar, tur, and cotton. Similarly, the size of coefficient for sugarcane is the largest, followed by banana, HYV paddy, wheat, other foodgrains, and other non-foodgrains. These results imply that as the availability of net irrigable land increases, the crop pattern would shift from low-return crops to high-return crops. Thus, the analysis of changes in crop pattern and hence in income and input requirements as a result of increasing the size of net irrigable land while holding the total farm size same is important.

(4) The estimated parameters for wealth, a proxy for incorporating risk hypothesis, and family size to proxy for monthly aggregate consumption expenditure have the logical signs in all the crop-equations, the sign being positive for wealth and negative for family size for high-return-high-working capital-intensive crops.

(5) The influence of per acre expected net returns from various crops and monthly net flow of internal finance formed from dairy plus non-farm incomes minus aggregate consumption expenditure on crop pattern is contrary to the a priori hypotheses tested with the given data. For example, in the equation for own (i^{th}) crop the sign of the coefficient for per acre expected net returns of this crop was negative, whereas that for the competing (q^{th}) crop was positive. Similarly, the sign of the coefficient associated with the monthly net flow of internal funds in the equation for high-return crop was negative. Therefore, the model was respecified by omitting two variables, namely, per acre expected net returns, and aggregate consumption expenditure. The availability of internal finance through dairy plus nonfarm incomes would shift crop pattern from low-return crops of cotton, and groundnut to high-return crops of HYV paddy, and wheat.

(6) The inconsistent results on influence of net flow of internal finance and of per acre expected net returns on various crops on crop

pattern may perhaps be due to two reasons. One, the analysis is based only on cross-section data of single point in time. Two, data on cash flows were not available to specify properly the variable of net flow of internal funds. This underscroes the need for generating time-series cum cross-section data from the same group of farmers. This would also permit a test of the hypothesis that farmers diversify crop pattern to avoid risk.

Aggregate Monthly Consumption Expenditure of Year t+1

(1) Expected family net income, wealth, family size, and expected intensity of crop-farming are all important factors influencing the aggregate consumption expenditure of the sample farmers. The estimated parameters associated with all these variables have expected signs. As the farmers' expectation of intensity of crop-farming (defined as gross returns per rupee of investment in variable inputs for crop-farming of year t) increases, holding other factors constant, their monthly, aggregate consumption expenditure decreases. This could be a result of inadequacy of capital market as well as risks in farming.

(2) Exclusion of the variable of expected intensity of crop-farming from the aggregate consumption function reduces by almost 33 per cent the marginal propensity to consume with respect to the expected net family income.

pattern of Monthly Aggregate Consumption Expenditure of Year t+1

(1) The pattern of additional demand (i.e. marginal propensity to expend) by an average farm-family in the sample is fairly diversified. Thus, the size of this demand for milk, ghee, vegetables and fruits together is about the same as that for manufactured nonfood items such as toiletry goods tobacco and its products, washing soap and other materials, footwear, and clothing. The former group of commodities have low capital-labor ratios in their production process.

(2) The share of sugar, gur, and edible oil in the sum of marginal propensity to spend (0.11) on all processed foods consumed by these families is 64 per cent.

(3) Nearly 42 per cent of the incremental expenditure on all commodities is on education, medical services, travel and recreation, etc.

(4) A typical small farm-family spends, at the margin, on foodgrains about twice as much as a typical large farm-family. The marginal propensity to expend on pulses by the former is about one-eighth of the aggregate of MPE on foodgrains. The corresponding figure for a large farm-family is nearly one-sixth. The MPE on milk and ghee by a small farm-family forms only about one-third of the sum of MPE on non-foodgrain food items. For a large farm-family the corresponding figure is about one-half. The MPE on travel and recreation, education, and medical services claims a much larger share in the sum of incremental expenses on non-food service items of a large farm-family than in that of a small one.

Predicted Effects of Change in Irrigation and Dairy Herd Resources of Sample Farmers

Since the estimated model exhibits reasonable accuracy in its predicting ability it is utilized to make alternative predictions of changes in crop pattern, input requirements, income and its distribution, and consumption expenditure on various goods and services by sample farmers. For this purpose, increases in the availability of net irrigable land, and dairy income of farmers, on account of fixed capital investment in well irrigation and in improved breed milking buffalo, respectively, are envisaged.

(1) The analysis of restricting resource changes to small farmers alone reveals that such policy would not prove desirable from the viewpoint of overall increases in incomes of farmers and laborers, nor for inducing intersectoral and interregional growth linkages.

(2) It is, however, suggested that the increase in dairy herd size may be encouraged more on small farms, whereas the size of net irrigable land be increased upto 100 per cent (either through canal or well water facilities) for both the small and large farmers.

(3) The detailed results of suggested policy of increasing the dairy herd of small farmers by two improved breed milking buffaloes and increasing net irrigable land upto 100 per cent, for both small and large farmers, by well irrigation are:

(a) It increases the incomes of small farmers by 40 percent as against 28 per cent of large farmers. (b) It enables small farmers to gain the fixed capital investment of Rs 16888 (for acquiring both well irrigation system and two improved breed milking buffaloes) in seven and three quarters years. This is comparable to 5 years for large farmers. (c) It also leads to larger increases in acreage under sugarcane, banana, HYV paddy, and wheat, while decreasing acreage under other crops such as jowar, tur, and cotton. This results in larger increases in demand for other production inputs like oil cakes and fertilizers, in addition to larger increases in employment. Larger increase in use of oil cakes is noteworthy for its potentialities to induce interregional and intersectoral growth linkages. (d) This policy also generates lager demand for those consumer goods like milk, ghee, vegetables and fruits, edible oil, footwear, etc. which are known for low capital-labor ratios in their production processes. (e) By increasing small farmers' income this policy enables them to consume more of foods with higher protein and vitamin content like milk, ghee, pulses, vegetables and fruits.

VI

POLICY MEASURES TO FACILITATE THE EXPANSION OF TWO RESOURCES

The preceding section outlined the effects of intensifying agriculture by increasing the acreages under HYV paddy, sugarcane, banana, wheat, and also by improving the quality and number of buffaloes. These changes are eventually caused by changes in fixed capital investment of farmers. Public policies to encourage such investment at the farm level should, therefore, include among others, the following programs:

Long-term Credit

The analysis suggests increasing long-term credit availability more for small than for large farmers. This suggestion is made to emphasize the development of dairy-farming on small farms, in addition to developing their irrigation resources. This is because dairy income being continuous in character can help these farmers by provid-

ing assured minimum income. Such income can also be considered indicative of relaxing risk and capital constraints which are particularly faced by small farmers.

Flexibility in repayment of loans, closer loan supervision, and also differential interest rates are necessary to encourage fixed investment in irrigati n and in acquiring improved quality buffaloes. Further research is required to determine whether or not these policies would make the business of lending a viable proposition. Research is also required to examine the extent to which the perfection of short-term capital market may reduce the relevance of dairy-farming as a source of internal finance particularly under the conditions of risks in crop-farming. Nevertheless, inasmuch as dairy income may help farmers by providing assured minimum income, long-term credit facilities for dairying may be expanded. Some of the prerequisites to make the above referred long-term credit policies practicable may now be discussed.

Dairy-Farming Development

The analysis shows that it would be profitable for farmers to invest in improved breed buffaloes. An average farmer in Surat district could recover the investment in improved breed buffalo in less than two years. Thus, research in and breeding of high-yielding and disease-resistant buffaloes is essential, in addition to supply of long-term credit. A buffalo insurance scheme is also required to protect farmers from risk of loss which may prevent them from changing the size and composition of their herd. It is, however, recognized that to ensure that farmers take proper care of their animals a penalty would be required in the case of death, in addition to considering different rates of insurance premiums. Facilities for veterinary services should also be improved. Research is required to determine the extent of gain to the farmers as well as to insurance agencies after accounting for the rates of premium and possible penalty. Research is also required to examine the stability of dairy income.

Well Irrigation Development

An important aspect of making investment in well irrigation a successful proposition is assessment of the ground water potentials, in addition to easy availability of machinery, equipment and other

materials including diesel oil, and electricity. Such facilities are expected to be provided by government agencies. A close liaison of these agencies with the agencies advancing long-term credit is essential from the view-points of both farmers, and institutions providing credit and other services.

Developing Marketing and Processing Facilities

The analysis shows that increasing the existing size of net irrigable land by expansion of irrigation facilities causes shifts in crop pattern in favour of crops such as sugarcane, and banana. Similarly, shift in composition of herd from "desi" to improved breed buffalo results in increases in milk production. Thus, public investment in marketing and processing facilities would be required to handle a larger output of these products.

The measures suggested in the preceding discussion would encourage larger shifts in crop pattern in favour of sugarcane, and banana as compared to HYV paddy, wheat, and other foodgrains. Such shifts in crop pattern may not, however, be desirable in the present conditions of foodgrain shortages in India. In the short-run with which the study is concerned, such shifts in crop pattern may lead to increases in foreign exchange and domestic tax resources, both of which may largely be utilized for the import of foodgrains and also for developing new varieties of foodgrains. However, in the long-run these shifts may not prove as desirable because the international market for both sugarcane, and banana is susceptible to instability. Yet another measure to encourage more desirable shifts in crop pattern is to evolve the policy of acreage allocation to various crops. Such policy may particularly be administered in the regions where irrigable land is expanded by earlier discussed programs. Finally, the larger shifts in favour of sugarcane and banana might in course of time cause relative prices of foodgrains to rise. This, in turn, might lead to new forces of shift in crop pattern. Since the available data did not contain variation in prices, we could not examine effects of these forces through carefully worked out price changes.